2024 Hazard Mitigation Plan

Contra Costa County, California



VOLUME I

Planning Area-wide Elements

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EXECUTIVE SUMMARY

The Contra Costa County Hazard Mitigation Plan (the Plan) was developed to guide Contra Costa County in a risk-based approach to become more resilient to the impacts of natural and technological hazards through mitigation planning. The Plan identifies potential hazards that could negatively impact County operations and assesses the risk and vulnerability of life safety and County assets for each hazard. This Plan also establishes strategies and priorities to mitigate risk from natural, human-caused, and technological hazards, identifies specific mitigation projects to pursue for each identified hazard, guides the County in associated risk management activities, and establishes eligibility for future mitigation program funds. The development of this Plan was a collaborative effort among the Contra Costa County Core Planning Team and Steering Committee with support from Integrated Solutions Consulting (ISC).

The five (5) goals for this Plan, identified by the Contra Costa County Steering Committee, are listed below. The goals represent the County's long term and strategic vision to accomplish and achieve successful mitigation efforts. Additionally, the Steering Committee identified 19 objectives which are specific strategies and steps identified to assist the communities in attaining the listed goals.

Goals	
1	Save (or protect) lives and reduce injury.
2	Increase resilience of infrastructure and critical facilities.
3	Avoid (minimize or reduce) damage to property.
4	Encourage the development and implementation of long-term, cost-effective, and environmentally sound mitigation projects.
5	Build and support capacity to enable local government and the public to prepare for, respond to and recover from the impact of natural hazards.

There are a number of hazards that pose a threat to human life, health, and well-being, and this Plan is not meant to compile an exhaustive list. Contra Costa County identified 10 natural hazards and five (5) human-caused/technological hazards for this Plan. Although FEMA only requires and reviews natural hazards in hazard mitigation plans, Contra Costa County decided to rank and mitigate against a comprehensive list of hazard events that could impact the County. Due to the nature of non-natural hazards and the discretionary status regarding their inclusion, the following hazards of interest have been briefly and qualitatively assessed for the sake of public education and informing their inclusion within the hazard ranking and mitigation process. Hazards that have been identified as significant in Contra Costa County and that will be considered in this Plan are listed below.

Identified Hazards
Natural Hazards
Climate Change
Dam and Levee Failure
Drought
Earthquake
Flood

Identified Hazards
Landslide
Sea Level Rise *(Coastal Flooding)*
Severe Weather *(Severe Thunderstorms – Hail, Strong Winds, Tornadoes – Heavy Rainfall, Heat Wave/Extreme Heat)*
Tsunami
Wildfire
Human-Caused/Technological Hazards
Cybersecurity Threats
Hazardous Materials Incidents
Utility Interruptions
Active Shooter Incidents
Terrorism (Weapons of Mass Destruction)

The following key elements are included in the 2024 Contra Costa County Hazard Mitigation Plan.

- **Planning Process:** The Core Planning Team, Steering Committee, and planning process are described and documented.
- **Community Profile:** Demographics (including underserved population), social, and economic data, as well as existing and future land use descriptions, are updated to reflect the status of Contra Costa County and its jurisdictions.
- **Hazard Risk Assessment:** Outlines the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards. In this section, the process focuses on the following elements – hazard identification, vulnerability identification, and cost evaluation.
- **Mitigation Strategy:** The mitigation strategy describes how the community will accomplish the overall purpose of the planning process. In this section, mitigation goals and objectives were reevaluated and updated; and mitigation actions were updated, identified, evaluated, and prioritized.
- **Plan Maintenance:** The Hazard Mitigation Plan requires monitoring, evaluation, and updating every five (5) years. This section includes a schedule for annual monitoring and evaluation of the programmatic outcomes established in the Plan and for producing a formal Plan revision every five (5) years.
- **Appendices:** Includes the Contra Costa County's mitigation actions, stakeholder and public engagement details and supporting documentation, and the plan adoption.
- **Annexes:** This Plan includes 40 plan participants – 16 municipalities and 24 special districts – and each jurisdiction developed its own annex. All jurisdiction specific information and supporting documentation (e.g., hazard vulnerability and impacts, mitigation actions, stakeholder and public engagement) can be found in the respective annexes.

CHAPTER 1. INTRODUCTION

The Contra Costa County Hazard Mitigation Plan (Plan) was developed to guide the County in a risk-based approach to become more resilient to the impacts of natural, human-caused, and technological hazards through mitigation planning. The Plan documents historical disasters, assesses probabilistic disasters through Hazus and GIS analysis, and addresses specific strategies to mitigate the potential impacts of these disasters.

This five (5) year update was a collaborative effort among the Contra Costa County Core Planning Team. The Plan accomplishes the following:

- Identifies areas of risk and assesses the probability, extent, vulnerability, and impacts for each natural hazard.
- Establishes strategies and priorities to mitigate risk from natural hazards.
- Identifies specific mitigation projects to pursue for each identified natural hazard.
- Guides the communities in their risk management activities and minimizes conflicts among agencies.
- Establishes eligibility for future mitigation program funds.

1.1 PURPOSE OF THE PLAN

The Plan identifies activities that can be undertaken by both the public and private sectors to reduce risk to natural, human-caused, and technological hazards, property damage, and economic disruption caused by these hazards. This Plan reviews mitigation activities and selects those that will be most beneficial for Contra Costa County.

The Federal Disaster Mitigation Act of 2000 requires jurisdictions to develop and maintain a Hazard Mitigation Plan to remain eligible for certain Federal disaster assistance and hazard mitigation funding programs (e.g., Hazard Mitigation Grant Program, Building Resilient Infrastructure and Communities). Renewal of the Plan every five (5) years is required to encourage continual awareness of mitigation strategies. Additionally, communities that participate in the Federal Emergency Management Agency (FEMA) Community Rating System (CRS), a voluntary program that reduces National Flood Insurance Program (NFIP) premiums and are designated as a Category C repetitive loss community, must prepare a Floodplain Management Plan (FMP) or a Repetitive Loss Area Analysis (RLAA). However, the CRS Program allows multi-hazard and multi-jurisdictional mitigation plans to fulfill this requirement.

This Plan fulfills the federal requirements for mitigation funding outlined in 44 Code of Federal Regulations (CFR), section 201.6 (44 CFR § 201.6) and United States Code (USC) 42, section 5165 (42 USC § 5165), the CRS Program and provides the jurisdiction with a blueprint for reducing the impacts of natural, human-caused, and technological hazards.

1.2 HAZARD MITIGATION PROGRAM

Hazard mitigation is defined as any sustainable action taken to reduce or eliminate long-term risk to people and property from future disasters. Mitigation planning breaks the cycle of disaster damage, reconstruction, and repeated damage. Hazard mitigation includes long-term solutions that reduce the impact of disasters in the future.

- Keep the hazards away from people, property, and structures.
- Keep people, property, or structures away from the hazard.
- Reduce the impact of the hazards on victims (e.g., insurance).

1.3 PLANNING AREA

The planning area was defined to consist of the unincorporated county, 16 incorporated jurisdictions (i.e., cities and towns), and 24 special districts within the geographical boundary of Contra Costa County. All partners to this Plan have jurisdictional authority within this planning area.

All incorporated jurisdictions were invited to participate in the planning process. The cities of Pittsburg and Concord declined participation because each city has a FEMA-approved Hazard Mitigation Plan. Additionally, the City of Antioch opted to not participate in this Hazard Mitigation Plan. Therefore, the cities of Antioch, Concord, and Pittsburg are not included as participating jurisdictions in this Plan. For countywide interest and statistical purposes, some Antioch, Concord, and Pittsburg demographics, and hazard-related data are included in this Plan. The intent of this inclusion is to create a more informative plan regarding the hazards, risks, and vulnerabilities across all of Contra Costa County.

1.4 PARTICIPATING JURISDICTIONS

All participating jurisdictions (i.e., cities, towns, and special districts) listed in **Table 1-1** were represented by one (1) or more representatives. Responsibilities for each of the participating jurisdiction's representatives included the following:

- Assist with gathering the appropriate data and historical information.
- Complete the community preparedness survey.
- Participate in their jurisdiction's hazard analysis.
- Identify new mitigation actions.
- Update existing mitigation actions.
- Participate in workshops, mitigation meetings, and webinars.
- Review draft documents, as necessary.

Contact information for each of the representatives and documentation of participation in the Plan update are available in **Appendix B**. The County also invited key organizations to assist and review the plan update process; supporting documentation is available in **Appendix C**.

Table 1-1. Participating Jurisdictions

Cities, Towns, and Unincorporated Contra Costa County		
Contra Costa County	City of Lafayette	City of Pleasant Hill
City of Brentwood	City of Martinez	City of Richmond
City of Clayton	Town of Moraga	City of San Pablo
Town of Danville	City of Oakley	City of San Ramon
City of El Cerrito	City of Orinda	City of Walnut Creek
City of Hercules	City of Pinole	
Special Districts		
Bethel Island Municipal Improvement District	Kensington Fire Protection District	Reclamation District No. 2065 (Veale Tract)
Central Contra Costa Sanitary District	Kensington Police Protection and Community Services District	Reclamation District No. 2122 (Winter Island)
Contra Costa County Fire Protection District	Mt. View Sanitary District	Reclamation District No. 2137
Contra Costa County Flood Control and Water Conservation District	Pleasant Hill Parks and Recreation District	Rodeo-Hercules Fire Protection District
Contra Costa Water District	Reclamation District No. 799 (Hotchkiss Tract)	San Ramon Valley Fire Protection District
Delta Diablo	Reclamation District No. 830 (Jersey Island)	San Ramon Valley Unified School District
Diablo Water District	Reclamation District No. 2025 (Holland Tract)	Town of Discovery Bay Community Services District
Ironhouse Sanitary District	Reclamation District No. 2026 (Webb Tract)	West County Wastewater District

1.5 PLAN PARTICIPATION

Updating this Plan involved assistance in identifying and evaluating hazards and mitigation actions from five (5) main groups – Core Planning Team, Steering Committee, representatives from County jurisdictions, members of the public, and other stakeholders.

1.5.1. Core Planning Team

The Core Planning Team consisted of key members from the Contra Costa County Office of Emergency Services (OES) and staff from Integrates Solutions Consulting (ISC). The Core Planning Team also served on the Steering Committee and helped guide the planning process. **Table 1-2** lists the Core Planning Team members from Contra Costa County OES.

Table 1-2. Core Planning Team Members

Name	Title	Jurisdiction/Organization
Rick Kovar	Emergency Services Manager	Contra Costa County Office of Emergency Services
Beatriz Portillo	Senior Emergency Planning Coordinator	Contra Costa County Office of Emergency Services
Lorena Herrera	Senior Emergency Planning Coordinator	Contra Costa County Office of Emergency Services

Name	Title	Jurisdiction/Organization
Jennifer Cannon	Senior Emergency Planning Coordinator	Contra Costa County Office of Emergency Services

1.5.2. Steering Committee

Hazard mitigation planning enhances collaboration and support among diverse parties whose interests can be affected by hazard losses. A Hazard Mitigation Steering Committee (the Steering Committee) was formed to oversee all phases of the planning process.

Throughout this Plan update, the Steering Committee agreed to meet as often as needed through the planning process. The Core Planning Team facilitated each meeting, which addressed a set of objectives based on the work plan established. All members of the Steering Committee were actively involved in attending meetings and responsible for the following:

- Identifying and prioritizing natural, human-caused, and technological hazards that impact Contra Costa County.
- Defining and identifying critical facilities.
- Identifying the Plan's goals and objectives.
- The planning area's capability assessment and consideration of mitigation alternatives.
- Identifying and prioritizing mitigation actions and projects.
- Coordinating and conducting outreach with key stakeholders, planning partners, and the public.

The Steering Committee members are listed on **Table 1-3** and the Steering Committee Meetings sign-in sheets are available in **Appendix B**.

Table 1-3. Hazard Mitigation Steering Committee Members

Name	Title	Jurisdiction/Organization
Beatriz Portillo	Senior Emergency Planning Coordinator	Contra Costa County Office of Emergency Services
Brian Helmick	Deputy Fire Chief	Contra Costa County Fire Protection District
Carol McCray	AFN Co-Coordinator	VistAbility
Daniel Barrios	Senior Planner	Department of Conservation and Development
Gilbert Salinas	Chief Equity Officer	Contra Costa Health (DEI)
Glenn Kimball	Community & Media Relations Specialist	Contra Costa County Office of Communication and Media
Jeff Valeros	Senior Civil Engineer	Contra Costa Public Works
Jody London	Sustainability Coordinator	Department of Conservation and Development
Kristi Jourdan	Director	Contra Costa County Office of Communication and Media
Larry Fong	Volunteer	American Red Cross, Contra Costa Search and Rescue, and CERT

Name	Title	Jurisdiction/Organization
Lissette Davis	Community & Media Relations Specialist	Contra Costa County Office of Communication and Media
Lorena Herrera	Senior Emergency Planning Coordinator	Contra Costa County Office of Emergency Services
Rick Kovar	Emergency Services Manager	Contra Costa County Office of Emergency Services
Robyn Cole	Emergency Services Coordinator	California Office of Emergency Services - Coastal Region Response Ops
Seana Fields	Senior Planner (Community Development)	City of Hercules
Thomas Rossberg	Lieutenant	Contra Costa County Office of the Sheriff

1.5.3. Local Planning Teams and Community Representatives

Each of the participating jurisdictions identified representatives to serve on their Local Planning Teams. The Local Planning Teams were instrumental in identifying community-specific risks/hazards and identifying and prioritizing mitigation actions that would reduce the costs of disaster response and recovery, protect people and infrastructure, and minimize overall disruption to their respective communities in the event of a disaster.

1.5.4. Supporting Organizations

Throughout the planning process, key stakeholders, departments, and community organizations, including local community organizations that provide support to underserved communities, were involved in providing key input, data, disseminating information about the Plan, survey, meetings, and reviewing the draft of the Plan (i.e., public comment period). Details regarding stakeholder engagement throughout the planning process and a list of stakeholders can be found in **Appendix B**.

1.6 PLAN APPROVAL AND ADOPTION

The Plan presents a comprehensive description of Contra Costa County's commitment to significantly reduce or eliminate the potential impacts of disasters through planning and mitigation. Adoption by the local governing body within the State of California legitimizes the Plan and authorizes Contra Costa County and its jurisdictions to implement mitigation responsibilities and activities.

A hazard mitigation plan must document that it has been formally adopted by the governing bodies of the jurisdictions requesting federal approval of the plan (44 CFR Section 201.6(c)(5)). For multi-jurisdictional plans, such as this, each jurisdiction requesting approval must formally adopt the Plan. This Plan will be submitted for a pre-adoption review to Cal OES and FEMA Region IX prior to adoption. Once pre-adoption approval has been provided, all participating jurisdictions will formally adopt the Plan. Federal Disaster Mitigation Act of 2000 compliance and its benefits cannot be achieved until the Plan is adopted. Copies of the resolutions adopting this Plan for all planning partners can be found in **Appendix D**.

CHAPTER 2. PLANNING PROCESS

The Contra Costa County Hazard Mitigation Plan was developed to provide a basis for identifying and managing natural, human-caused, and technological hazards, and to meet federal, state, and local requirements for hazard mitigation and FEMA mitigation grant funding.

Updating this Plan began with an initial kick-off meeting with the Contra Costa County Office of Emergency Services (OES) on September 7, 2023. Following this meeting, a series of Stakeholder and Jurisdiction Introductory Webinars were held on September 25 and 27, 2023, and October 3 and 4, 2023. The main purpose of these webinars was to provide information regarding FEMA's Hazard Mitigation Program directive and how participating in this Plan will enable jurisdictions (i.e., cities, towns, and special districts) to become eligible for FEMA hazard mitigation grant programs. Furthermore, the planning process involved the following:

- Review of the existing Plan.
- Updating Contra Costa County's hazard history.
- Gathering information on local hazards from individual communities.
- Gathering input on hazard priorities.
- Identifying specific vulnerabilities and desired mitigation strategies.
- Evaluating the previous Plan goals, objectives, and mitigation strategies.
- Determining the status of previous mitigation strategies and action plans.
- Identifying Repetitive Loss and Severe Repetitive Loss properties.
- Facilitating the activities of the Steering Committee.
- Conducting multiple public meetings and outreach activities.

Information regarding Contra Costa County's hazards and applicable mitigation strategies was obtained through two (2) Stakeholder Workshops held in the Contra Costa County Emergency Operations Center on December 4 and 6, 2023. Additionally, a comprehensive public survey reached 1,894 residents and resulted in 1,387 completed responses.

The 2024 Contra Costa County Hazard Mitigation Questionnaire (i.e., Public Survey) was available in English, Spanish, Traditional Chinese, Simplified Chinese, and Tagalog. The English and Spanish survey opened on October 19, 2023. While the Traditional Chinese, Simplified Chinese, and Tagalog opened on November 15, 2023. As part of this survey, Steering Committee members, community representatives, and members of the public were asked to rate each of the hazards in terms of perceived risk. Furthermore, they were asked to rate "mitigation importance" for each of the identified hazards in the Plan. The information gathered from this survey was used to inform the hazard risk prioritization process, and to ensure the Plan adequately addressed the public's concerns and priorities. Three (3) Public Meetings were held throughout the County on December 4, 5, and 6, 2023. These meetings were advertised for residents to have an opportunity to provide input into the Plan. Additionally, a draft of the Plan was made available on the Contra Costa County OES website for public review and comment from April 22, 2024, through May 31, 2024.

The purpose of the two (2) Stakeholder Workshops was to ensure local jurisdictions had the opportunity to identify their community's risks and identify/update their mitigation strategies and priorities. These Workshops included local planning team members from each city, town, and special district. Participants validated the County's risk assessment findings, described specific hazard risks and concerns for their communities, updated existing mitigation actions/strategies from the 2018 Plan, and worked with their local planning teams to identify new mitigation initiatives. Through a combination of ranking exercises, worksheets, and discussions, workshop participants evaluated hazard risk results, action plans, and rankings; and selected options for mitigating specific hazards to be included in the 2024 Plan update.

In summary, the planning process consisted of the following key tasks:

Task 1: Organize Resources
Contra Costa County OES created a Core Planning Team to attend meetings, gather data and historical information, review drafts, and participate in mitigation brainstorming sessions. Additionally, a Steering Committee was formed to provide overall guidance and direction throughout the mitigation planning process. A series of Steering Committee meetings were held throughout the Plan update process. Participating jurisdictions were invited to form Local Planning Teams to ensure their jurisdiction's mitigation needs and priorities were addressed. *Refer to Plan Participation under Chapter 1 (Introduction) for a list of Core Planning Team and Steering Committee members.*

Task 2: Risk Assessment
The Core Planning Team identified the hazards to include in this Plan, as well as hazard profiles to address the probability, extent, vulnerabilities, and impacts associated with each hazard. Furthermore, the Team used local resources to inventory Contra Costa County's assets and estimated losses. The Core Planning Team and Steering Committee provided input and subject matter expertise throughout this process.

Task 3: Public Involvement and Participation
The public was given an opportunity to be involved throughout the planning process via a public survey, in-person and virtual public meetings, and public engagement activities to review the Plan draft. The public was invited to attend one (1) of three (3) Public Meetings to review the risk assessment results and discuss mitigation strategies. The Public Meetings were conducted in person with options to attend virtually and were advertised locally in advance. A comprehensive Public Survey that reached 1,895 residents and resulted in 1,387 completed responses, up until January 30, 2024, was also conducted. The survey results were used to inform the hazard risk prioritization process and to ensure the Plan adequately addresses the public's concerns and priorities. The complete survey and a summary of its findings can be found in **Appendix C**. Once the draft Plan was completed, the public was given an opportunity to review and provide comments on Volume 1 (Planning Area-wide Elements) and each of the jurisdiction annexes. The public comment period began on April 22, 2024. Each plan participant developed a public outreach strategy to engage stakeholders and the public during the public comment period. Further details on public engagement and participation along with supporting documentation can be found in **Appendix C**. Public engagement participation and supporting documentation for each plan participant can be found in their respective annexes.

To further facilitate continued public involvement in the planning process, the public will have an opportunity to provide continual feedback and input. As future needs and concerns arise, or if the public would like to provide feedback regarding the latest version of the Contra Costa County Hazard Mitigation Plan, the public is invited to use the form provided on the County's website to provide comments.

Task 4: Develop Mitigation Strategies
The Core Planning Team met with representatives from each community (Local Planning Team) to develop and prioritize mitigation strategies and actions items that would reduce the costs of disaster response and recovery, protect people and infrastructure, and minimize overall disruption to the County in the event of a disaster. A list of mitigation actions for each plan participant can be found in their respective annexes.

Task 5: Complete the Plan
The Core Planning Team compiled all the relevant sections of the Plan to produce a Draft Plan for review. Contra Costa County stakeholders, which include members of the public, had multiple opportunities to review and revise the Plan before submitting it to the California Office of Emergency Services and FEMA for review.

Task 6: Plan Adoption
Contra Costa County OES coordinated the effort to ensure the Approvable Pending Adoption (APA) was formally adopted by each participating jurisdiction (i.e., city, town, and special district) and that at least one (1) jurisdiction adopted the Plan within one (1) year of the APA notification from FEMA.

Updating this Plan involved assistance in identifying and evaluating hazards and mitigation options from five (5) key groups – Core Planning Team, Steering Committee, local planning teams from the participating jurisdictions/districts, members of the public, and other stakeholders.

2.1 REVIEW OF EXISTING PROGRAMS AND PLANS

Since a Hazard Mitigation Plan is only a part of the emergency planning, mitigation, preparedness, response, and recovery process, a second objective of the planning process was to coordinate Plan preparation with existing Contra Costa County emergency plans, programs, procedures, and organizations. The following programs can affect mitigation within the planning area:

- California Fire Code
- The California Fire Alliance
- California Building Code
- California State Hazard Mitigation Forum
- Adapting to Rising Tides
- Contra Costa County Climate Action Plan
- Local Capital Improvement Programs
- Local Emergency Operations Plans
- Local General Plans
    - Housing Element
    - Safety Element
- Local Zoning Ordinances
- Local Coastal Program Policies

An assessment for each jurisdiction's capabilities that can contribute to the reduction of long-term vulnerabilities to hazards are addressed in their respective annexes. It should be noted that this Plan does not replace any existing plans or programs but is intended to provide a reference on hazard mitigation to be used in planning and program development.

2.2 EQUITY CONSIDERATION FOR THE UNDERSERVED POPULATION

Some disasters occur on larger scales and are more impacted by built environments and are most likely to continually impact those most at risk because of existing health conditions, lack of resources, being underserved by past mitigation planning work, facing historical disinvestment in their communities, or other factors. In this case, people in widely different locations can be the most harmed by repeating disaster cycles, so mitigation strategies should also work to break cycles of loss caused by social and economic disparities. Hazard mitigation strategies can reduce existing risk by, for example, relocating a building out of an area that frequently floods. In each case, an attempt has been made to lessen the harm of a future flood before the event happens. Strategies may also seek to make future development less vulnerable to hazards at the time it is built. Examples would be requiring new structures to be elevated above predicted flood levels or building structures to better withstand future hazards. Hazard mitigation plans are designed to involve the input of stakeholders from different perspectives to ensure plans use the best available data, are aligned with the needs of the entire community, and are in alignment with other plans, such as general plans, capital improvement plans, and climate action plans.

The Contra Costa County Hazard Mitigation Plan recognizes that all members of the community are not impacted in the same way by natural, human-caused, and technological disasters. Some community members are at more risk, for a number of possible reasons. A mitigation strategy that uses a 'one size fits all' approach and does not recognize different levels of risk will not adequately or efficiently support historically underserved populations and can actually make inequalities worse after a disaster.

This Plan highlights equity as a key component of the Plan's overall vision and seeks to continue to develop a shared understanding among participants of how hazard mitigation can be made more inclusive and be proactive in creating strategies that reduce existing disparities in risk and hazard recovery. Addressing the whole community requires an understanding that while a single solution for all seems fair, it does not address historical inequalities and current differences in age, financial resources, housing stability, neighborhood investment, health or ability, and access to government services. In mitigation planning, this means that successfully reducing risk in the most meaningful and efficient way requires understanding how the distribution of resources will actually reduce risk and for whom.

Equitable mitigation success should be measured by assessing who was most impacted in loss of life or financial harm by past and future disasters, quantifiable reductions of vulnerability to those most at risk, and increasing engagement with historically underserved populations and community organizations to better understand how plans and processes and natural hazard events are affecting different communities. The following highlights how this Plan addresses this priority.

Chapter 3 (Community Profile): This section describes different demographic and economic factors in Contra Costa County. Additionally, Centers for Disease Control and Prevention (CDC) Social Vulnerability Index (SVI) data was included.

Chapter 4 (Hazard Identification and Risk Assessment): This section includes FEMA's National Risk Index scores for the County for social vulnerability and community resilience. *Social vulnerability* is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including

disproportionate death, injury, loss, or disruption of livelihood.[1] *Community resilience* is defined as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions.[2] Additionally, it includes a hazard ranking methodology that specifically assessed the impact of the hazard on underserved populations. Furthermore, each hazard profile includes a narrative of the vulnerability and impacts for the underserved and at-risk population, FEMA's Expected Annual Loss analysis, and the National Risk Index score for the County. The Risk Index score is based on the following components: Social Vulnerability, Community Resilience, and Estimate Annual Loss (based on Exposure, Annualized Frequency, and Historic Loss Ratio (HLR) factors, for a total of five (5) risk factors).[3]

Under the Climate Change hazard profile in **Chapter 4 (Hazard Identification and Risk Assessment)**, it includes an analysis of the 42 Census Tracts in Contra Costa County which are identified as *disadvantaged* by the United States Council on Environmental Quality (ACEQ). According to the ACEQ, a *disadvantaged community* is identified if is located in a Census Tract that is at or above the threshold for one (1) or more environmental, climate, or other burdens, and at or above the threshold for associated socioeconomic burdens, including poverty and language barriers.[4]

Mitigation goals were updated to encourage greater participation and engagement from underserved populations and groups and aligns with the Contra Costa County General Plan, which prioritizes diversity, inclusion, and equity. During Stakeholder Workshops, in which new and ongoing mitigation strategies were discussed, jurisdictional representatives were encouraged to consider how the mitigation actions directly and/or indirectly resulted in equitable outcomes.

During this Plan update process, a comprehensive community preparedness questionnaire was developed and disseminated. The questionnaire was developed with a specific focus to better understand the challenges and concerns related to access and functional needs, access to information, ability to recover, and services needed, especially for those who may be underserved or lack access to key resources. The survey was available in English, Spanish, Traditional and Simplified Chinese, and Tagalog. Additionally, Spanish translation assistance was provided during all Public Meetings that were held, which is a key demographic in Contra Costa County.

The County and participating jurisdictions have a responsibility to ensure equitable outcomes in the implementation of this Plan and to ensure that action is taken to reduce vulnerabilities to disasters experienced disproportionately by marginalized populations.

When conducting community engagement related to implementation of or update to this Plan, Contra Costa County will ensure that the whole community has an opportunity to participate in the process and discussion. FEMA defines the *whole community* as the groups and organizations that should share the responsibility for emergency preparedness and mitigation, to include:[5]

[1] Federal Emergency Management Agency. (2023). Social Vulnerability. Retrieved from https://hazards.fema.gov/nri/social-vulnerability.
[2] Federal Emergency Management Agency. (2023). Community Resilience. Retrieved from https://hazards.fema.gov/nri/community-resilience.
[3] Federal Emergency Management Agency. (2023). Determining Risk. Retrieved from https://hazards.fema.gov/nri/determining-risk.
[4] United States Council of Environmental Quality. (n.d.). Climate and Economic Justice Screening Tool: Methodology. Retrieved from https://screeningtool.geoplatform.gov/en/methodology.
[5] Federal Emergency Management Agency. (n.d.). Guide to Expanding Mitigation. Retrieved from https://www.fema.gov/sites/default/files/documents/fema_mitigation-guide_whole-community.pdf.

- Individuals
- Families
- Businesses
- Faith-based and community organizations
- Non-profit groups
- Schools and academia
- Media
- Local and state government
- Artists and arts organizations
- Tribal government and associations
- Territories
- Other federal agencies

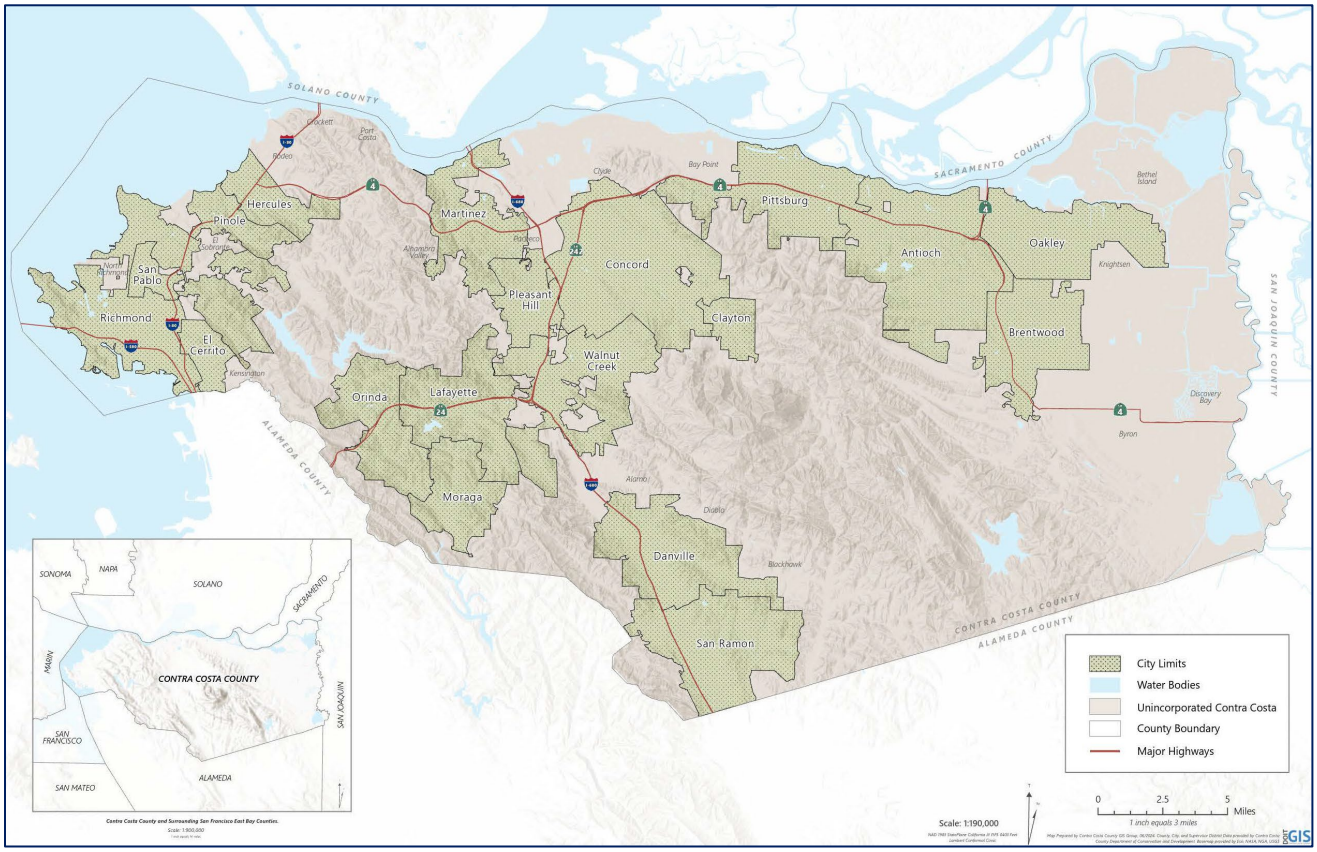
CHAPTER 3. COMMUNITY PROFILE

Contra Costa County is located in the Bay Area region of California and is considered an East Bay region.[6] The County is the ninth most populous County in the State of California with a population of 1,157,019 and 19 municipalities including 17 cities and two (2) towns.[7] The population per square mile is approximately 1,614.[8] The major population centers include the cities of Concord, Antioch, and Richmond and the County seat is the City of Martinez, located in the northwest part of the County.[9]

The name "contra costa" is Spanish for "opposite coast" due to its location across San Francisco.[10]

Like most locations in the United States, Contra Costa County is vulnerable to natural, human-caused, and technological hazards that threaten life safety, public health, business, economy, and its critical infrastructure. **Figure 3-1** illustrates the Contra Costa County planning area.

Figure 3-1. Contra Costa County Planning Area



[6] Contra Costa County. (n.d.). Our County. Retrieved from https://www.contracosta.ca.gov/31/Our-County.
[7] United States Census Bureau. (2022). Quick Facts: Contra Costa County. Retrieve from https://www.census.gov/quickfacts/fact/table/contracostacountycalifornia/.
[8] Ibid.
[9] State of California Department of Finance. (2023). Population and Housing Estimates for Cities, Counties, and the State - January 1, 2022 and 2023. Retrieved from https://dof.ca.gov/forecasting/demographics/estimates-e1/.
[10] Contra Costa County. (2023). Public Review Draft Contra Costa County 2045 General Plan – Planning Context. Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/Contra-Costa-County-General-Plan_Public-Review-Draft_Combined-2.pdf.

3.1 CONTRA COSTA COUNTY HISTORY

The first inhabitants in Contra Costa County were members of the Bay Miwok, Northern Valley Yokuts, and Ohlone Tribes and land was used for a variety of reasons. [11]

The Spanish colonization of what is now known as California began in 1769 and the area was controlled by Spain until 1821 when Mexico won its independence. Under Mexican rule, the County was divided into 15 land grants (i.e., ranchos), which were granted to settlers. Many names of the County's cities and areas are derived from the ranchos or their owners. [12] In 1848, after the Mexican American War, California was relinquished by the United States. Two (2) years later, in 1850, Contra Costa County became one of the original 27 counties established in the State of California with Martinez as the County seat. Less than 5,000 people resided in the County at the time.

Cattle ranching was always present since the ranchos. However, the latest economic activity in the 19th century was agriculture. Although crops grown changed throughout the years, wheat, grapes, and walnuts were prominent. Additionally, the presence of deep water along the western coastline and the Carquinez Strait made industrial development possible with the Standard Oil refinery in Richmond. [13]

Rapid industrialization during World War II sparked urban development and economic expansion and diversification in the area. [14]

Contra Costa County is usually considered as comprising of three (3) regions – West County, Central County, and East County. The West County area was the first area to develop with urban and industrial uses. Prior to World War II, several cities and unincorporated areas existed, but they were relatively small. Richmond was the largest city with a population of 23,093 in the 1940 United States Census. Nonetheless, West County became a central point for industrial activity during the War, which led to fast and extensive urbanization. Kaiser Shipyards was located in Richmond and produced 750 ships, more than any other shipyard in the United States. In 1950, the City of Richmond had a population of approximately 100,000. Post World War II (1950s through 1960s), a wave of suburbanization was experienced in Central County. Rural agricultural communities were transformed into cities where middle and upper-class residents were able to live in new construction with the ability to commute via the expanding freeway network. In the 1980s, suburban development began extending into the agricultural landscape of East County, and due to the lower housing costs in the area and scenic open spaces, residents tended to gravitate more towards this area. The City of Brentwood grew rapidly, and the City of Oakley was incorporated in 1999. [15]

3.2 TOPOGRAPHY

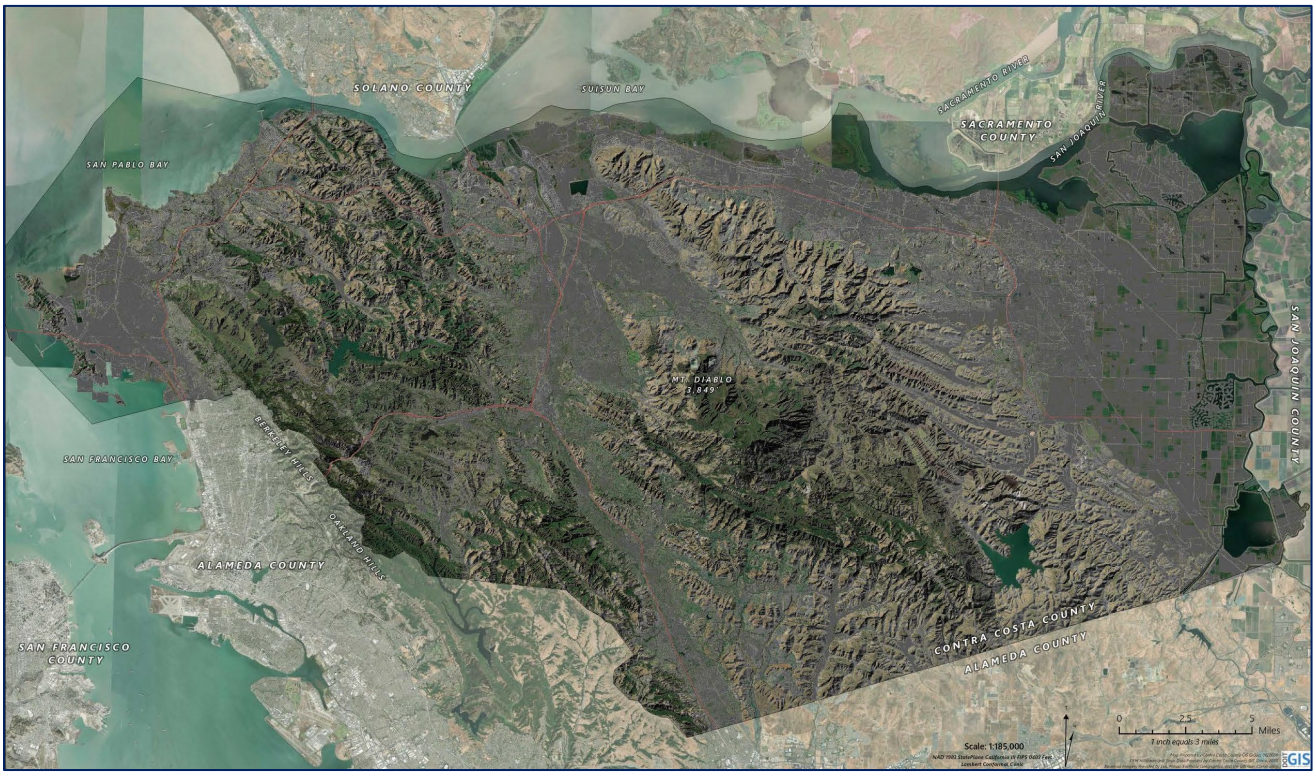
Contra Costa County is located in northern California bordered by Alameda County to the south, San Joaquin County to the east, Sacramento and Solano counties to the north, and East Bay of the San Francisco Bay to the west. The County stretches approximately 40 miles from west to east and 20 miles

[11] Ibid.
[12] Contra Costa County Historical Society. (n.d.). Contra Costa County History. Retrieved from https://www.cocohistory.org/contra-costa-county-history.
[13] Ibid.
[14] Contra Costa County. (2023). Public Review Draft Contra Costa County 2045 General Plan – Planning Context. Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/Contra-Costa-County-General-Plan_Public-Review-Draft_Combined-2.pdf.
[15] Ibid.

from north to south. Contra Costa County has a total land area of 716.9 square miles.[16] Contra Costa County's topography is comprised of the San Francisco and San Pablo bays, and the Sacramento-San Joaquin Delta. Furthermore, near the County's center is Mount Diablo with a peak of 3,849 feet.[17] Mount Diablo is part of the Diablo Range which is a dominant topographic feature in northern California, and it is a localized uplift associated with the San Andreas Fault system.[18] Other topographic features include the Oakland/Beverly Hills.

Figure 3-2 illustrates the topographical map for Contra Costa County.

Figure 3-2. Topographical Map



3.3 CLIMATE

Based on the Modified Köppen Climate Classification System, Contra Costa County is a Mediterranean (temperate, warm, dry summers) climate that is characterized by hot, dry summers and cool, wet winters. However, the location's distance from the coast has a significant effect on the location's climate. Coastal Contra Costa County has moderate temperatures throughout the year with mild and wet winters, and

[16] United States Census Bureau. (2022). Contra Costa County, California Profile. Retrieved from https://data.census.gov/profile/Contra_Costa_County,_California?g=050XX00US06013.
[17] Contra Costa County. (2015). Contra Costa County Climate Action Plan. Retrieved from https://www.contracosta.ca.gov/DocumentCenter/View/39791/Contra-Costa-County-Climate-Action-Plan?bidId=.
[18] California Geological Survey and California State Parks. (2015). CGS Special Report 230: Geological Gems of California State Parks. Retrieved from https://www.parks.ca.gov/pages/734/files/GeoGems%20FINAL%20WEB.pdf.

foggy conditions during the summer months. Central and easter portion of the County, in the inland valley, summers tend to be hotter while the winters are colder. [19, 20]

In the winter (December through February), the average daily temperature is 52.7°F with temperatures reaching low 60s during the day and mid 40s during the evening. During the summer (June through August), the average daily temperature is 64.6°F with temperatures reaching the low 70s during the day and high 50s in the evening. The coldest month in Contra Costa County is January and the warmest month is September. The monthly climate summary, based on the Oakland Museum weather station, is listed on **Table 3-1**.

Table 3-1. Contra Costa County Monthly Climate Summary (1970 – 2023)

Average Daily Temperature [21] *(° F)*												
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Annual**
51.7	54.7	56.3	58.3	61.0	63.6	64.4	65.8	66.4	63.7	57.2	51.7	59.4
Average Maximum Temperature [22] *(° F)*												
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Annual**
58.8	62.1	63.8	66.4	68.9	71.7	72.0	73.4	74.8	72.4	65.0	58.4	67.1
Average Minimum Temperature [23] *(° F)*												
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Annual**
44.7	47.2	48.8	50.3	53.2	55.5	56.8	58.1	58.0	55.1	49.5	45.0	51.8
Average Total Precipitation [24] *(inches)*												
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Annual**
4.13	3.90	3.47	1.28	0.58	0.15	0.04	0.06	0.24	1.29	2.87	4.26	22.10
The closest National Weather Service weather station to Contra Costa County is the Oakland Museum where weather observations have been continuous since October 1970.												

[19] Contra Costa County. (2015). Contra Costa County Climate Action Plan. Retrieved from https://www.contracosta.ca.gov/DocumentCenter/View/39791/Contra-Costa-County-Climate-Action-Plan?bidId=.
[20] State of California The Resource Agency Department of Fish and Wildlife. (2021). Atlas of the Biodiversity of California. Retrieved from https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=211302&inline.
[21] National Oceanic and Atmospheric Administration. (2023). NOWData – NOAA Online Weather Data (Monthly Mean Average Temperature for Oakland Museum, CA). Retrieved from https://www.weather.gov/wrh/climate?wfo=mtr.
[22] National Oceanic and Atmospheric Administration. (2023). NOWData – NOAA Online Weather Data (Monthly Mean Max Temperature for Oakland Museum, CA). Retrieved from https://www.weather.gov/wrh/climate?wfo=mtr.
[23] National Oceanic and Atmospheric Administration. (2023). NOWData – NOAA Online Weather Data (Monthly Mean Min Temperature for Oakland Museum, CA). Retrieved from https://www.weather.gov/wrh/climate?wfo=mtr.
[24] National Oceanic and Atmospheric Administration. (2023). NOWData – NOAA Online Weather Data (Monthly Sum Precipitation for Oakland Museum, CA). Retrieved from https://www.weather.gov/wrh/climate?wfo=mtr.

3.4 LAND USE

Contra Costa County, including incorporated and unincorporated County, has a total area of 515,840 acres (806 square miles) of which 57,600 acres (90 square miles) are water. **Table 3-2** outlines the acreage of unincorporated county area designated for each land use type.[25] Residential densities are expressed in terms of dwelling units per net acre, which is the area remaining after land is dedicated for rights-of-way, easements, and other public or common uses. As a rule of thumb, the County assumes net acreage to be 75% of the gross for single-family residential projects and 80% of the gross for multiple-family residential and mixed-use projects. A project's actual density is calculated during the development review process and must usually fall within the density range for the applicable land use designation. Development intensities for nonresidential uses are expressed in terms of floor area ratio (FAR), which is the ratio of gross building floor square footage to gross land area, expressed as a decimal number. When a building's square footage is equal to the area of the parcel it occupies, the FAR is 1.0. FARs are lower in suburban areas, where buildings are shorter and often surrounded with parking and landscaping, than in urban areas, where buildings are taller and occupy more of their respective parcels. Nonresidential development cannot exceed the FAR for the applicable land use designation.

Table 3-2. Acreages of Land Use Designations

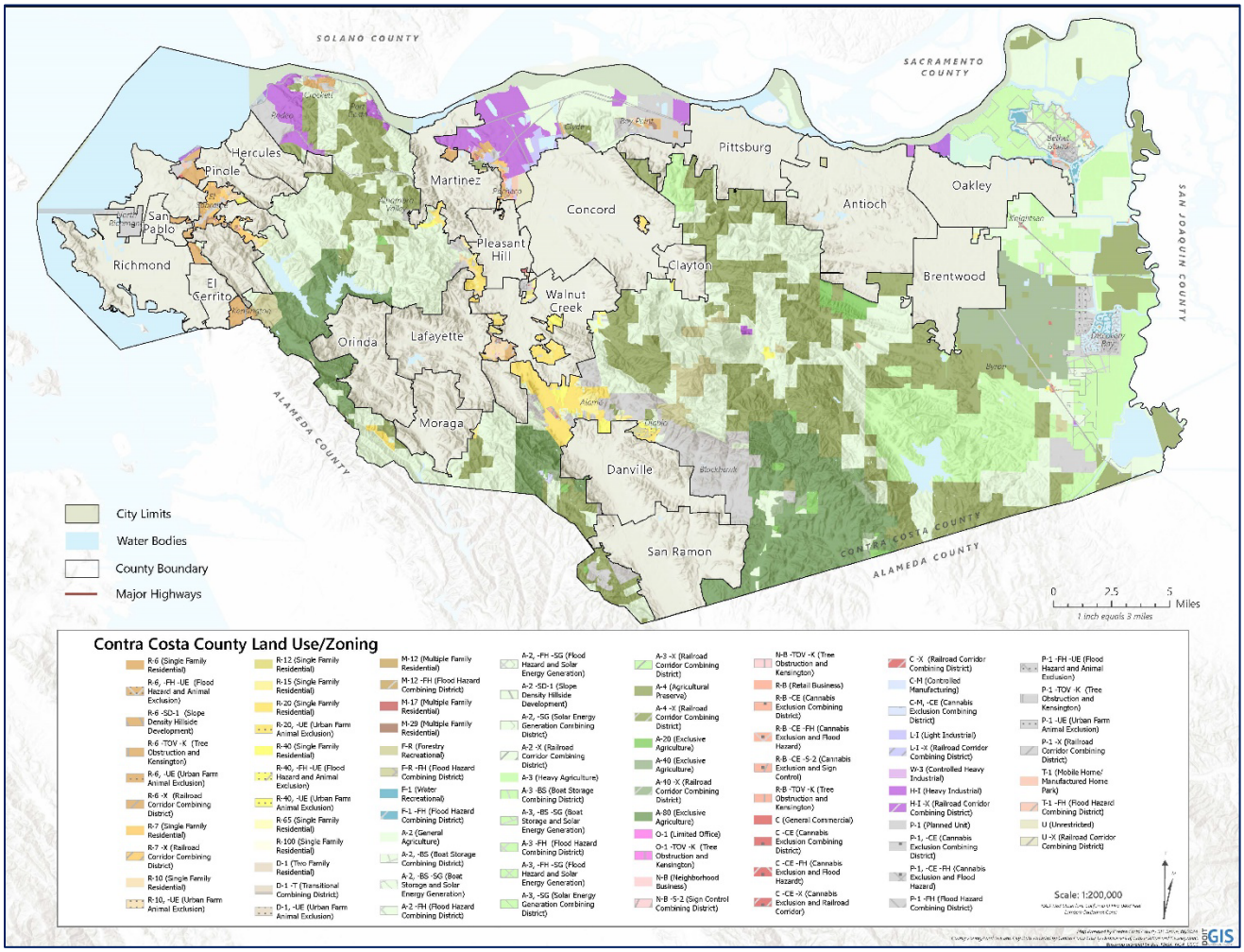
Land Use Designation	Area *(acres)*	Percent of Total
Residential Very Low Density	2,518	0.81%
Residential Low Density	6,302	2.03%
Residential Low-Medium Density	5,810	1.87%
Residential Medium Density	3,504	1.13%
Residential Medium-High Density	771	0.25%
Residential High Density	125	0.04%
Residential very High Density	55	0.02%
Commercial and Office	269	0.09%
Light Industry	1,285	0.41%
Heavy Industry	3,408	1.10%
Mixed-Use Low Density	233	0.08%
Mixed-Use Medium Density	69	0.02%
Mixed-Use High Density	108	0.34%
Mixed-Use Community-Specific Density	363	0.12%
Public and Semi-Public	16,884	5.44%
Agriculture Core	11,902	3.83%
Agriculture Lands	95,852	30.86%
Parks and Recreation	72,796	23.44%

[25] Contra Costa County. (2023). Public Review Draft Contra Costa County 2045 General Plan – Planning Context. Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/Contra-Costa-County-General-Plan_Public-Review-Draft_Combined-2.pdf.

Land Use Designation	Area *(acres)*	Percent of Total
Commercial Recreation	1,838	0.59%
Resource Conservation	59,900	19.29%
Water	26,564	8.55%
Total	**310,554**	**100.0%**

Figure 3-3 illustrates the general land use map within Contra Costa County.

Figure 3-3. Land Use Map



3.5 CHANGES IN DEVELOPMENT & DEVELOPMENT TRENDS

The State of California requires, by law, that every county and city adopt a general plan that outlines the goals, policies, and specific implementation measures expected to guide the decision on future growth, development, and resource conservation for the next 20 years. [26] Additionally, each general plan serves are the "charter" or "constitution" governing development, and governments are required, by law, to implement the plan once it is adopted. Each general plan must contain the eight (8) State-mandated elements – Land Use, Circulation, Housing, Conservation, Open Space, Safety, Noise, and Environmental Justice. [27]

The Contra Costa County Hazard Mitigation Plan will work together with the general plans to support wise land use in the future by providing vital information on the risks associated with natural hazards in the planning area. Furthermore, all municipal planning partners will incorporate this Hazard Mitigation Plan in their general plans by reference. This will ensure that future development trends can be established with the benefits of the information on risk and vulnerability to the hazards identified in this Plan.

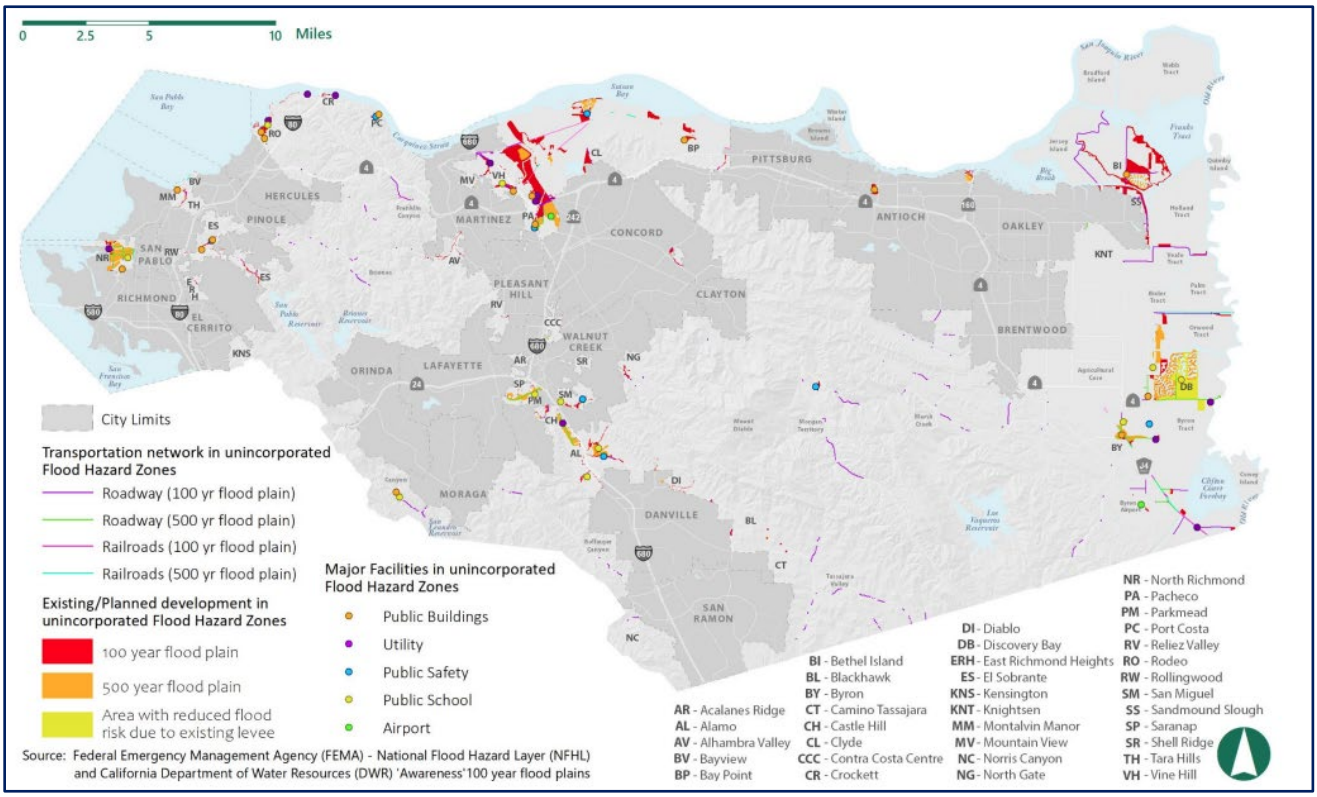
The Contra Costa County General Plan can be accessed via the following link https://www.contracosta.ca.gov/4732/General-Plan. The County's General Plan was undergoing an update during the development of this Hazard Mitigation Plan. Further details of the update can be accessed via the following link https://envisioncontracosta2040.org/.

3.5.1. Implications of Development on Risk

Growth patterns directly affect hazard impacts, risk, and vulnerability. Growth can lead to an increase in the number of people and developed properties exposed to hazards. **Figure 3-4** illustrates existing development in flood zones within Unincorporated Contra Costa County areas.

[26] Contra Costa County. (n.d). General Plan: Overview. Retrieved from https://www.contracosta.ca.gov/4732/General-Plan.
[27] Contra Costa County. (2023). Public Review Draft Contra Costa County 2045 General Plan – Planning Context. Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/Contra-Costa-County-General-Plan_Public-Review-Draft_Combined-2.pdf.

Figure 3-4. Existing Development in Unincorporated Contra Costa County Flood Zones [28]



3.6 FUTURE TRENDS IN DEVELOPMENT

The State of California is a strong growth management state that equips its local governments with general plans to address future developments, including safety and housing elements. Regional housing needs assessments are mandated by State law as part of the periodic process of updating local general plan housing elements. Safety elements have similar mandates, including those that promote integration with local hazard mitigation plans. These initiatives provide a strong footing for Contra Costa County to manage and address development pressures as it interfaces known hazard areas. These land use initiatives, and the adoption and enforcement of strong building codes and standards are key ingredients to overall community resilience.

3.7 DEMOGRAPHICS

Population and Population Density: Contra Costa County had a population of 1,156,966 as of July 1, 2022. The majority of this population resides within incorporated areas. Between 2010 and 2020, the population increased by approximately 11.1%; however, a population decrease of 0.8% occurred between 2020 and 2022. [29] **Table 3-4** shows Contra Costa County's population distribution by jurisdiction between 2010 and 2022.

[28] Ibid.
[29] United States Census Bureau. (2022). Quick Facts: Contra Costa County, California. Retrieve from https://www.census.gov/quickfacts/fact/table/contracostacountycalifornia/PST045222.

Table 3-3. Population Estimates [30]

Jurisdiction	2010	2020	2022	Population Change *(2010 – 2022)*
Contra Costa County	1,046,025	1,165,927	1,156,966	10.6%
City of Antioch	102,372	115,291	115,264	12.6%
City of Brentwood	51,481	64,292	66,127	28.4%
City of Clayton	10,897	11,070	10,904	0.1%
City of Concord	122,067	125,410	122,265	0.2%
Town of Danville	42,039	43,582	42,732	1.6%
City of El Cerrito	23,549	25,962	25,583	8.6%
City of Hercules	24,060	26,016	25,920	7.7%
City of Lafayette	23,893	25,391	25,044	4.8%
City of Martinez	35,824	37,287	36,447	1.7%
Town of Moraga	16,016	16,870	16,707	4.3%
City of Oakley	35,432	43,357	44,688	26.1%
City of Orinda	17,643	19,514	19,355	9.7%
City of Pinole	18,390	19,022	18,582	1.0%
City of Pittsburg	63,264	76,416	77,572	22.6%
City of Pleasant Hill	33,152	34,613	33,913	2.3%
City of Richmond	103,701	116,448	114,301	10.2%
City of San Pablo	29,139	32,127	31,389	7.7%
City of San Ramon	72,148	84,605	85,953	19.1%
City of Walnut Creek	64,173	70,127	68,969	7.5%

Income and Socioeconomic Status: In 2022, the median household income in Contra Costa County was $120,061. [31] About 6.6% of the households in the Contra Costa County have an annual income of less than $15,000 per year and are therefore below the poverty level. **Table 3-5** outlines the poverty thresholds for 2022 by size of family. [32]

[30] United States Census Bureau. (2022). Quick Facts. Retrieved from https://www.census.gov/quickfacts/.
[31] United States Census Bureau. (2022). S1901: Income in the Past 12 Months (in 2022 Inflation-Adjusted Dollars). Retrieve from https://www.census.gov/quickfacts/fact/table/contracostacountycalifornia/PST045222.
[32] United States Census Bureau. (2022). Poverty Threshold (By Size of Family and Number of Children). Retrieved from https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html.

Table 3-4. Poverty Thresholds for 2022 by Size of Family

Size of Family Unit	Weighted Average Threshold
One (1) Person	$14,880
Two (2) People	$18,900
Three (3) People	$23,280
Four (4) People	$29,950
Five (5) People	$35,510
The source of the weighted average thresholds is the 2023 Current Population Survey Annual Social and Economic Supplement (CPS ASEC).	

Sex and Age Distribution: 17.4% of Contra Costa County's population is 65 years old and over, compared to the State average of 15.8%. It is also estimated that 21.7% of the County's population is 18 or younger, compared to the State average of 21.8%. [33] Additionally, approximately 21.4% of Contra Costa County population has a disability type (i.e., hearing, vision, cognitive, or ambulatory, self-care, and independent living difficulty). [34] Females make up 50.8%, which is slightly above the national average of 50.4%, while males make up 49.2% of the Contra Costa County population. [35] The age group with the highest percentage is the 35 to 39 age group, with the 40 to 44 age group as the second highest. The overall age distribution for Contra Costa County is outlined in **Table 3-6**.

Table 3-5. Age Distribution (2022) [36]

Age Group	Estimate	Percent
Under 5 Years	61,175	5.3%
5 to 9 Years	68,924	6.0%
10 to 14 Years	72,660	6.3%
15 to 19 Years	74,953	6.5%
20 to 24 Years	67,593	5.8%
25 to 29 Years	65,654	5.7%
30 to 34 Years	75,126	6.5%
35 to 39 Years	82,400	7.1%
40 to 44 Years	80,566	7.0%
45 to 49 Years	77,407	6.7%
50 to 54 Years	79,534	6.9%
55 to 59 Years	75,803	6.6%

[33] United States Census Bureau. (2022). Quick Facts: California. Retrieve from https://www.census.gov/quickfacts/fact/table/CA/.
[34] United States Census Bureau. (2022). S1810: Disability Characteristics (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S1810?g=050XX00US06013.
[35] United States Census Bureau. (2022). Quick Facts: Contra Costa County, California. Retrieve from https://www.census.gov/quickfacts/fact/table/contracostacountycalifornia.
[36] United States Census Bureau. (2022). S0101: Age and Sex (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S0101?g=050XX00US06013.

Age Group	Estimate	Percent
60 to 64 Years	74,035	6.4%
65 to 69 Years	61,568	5.3%
70 to 74 Years	53,717	4.6%
75 to 79 Years	38,877	3.4%
80 to 84 Years	22,488	1.9%
85 Years and Over	24,486	2.1%

Race and Ethnic Distribution: The majority of the population in Contra Costa County is White (40.9%), with the next highest percent being Hispanic or Latino (27.0%) and Asian (19.3%). **Table 3-7** outlines the racial and ethnic distribution in Contra Costa County. 27.0% of the population in Contra Costa County is foreign-born.[37] Other than English, the most commonly spoken language in Contra Costa County is Spanish (18.7%). The United States Census Bureau estimates that 14.5% of the County's residents speak English "less than very well."[38]

Table 3-6. Racial and Ethnic Distribution (2022)[39]

Race and Ethnicity	Estimate	Percent
White (not Hispanic or Latino)	472,779	40.9%
Black or African American	100,358	8.7%
American Indian and Alaska Native	8,043	0.7%
Asian	223,114	19.3%
Native Hawaiian and Other Pacific Islander	5,970	0.5%
Two (2) or More Races	182,593	15.8%
Some Other Race Alone	164,109	14.2%
Hispanic or Latino	311,808	27.0%

3.7.2. Underserved Population

The 2023 California State Hazard Mitigation Plan identifies the Centers for Disease Control and Prevention (CDC) Social Vulnerability Index (SVI) as the most appropriate and authoritative dataset to identify areas where efforts can be prioritized to ensure equitable outcomes from mitigation planning and actions.

[37] United States Census Bureau. (2022). DP02: Selected Social Characteristics in the United States (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP02?g=050XX00US06013.
[38] United States Census Bureau. (2022). S1601: Language Spoken at Home (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S1601?g=050XX00US06013.
[39] United States Census Bureau. (2022). DP05: ACS Demographic and Housing Estimates (2022:ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP05?g=050XX00US06013.

CDC's SVI combines 16 social factors, within four (4) themes (i.e., socioeconomic status, household characteristics, racial and ethnic minority status, and housing type and transportation), to identify areas of social vulnerability. **Table 3-8** outlines the SVI information for Contra Costa County.

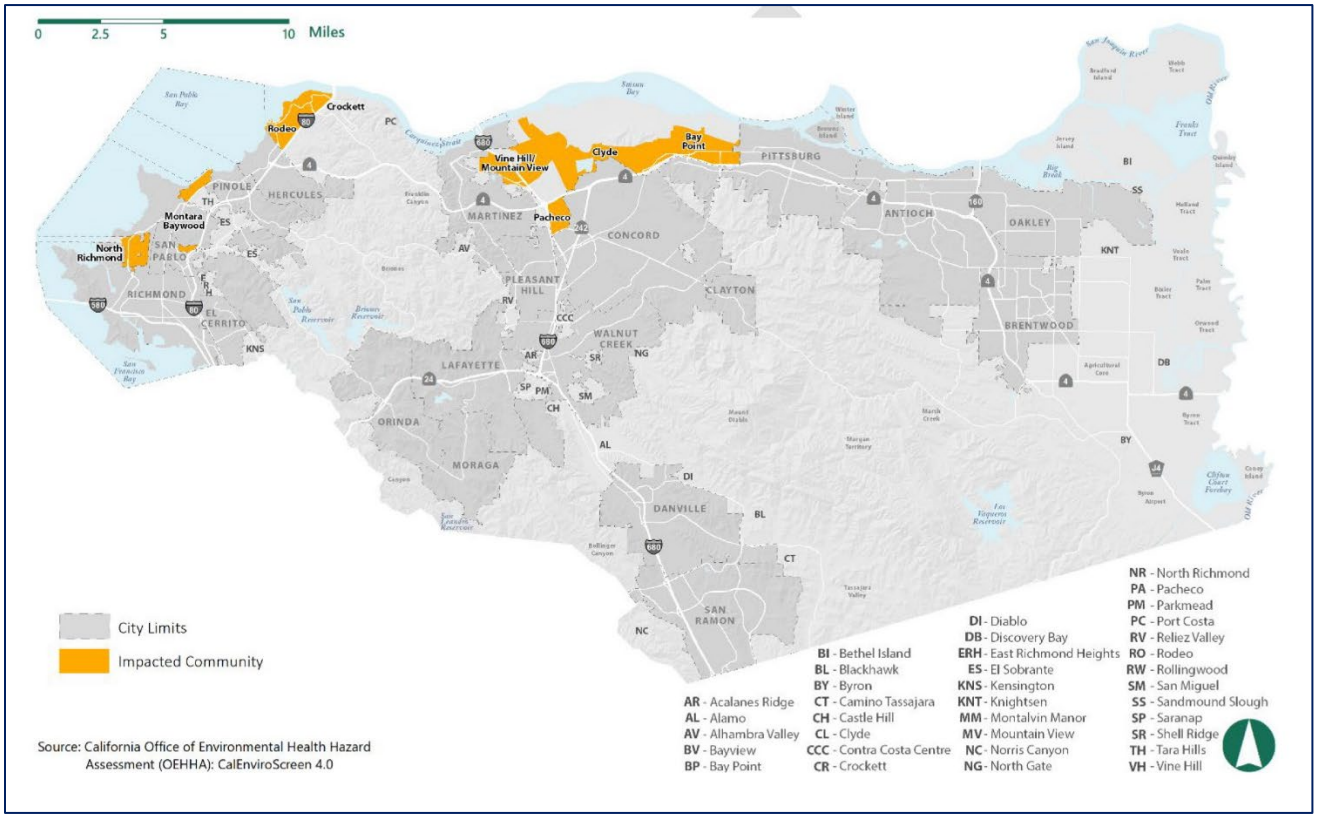
Table 3-7. Social Vulnerability Index (2020)

Theme	Social Factors	Population	Percent
Socioeconomic Status	People below 150% poverty estimate	156,345	13.4%
	Unemployed *(Civilian 16 years old and older)*	32,666	2.8%
	Housing Cost Burden	98,841	8.5%
	No High School Diploma	80,257	6.9%
	No Health Insurance	57,133	4.9%
Household Characteristics	65 years old and older	181,578	15.6%
	17 years and younger	260,191	22.3%
	Civilian with a Disability	127,957	11.0%
	Single-Parent Household	23,103	2.0%
	English Language Proficiency	65,454	5.6%
Racial and Ethnic Minority Status	• Hispanic or Latino (of any race) • Black or African American • Asian • American Indian or Alaska Native • Native Hawaiian or Pacific Islander • Two or More Races • Other Races	658,653	56.5%
Housing Type and Transportation	Multi-Unit Structures	53,171	4.6%
	Mobile Homes	6,533	0.6%
	Crowding	19,927	1.7%
	No Vehicle	21,003	1.8%
	Group Quarters	9,828	0.8%

3.7.2.1. Impacted Communities

The term *impacted communities* was introduced into the 2024 Contra Costa County Climate Action Plan. Impacted communities (e.g., low income, disabled, seniors, communities of color) have faced extensive discrimination, negligence, and economic disempowerment. Members of these communities often live in areas that are uniquely vulnerable to climate change related natural hazards. Furthermore, these individuals often lack the financial means and other resources or authority to act on climate change initiatives. **Figure 3-5** illustrates the where the impacted communities are located within unincorporated Contra Costa County which are concentrated along the County's northern waterfront.

Figure 3-5. Impacted Communities



3.8 ECONOMY

64.5% of the 16 and over population was in the labor force. Of the 604,766 civilian-employed population, 77.4% were employed in the private sector. Contra Costa County is currently experiencing an average unemployment rate of 5.1%. Educational services, health care, and social assistance represent the largest sector, employing over 22.5% of the workforce. **Tables 3-9** through **3-11** provide a breakdown of the economic characteristics of Contra Costa County. [40]

[40] United States Census Bureau. (2022). DP03: Selected Economic Characteristics (2022:ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP03?g=050XX00US06013.

Table 3-8. Employment by Industry (2022)

Industrial Sector	Estimate	Percent
Agriculture, forestry, fishing, hunting, and mining	3,771	0.7%
Construction	45,553	7.9%
Manufacturing	33,037	5.8%
Wholesale funds	11,224	2.0%
Retail trade	61,311	10.7%
Transportation, warehousing, and utilities	34,306	6.0%
Information	14,469	2.5%
Finance and insurance, real estate, and leasing	42,417	7.4%
Professional, scientific, management, and administrative	102,135	17.8%
Educational services, health care, and social assistance	129,074	22.5%
Arts, entertainment, recreation, accommodation, and food	45,803	8.0%
Other services (except public administration)	24,092	4.2%
Public administration	26,892	4.7%
Civilian Employed Population 16 Years and Over	**574,084**	

Table 3-9. Employment Status (2022)

Employment Status	Estimate	Percent
Civilian Labor Force	604,766	64.5%
Employed	574,084	61.2%
Unemployed	30,682	3.3%
Armed Forces	513	0.1%
Not in Labor Force	33,2497	35.5%
Total Employed Population 16 and Over	**937,776**	

Table 3-10. Occupation (2022)

Employment Status	Estimate	Percent
Management, Business, Science, and Arts	27,8075	48.4%
Service Occupations	92,665	16.1%
Sales and Office Occupations	110,681	19.3%
Natural Resources, Construction, and Maintenance	42,251	7.4%
Production, Transportation, and Material Moving	50,412	8.8%
Civilian Employed Population 16 and Over	**574,084**	

The median household income in Contra Costa County estimated in 2022 was $120,061, while 6.6% of the households in the Contra Costa County have an annual income of less than $15,000 per year and are therefore below the poverty level. **Table 3-12** outlines the breakdown of income and benefits in Contra Costa County. [41]

Table 3-11. Income and Benefits (2022)

Income	Number of Households *(Estimate)*	Percent
Less than $10,000	17,255	4.2%
$10,000 to $14,999	10,498	2.5%
$15,000 to $24,999	15,288	3.7%
$25,000 to $34,999	17,830	4.3%
$35,000 to $49,999	28,484	6.9%
$50,000 to $74,999	40,705	9.8%
$75,000 to $99,999	45,025	10.8%
$100,000 to $149,999	74,364	17.9%
$150,000 to $199,999	52,049	12.5%
$200,000 or more	113,696	27.4%
Median Household Income	**$120,061**	
Total Households	**415,194**	

3.9 CRITICAL INFRASTRUCTURE

Critical infrastructure is comprised of assets, systems, and networks, whether physical or virtual, which are so vital to the United States that their incapacitation or destruction would have a debilitating effect on security, national economic security, national public health or safety, or any combination thereof. [42] **Table 3-13** summarizes the number of critical infrastructure within each broad category. Due to the sensitivity of this information, a detailed list of facilities is not provided as part of this Plan. The list is on file with Contra Costa County OES. **Figure 3-6** shows locations of the critical infrastructure within Contra Costa County.

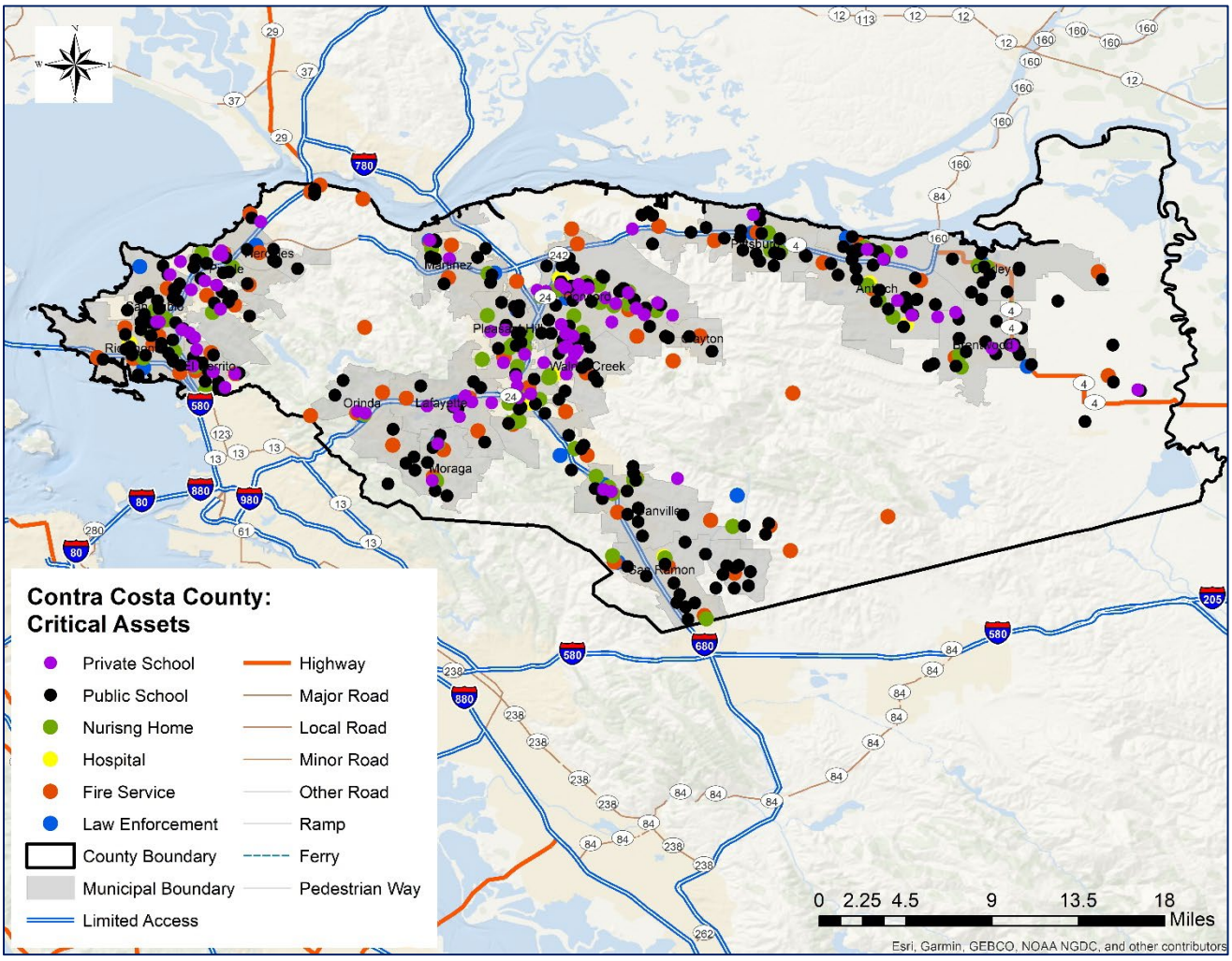
Table 3-12. Critical Infrastructure in Contra Costa County

Critical Infrastructure Category	Number of Facilities
Medical and Health	27
Government Functions	9
Protective Functions	152
School and Educational Facilities	493
HazMat	45

[41] Ibid.
[42] Cybersecurity & Infrastructure Security Agency. (n.d.). Critical Infrastructure Sectors. Retrieved from https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/critical-infrastructure-sectors.

Critical Infrastructure Category	Number of Facilities
Bridges	407
Water Supply	157
Wastewater	66
Power	52
Communications	109
Other Critical Functions	17
Other Critical Infrastructure	117
TOTAL	**1,651**

Figure 3-6. Critical Infrastructure in Contra Costa County



3.10 CAPABILITY ASSESSMENT

Federal regulations require hazard mitigation plans to identify goals for reducing long-term vulnerabilities to the identified hazards in the planning area (Section 201.6(c)(3)(i)). A critical step in the development of specific hazard mitigation actions and projects is assessing existing authorities, policies, programs, resources, and capabilities to use or modify local tools to reduce losses and vulnerability from profiled hazards.

A capability assessment was conducted for Contra Costa County and participating jurisdictions' authorities, policies, programs, and resources. Goals and mitigation actions were developed using input from this assessment. This section also includes information regarding the County's jurisdictions' implementation of and continued participation in the National Flood Insurance Program (NFIP). *Capability assessments for each participating jurisdiction can be found in their respective annexes.*

The Core Planning Team assessed Contra Costa County's capabilities that can contribute to the reduction of long-term vulnerabilities to hazards. The capabilities include the following categories:

- Planning and Regulatory Capabilities
- Administrative and Technical Capabilities
- Financial Capabilities
- Education and Outreach Capabilities

Additionally, ways to expand on and improve these existing policies and programs to integrate hazard mitigation into the day-to-day activities and programs of the County were considered.

3.10.1. Planning and Regulatory Capabilities

These include local ordinances, policies, and laws to manage growth and development (e.g., land use plans, capital improvement plans, transportation plans, emergency preparedness and response plans, building codes, and zoning ordinances). The County and cities will adopt the approved 2024 Hazard Mitigation Plan into their General Plan Safety Element for AB 2140 compliance. **Table 3-14** contains a list of legal and regulatory capabilities. The description section of each Planning and Regulatory Capability includes a paragraph on expansion, implementation, and improvement. These sections describe the processes to integrate this Hazard Mitigation Plan into other planning mechanisms.

Table 3-13. Countywide Planning and Regulatory Capabilities

County Ordinance Code Title 7 County Code, Building Regulations *Includes: Building Code, Electrical Code, Plumbing Code, Mechanical Code, Housing Code, House Moving, Grading, Community Preservation, Fire Code*			
Building Regulations (incorporated by reference and is based upon the 2022 California Building Code, 2022 California Residential Code, 2022 California Green Building Standards Code, and 2022 California Existing Building Code [all codified in California Code of Regulations, Title 24]); adopted November 17, 2022. **Expansion, Implementation, and Improvement:** Building and Fire codes will be reviewed based on developing trends in identified hazards and mitigation measures that can make them more effective at preventing losses. They will be updated to comply with the latest International and State building codes.			
Lead Department	Department of Conservation and Development	**Hazards Addressed**	All hazards

County Ordinance Code Title 8 – Zoning			
The Zoning Code addresses land use in precise detail. It sets standards for building and construction types and usage for all parcels in the County. **Expansion, Implementation, and Improvement:** Zoning Code must be modified and updated to reflect changes in development. Zoning Code may be used to address land use regulations that support mitigation actions such as development.			
Lead Department	Department of Conservation and Development	**Hazards Addressed**	Climate Change, Dam/Levee Failure, Drought, Earthquake, Flooding, Severe Weather, Wildland Fire
County Ordinance Code Title 9 – Subdivisions			
The Subdivision Code addresses the development of groups of residences and commercial property. It describes requirements for transportation, water, and wastewater services. It sets limits on residential property density. **Expansion, Implementation, and Improvement:** Subdivision Code should be modified and updated to support changes in land use development. Additionally, it should be implemented to require adequate infrastructure to support residential area populations.			
Lead Department	Department of Conservation and Development	**Hazards Addressed**	Climate Change, Dam/Levee Failure, Drought, Earthquake, Flooding, Severe Weather, Wildland Fire
County Ordinance Code Title 10 – Public Works and Flood Control			
The purpose is to provide for public health, safety, and general welfare and to minimize public and private losses due to flood conditions in specific areas. It also addresses the intent to protect and enhance the water quality of the County's unincorporated area watercourses pursuant to and consistent with the Porter-Cologne Water Quality Control Act (Water Code Section 13000 et seq.), the Federal Clean Water Act (33 U.S.C. Section 1251 et seq.) and applicable implementing regulations. **Expansion, Implementation, and Improvement:** The FEMA Flood Inundation Risk Maps (FIRMs) will be used in selecting mitigation items related to flooding. Development in the 100 and 500-year floodplains will be monitored and adhered to flood safe practices. As the FIRMs are updated, new mitigation activities will be considered.			
Lead Department	Department of Public Works	**Hazards Addressed**	Flood

General Plan

The purpose of the Contra Costa County General Plan is to express the broad goals and policies, and specific implementation measures, which will guide decisions on future growth, development, and the conservation of resources over 20 years into the future. This Plan includes eight (8) state-mandated elements and two (2) optional elements.

- Land Use
- Circulation (i.e., Transportation)
- Housing
- Conservation (i.e., Conservation, Open Space, and Working Lands)
- Open Space (i.e., Conservation, Open Space, and Working Lands)
- Safety (i.e., Health and Safety)
- Noise (i.e., Health and Safety)
- Environmental Justice (i.e., Stronger Communities)
- Public Facilities and Services
- Growth Management

The Contra Costa County 2045 General Plan was undergoing public review during the update period of this Hazard Mitigation Plan.

Expansion, Implementation, and Improvement: The Contra Costa County Hazard Mitigation Plan will be incorporated in the General Plan Safety Element. The General Plan will include specific actions that support mitigation throughout unincorporated Contra Costa County, and will be closely aligned with the Hazard Mitigation Plan.

Lead Department	Department of Conservation and Development	**Hazards Addressed**	All hazards

County Climate Action Plan (CAP)

The Climate Action Plan (CAP), adopted in December 2015, is the County's strategic approach to reduce greenhouse gas (GHG) emissions from sources throughout the unincorporated area. The CAP reflects the County's programs and actions to decrease energy use, improve energy efficiency, develop renewable energy, reduce vehicle miles traveled, increase multi-modal travel options, expand green infrastructure, reduce waste, and improve the efficiency of government operations.

Expansion, Implementation, and Improvement: The CAP will be updated in parallel with the General Plan. The General Plan will provide the long-term resiliency framework of goals and policies, and the CAP will provide strategic implementation programs to show how the County will reduce GHG emissions in support of the State's adopted reduction targets for 2030 and 2050, reducing GHG emissions 40% below 1990 levels by 2030, with consideration of the State's long-term goal to reduce GHG emissions to 80% below 1990 levels by 2050.

Lead Department	Contra Costa County Department of Conservation and Development	**Hazards Addressed**	Climate Change, Drought, Flooding, Severe Weather, Wildland Fire, Sea Level Rise

Contra Costa Hazardous Materials Plan / Hazardous Material Business Plan

Addresses the storage, use, and emergency planning for hazardous materials and extremely hazardous substances in the community and at businesses.

Expansion, Implementation, and Improvement: The Hazard Mitigation Plan will support mitigation measures compatible with the County Hazardous Materials Plan to reduce potential hazardous material releases.

Lead Department	Contra Costa Health Services, Hazardous Materials Program Office; Contra Costa County Fire Protection District	**Hazards Addressed**	Hazardous Materials

Alameda and Contra Costa County Regional Wildfire Prevention Plan			
The Contra Costa Resource Conservation District (CCRCD) and the Alameda City Resource Conservation District (ACRCD) worked jointly with funding from the Coastal Conservancy to develop a Regional Priority Plan (RPP) for Contra Costa and Alameda counties. The goal of the Regional Priority Plan process was to identify regional natural resource concerns that could be exacerbated by catastrophic wildfire and develop projects or other methods to remedy those issues ahead of the next fire. The planning process started in November 2020 and completed in September 2022. **Expansion, Implementation, and Improvement:** The Hazard Mitigation Plan and Regional Wildfire Prevention Plan should be aligned and mitigation actions in the Hazard Mitigation Plan should support the goals of the Regional Wildfire Prevention Plan. Analysis of the fire hazard in the Hazard Mitigation Plan can inform updates and revisions to the Wildfire Prevention Plan.			
Lead Department	Contra Costa County Fire Protection District	**Hazards Addressed**	Wildland Fire
Community Wildfire Protection Plan – Contra Costa County			
The 2019 update of the Contra Costa County Wildfire Protection Plan (CWPP) provides an analysis on wildfire hazards and risk in the wildland urban interface (WUI) in Contra Costa County. The Plan follows the standards for CWPPs established by the federal Healthy Forest Restoration Act. **Expansion, Implementation, and Improvement:** The Hazard Mitigation Plan and County Community Wildfire Protection Plan should be aligned and mitigation actions in the Hazard Mitigation Plan should support the goals of the CWPP. Analysis of the fire hazard in the Hazard Mitigation Plan can inform updates and revisions to the CWPP.			
Lead Department	Contra Costa County Fire Protection District	**Hazards Addressed**	Wildland Fire
Capital Improvement Plan (CIP)			
The Capital Improvement Plan (CIP) provides broad direction for development of County facilities and infrastructure. It describes a strategy to maintain adequate support for the County's communities and commerce. Additionally, it addresses transportation, greenhouse gases, stormwater, and other environmental factors. **Expansion, Implementation, and Improvement:** The CIP should include mitigation measures that will be funded by the County such as improvements to stormwater collection systems, elevation of roadways at risk for flooding and strengthening of structures.			
Lead Department	Contra Costa County Fire Protection District	**Hazards Addressed**	Climate Change, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire
Continuity of Operations Plan			
This Plan is under development.			
Lead Department	Contra Costa County Office of Emergency Services	**Hazards Addressed**	Climate Change, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire

3.10.2. Administrative and Technical Capabilities

The administrative and technical capabilities include community (i.e., public and private) staff and their skills and tools, which can be used for mitigation planning and implementation. This capability includes engineers, planners, emergency managers, GIS analysts, building inspectors, grant writers, and

floodplain managers. Small communities may rely on other government entities, such as counties or special districts, for resources. These capabilities may be used to support mitigation activities. **Table 3-15** lists administrative and technical capabilities.

Table 3-14. Administrative and Technical Capabilities

Planners, Engineers, Building Officials, Code Enforcement	
Planners, engineers, building officials, and/or code enforcement issue building permits, review plans for new construction and improvements; conduct plan checks; work with architects, engineers, designers, and building owners during pre-construction; inspect all phases of residential and commercial/industrial construction for compliance; enforce municipal code violations. **Expansion and Improvement:** Provide opportunities for continued education to Community Development staff to maintain state of the art knowledge of new code and regulatory requirements.	
Department	Department of Conservation and Development
Planners, Engineers, Analysts, General Staff	
Planners, engineers, analysts, and general staff plan future County land use; development and implementation of the Envision 2040 General Plan; land use regulations through zoning and subdivision codes, and environmental review of development; administration of the Community Development Block Grant Program (CDBG), conduct the Code Compliance program with the Building Division; conduct conditional use permits, variances, land subdivision, California Environmental Quality Act (CEQA) review, public hearings, noise permits, and zoning information. **Expansion and Improvement:** Provide opportunities for continued education to Community Development staff to maintain state of the art knowledge of new code and regulatory requirements.	
Department	Department of Conservation and Development
Director, Assistant Director, Superintendent, Supervisor, Engineers, Analysts, General Staff	
Directors, assistant directors, superintendents, supervisors, engineers, analysts, and general staff oversee public and private improvements in the public right of way; develop and implement the Capital Improvement Program by providing staff support to the County Infrastructure and Transportation Subcommittee regarding County streets, sanitary sewer, storm drains, water system facilities, traffic signals, park, and recreational facilities; maintain and upgrade public infrastructure; provide services related to traffic issues; monitors the street lighting system maintained by the County and Pacific Gas and Electric Company (PG&E); keeps and maintains record drawings of County owned infrastructure; conducts traffic committee meetings with the Police Department; and provides engineering support to other County departments and divisions within the Public Works Department. **Expansion and Improvement:** Provide opportunities for continued education to Public Works staff to maintain state-of-the-art knowledge of new code and regulatory requirements.	
Department	Department of Public Works
Office of Emergency Services (OES)	
The Office of Emergency Services (OES) provides coordinated response and recovery from major emergencies and disasters; develop, administer, and coordinate the emergency planning preparedness program in conformity with local, State, and Federal requirements; develop emergency management and hazard mitigation plans; provide training to County staff in emergency planning and preparedness; operate the County Emergency Operations Center; provide businesses and residents with emergency planning and preparedness material to help reduce the loss of life and property resulting from a disaster; coordinate with County, State, and Federal counterparts; prepare emergency management grants; coordinate the efforts of volunteer organizations. **Expansion and Improvement:** Provide training to officers, EOC staff, and other key personnel to better prepare them to respond and recover.	
Department	Contra Costa County Office of the Sheriff

Code Enforcement Officer	
Investigates citizen complaints regarding the enforcement of municipal code violations, conduct inspections, notification, communication, and the issuance of citations to proactively respond to citizens' concerns. **Expansion and Improvement:** Provide opportunities for continued education to Community Development staff to maintain state of the art knowledge of new code and regulatory requirements.	
Department	Department of Conservation and Development
Fire Marshal	
The Fire Marshal performs fire inspections for construction, commercial, multi-family occupancies, and high-rise buildings; conducts fire prevention, emergency evacuation, and extinguisher training to businesses and the public; conducts enforcement and identifies and issues notices for fire code violations; updates Fire Prevention Regulations to conform with currently adopted Codes, Regulations, and Standards; coordinates with industries for fire prevention. **Expansion and Improvement:** Continue to coordinate with the County Fire Marshal to update building codes and conduct inspections of new construction.	
Department	Contra Costa County Fire Protection District
Floodplain Administrator	
As a member of the National Flood Insurance Program (NFIP), the Floodplain Manager is responsible for collaborating with stakeholders to ensure the Floodplain Management Ordinance is followed within the County. **Expansion and Improvement:** Continue to manage the County's NFIP participation. Support the development of mitigation activities consistent with the best practices for floodplain management.	
Department	Director of Public Works
Public Information Officer (PIO)	
The Public Information Officer (PIO) provides public and media information regarding the County's disaster response, mitigation, and recovery efforts. **Expansion and Improvement:** Continue to use PIOs to promote awareness of the Hazard Mitigation Plan and activities associated with individual mitigation projects as they are implemented.	
Department	Office of Communications and Media
Information Technology (IT) and Geographic Information System (GIS)	
Information technology (IT) and Geographic Information System (GIS) provide the technical resources and support necessary to operate all of the applications relating to the County's information resources; respond to the service needs to all departments based on countywide priorities as established by the County Administrator's Office (CAO); responsible for the training and effective use of all County technology computer hardware, software, and peripherals; provide internal coordination of technology efforts Countywide including substantial interface with all technology vendors to assure cost-effective, secure, and reliable technologies compatible with the long-range needs of the County; provide high-quality spatial data to County departments. **Expansion and Improvement:** Acquire and conduct training for GIS technicians on the latest versions of ArcGIS.	
Department	Department of Information Technology

Risk Management	
Risk Management provides services to assist County departments in managing their risk of injury to employees, County property, and the public at large; purchase insurance for County departments and act in an advisory capacity with respect to workers' compensation, public liability, County property, and County contracts. **Expansion and Improvement:** Continue to have the Risk Manager provide input to support the analysis of potential losses due to hazards. Update Hazard Mitigation Plan based on current insurance values.	
Department	Contra Costa County Risk Management

3.10.3. Financial Capabilities

Table 3-16 contains a list of financial capabilities available to the County. These financial resources may be used to support mitigation activities based on procedures for each resource.

Table 3-15. Financial Resources

General Fund	
The General Fund Program funds operations and specific projects. **Expansion and Improvement:** Hazard mitigation projects may be considered during the annual budgeting process for funding from the general fund.	
Administrator	Department Specific
Board of Supervisors Administered Special Funds	
The Board of Supervisors Administered Special Funds most special revenue funds were established to mitigate the impact of projects approved in certain areas of the County and that most funds have been intended for uses that will benefit the quality of life for the communities in which the project is approved and special revenue funds originated. **Expansion and Improvement:** Focus Administered Special Funds on projects that provide mitigation to natural hazards.	
Administrator	Board of Supervisors
National Pollutant Discharge Elimination System (NPDES)	
The National Pollutant Discharge Elimination System (NPDES) is a joint effort of the Planning, Engineering, and Public Works departments through the Contra Costa County Clean Water Program. Since 1993, Contra Costa County Flood Control and Water Conservation District, and 16 cities in the county have worked together to meet federal mandates for minimizing pollutants in stormwater runoff. This revenue is used to fund its pro-rated share of the Clean Water Program's staffing, overhead costs, and local-level activities necessary to comply with the joint Municipal Regional Permit (MRP) provisions. **Expansion and Improvement:** Where permissible, the NPDES Fund may be considered during the annual budgeting process for funding mitigation projects.	
Administrator	Department of Conservation and Development

Community Development Block Grant (CDBG)	
The Community Development Block Grant (CDBG) Program provides funding for eligible senior activities such as in-home care, art classes, counseling, and home-delivered meals. United States Department of Housing and Urban Development (HUD) also provides Disaster Recovery Assistance in the form of flexible grants to help cities, counties, and states recover from Presidentially declared disasters, especially in low-income areas, subject to the availability of supplemental appropriations. **Expansion and Improvement:** Where applicable, CDBG should be used to fund mitigation projects that enhance the resiliency of low-income and underserved communities.	
Administrator	Federal Emergency Management Agency, Department of Conservation and Development
Hazard Mitigation Grant Program (HMGP)	
The Hazard Mitigation Grant Program (HMPG) provides support for post-disaster mitigation plans and projects. **Expansion and Improvement:** Train staff on notice of intent (NOI) procedures and track opportunities on the California OES mitigation website to initiate applications for grant funding.	
Administrator	Federal Emergency Management Agency
Building Resilient Infrastructure and Communities (BRIC)	
Building Resilient Infrastructure and Communities (BRIC) provides support for pre-disaster mitigation plans and projects. **Expansion and Improvement:** Train staff on notice of intent (NOI) procedures and track opportunities on the California OES mitigation website to initiate applications for grant funding.	
Administrator	Federal Emergency Management Agency
Flood Mitigation Assistance (FMA) Grant Program	
The Flood Mitigation Assistance (FMA) Grant Program mitigates structures and infrastructure with repetitive losses. **Expansion and Improvement**: Train staff on notice of intent (NOI) procedures and track opportunities on the California OES mitigation website to initiate applications for grant funding.	
Administrator	Federal Emergency Management Agency

3.10.4. Education and Outreach Capabilities

Table 3-17 lists the County's public outreach capabilities. These capabilities include fire safety programs, hazard awareness campaigns, public information, and communications offices. Education and outreach capabilities can be used to inform the public about current and potential mitigation activities.

Table 3-16. Education and Outreach Resources

County Emergency/Disaster Readiness Website *https://www.cocosheriff.org/disaster-preparedness/emergency-services-division*	
The County Sheriff's website has educational material on numerous programs, including making an emergency plan, stocking supplies, staying informed, and getting involved in community preparedness programs. **Expansion and Improvement:** Provide links to the County website on all County websites. Post material on social media accounts that provide a link to the appropriate FEMA website page.	
Lead Organization	Contra Costa County Office of Emergency Services

County Public Safety and Emergency Information https://www.contracosta.ca.gov/5435/Public-Safety-Emergency-Info	
Provides resources and links for public safety and emergency information in Contra Costa County. **Expansion and Improvement:** Provide additional links to other organizations such as FEMA and PG&E.	
Lead Organization	Contra Costa County Office of Emergency Services
County Community Emergency Response Team (CERT) Coalition	
The Community Emergency Response Team (CERT) Program is a 20-hour all risk, all hazard training offered by the County Fire Department. This valuable course is designed to help you protect yourself, your family, your neighbors, and your neighborhood before, during, and after an emergency. **Expansion and Improvement:** Conduct coordinated training and exercises with all County CERTs to improve interoperability.	
Lead Organization	Contra Costa County Cities Citizen Corps
County Office of Communications and Media https://www.contracosta.ca.gov/128/Office-of-Communications-and-Media	
The Contra Costa County's Office of Communications and Media, a division of County Administration, oversees public information and media relations. It is responsible for coordinating emergency communications countywide. **Expansion and Improvement:** Use Office of Communications and Media resources to increase enrollment in the County Community Warning System. Feature mitigation activities in programming on public access channels.	
Lead Organization	County Administration
Contra Costa Television (CCTV)	
Contra Costa Television (CCTV) is the flagship channel of Contra Costa County's cable television programming, bringing special events, government meetings, and produced shows. CCTV broadcasts on channels Comcast Cable 27, ATT/U-Verse 99, and Astound 32 & 1027. **Expansion and Improvement:** Use CCTV to provide information on how the public can support mitigation activities including limiting creating greenhouse gases and providing fire safety zones around residences.	
Lead Organization	County Administration
Community Warning System (CWS)	
The Community Warning System (CWS) can alert residents and businesses within Contra Costa County that are impacted by or are in danger of being impacted by an emergency. The CWS message will include basic information about the incident and what specific protective actions (e.g., shelter in place, lockdown, evacuate, avoid the area) are necessary for life safety and health. **Expansion and Improvement:** Coordinate community evacuation drills using the CWS to implement the exercise. Conduct post-exercise information fairs at evacuation collection points.	
Lead Organization	Contra Costa County Office of the Sheriff

3.11 HAZARD MITIGATION INTEGRATION

The information on hazards, risk, vulnerability, and mitigation contained in this Hazard Mitigation Plan is based on the best available data at the time of the Plan update. Plan integration consists of the incorporation of hazard mitigation into other relevant planning mechanisms (e.g., general planning and capital improvement planning). It includes the integration of natural hazard information and mitigation

policies, principles, and actions into local planning mechanisms and vice versa. Additionally, plan integration is achieved through the involvement of key staff and community officials in collaborative hazard mitigation planning.

3.11.1. Existing Plan Integration

In the performance period since the adoption of the previous Hazard Mitigation Plan, Contra Costa County made progress on integrating components of the hazard mitigation strategy (e.g., goals, objectives, and actions) into the planning initiatives listed in **Table 3-18**.

Table 3-17. Current Plan Integration

Planning Initiative	Description
Capital Improvement Plan	The Plan includes projects that can help mitigate potential hazards. The County will strive to ensure consistency between the Hazard Mitigation Plan and the current and future Capital Improvement Plan. The Hazard Mitigation Plan may identify new possible funding sources for capital improvement projects and may result in modifications to proposed projects based on results of the risk assessment.
Building Code	The County's adoption of the 2022 California Building Code incorporated local modifications addressing seismic and fire hazards.
General Plan	The County General Plan includes a Safety Element to protect the community from unreasonable risk by establishing policies and actions to avoid or minimize geological and seismic, fire, hazardous materials, and flooding hazards. Contra Costa County is in the process of updating the General Plan, and efforts to continue integrating and improving the Safety Element are ongoing. The 2045 General Plan's Safety Element includes all the hazards that impact the County; Community Profiles (for each unincorporated neighborhood) that identify the community's local hazards; Impacted Communities where the population is exposed to hazards at higher levels than others; and policies and actions.
Climate Action Plan	Highlights potential programs that could be implemented to reduce greenhouse gas emissions and discusses possible impacts of climate change.
County Debris Management Plan	The County of Contra Costa Disaster Debris Management Plan (DDMP) provides a comprehensive framework for managing debris following a disaster for all debris-generating hazards. It addresses the roles and responsibilities of government organizations, private firms, and non-governmental organizations that might have a role in debris operations.
Envision Contra Costa	Envision Contra Costa 2040 is the County's plan to address land use, transportation, housing, climate change, environmental justice, and other important issues over the next 20 years. At the time of this Hazard Mitigation Plan update, the 2045 General Plan and the 2024 Climate Action Plan were undergoing public comment. In an effort to integrate both of these plans into hazard mitigation, the outcomes of the extensive public outreach for the ongoing Envision Contra Costa 2040 process were incorporated into this Plan.

3.11.2. Potential Future Integration

As the Hazard Mitigation Plan is implemented, Contra Costa County will use information from the Plan as the best available science and data on hazards. The capability assessment presented in Section 3.10.1 of this Annex identifies codes, plans, and programs that provide opportunities for integration. The countywide and local action plans developed for this Plan are related to plan integration. The capability

assessment identified plans and programs, listed in **Table 3-19**, that do not currently integrate goals and recommendations of this Plan but provide opportunities to do so in the future.

Table 3-18. Potential Future Integration

Planning Initiative	Description
Flood Control Capital Improvement Plan	Capital improvement project proposals may take into consideration hazard mitigation potential as a means of evaluating project prioritization.
Capital Road Improvement and Protection Plan	Capital improvement project proposals may take into consideration hazard mitigation potential as a means of evaluating project prioritization.
County General Plan	The County is conducting a comprehensive update to its General Plan. The opportunity to incorporate additional hazard mitigation and abatement measures will be considered for inclusion into the updated General Plan.
County Emergency Operations Plan (EOP)	The County EOP establishes the emergency organization, assigns tasks, specifies policies and general procedures, and provides for the coordination of planning efforts of the various emergency staff and service elements utilizing the Standardized Emergency Management System (SEMS). The EOP and the Hazard Mitigation Plan are currently integrated and will continue to be integrated, as appropriate. Specifically, the new hazard ranking methodology and rankings may be one area for inclusion.
Post-Disaster Recovery Plan	The County does not have a recovery plan and intends to develop one as a mitigation planning action during the next five (5) years. The Recovery Plan will build on the mitigation goals and objectives identified in the Hazard Mitigation Plan.

3.12 NATIONAL FLOOD INSURANCE PROGRAM

As of January 2024, Unincorporated Contra Costa County and all 19 jurisdictions within the County are members of the National Flood Insurance Program (NFIP). **Table 3-20** identifies each community and the date each participant joined the NFIP. [43]

Seven (7) of the NFIP communities also participate in the Community Rating System (CRS) which is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions, meeting the three (3) goals of the CRS:

- Reduce flood losses.
- Facilitate accurate insurance ratings.
- Promote flood insurance awareness.

Table 3-19. NFIP Participation Information

CID	Community Name	NFIP Participation Date	Current Effective FIRM Date	CRS Entry Date	CRS Current Effective Date	CRS Class
060025	Unincorporated Contra Costa	11/1/1974	3/21/2017	10/1/1991	10/1/2022	6

[43] Federal Emergency Management Agency, National Flood Insurance Program. (2024). Community Status Book Report. Retrieved from https://www.fema.gov/cis/CA.pdf.

CID	Community Name	NFIP Participation Date	Current Effective FIRM Date	CRS Entry Date	CRS Current Effective Date	CRS Class
060026	City of Antioch	6/28/1974	3/21/2017	N/A	N/A	N/A
060439	City of Brentwood	2/7/1975	3/21/2017	N/A	N/A	N/A
060027	City of Clayton	5/17/1974	3/21/2017	N/A	N/A	N/A
065022	City of Concord	6/28/1974	3/21/2017	10/1/2008	5/1/2022	6
060707	Town of Danville	N/A	3/21/2017	N/A	N/A	N/A
065027	City of El Cerrito	6/28/1974	3/21/2017	N/A	N/A	N/A
060434	City of Hercules	3/26/1976	3/21/2017	N/A	N/A	N/A
065037	City of Lafayette	7/26/1974	3/21/2017	N/A	N/A	N/A
065044	City of Martinez	6/28/1974	3/21/2017	N/A	N/A	N/A
060637	Town of Moraga	11/19/1976	6/16/2009	N/A	N/A	N/A
060766	City of Oakley	11/1/1974	3/21/2017	N/A	N/A	N/A
060722	City of Orinda	N/A	6/16/2009	N/A	N/A	N/A
060032	City of Pinole	5/24/1974	3/21/2017	N/A	N/A	N/A
060033	City of Pittsburg	6/21/1974	3/21/2017	N/A	N/A	N/A
060034	City of Pleasant Hill	5/24/1974	3/21/2017	5/1/2003	10/1/2018	9
060035	City of Richmond	6/28/1974	NSFHA	10/1/1995	5/1/2015	10
060036	City of San Pablo	3/15/1974	3/21/2017	10/1/2013	10/1/2013	8
060710	City of San Ramon	N/A	6/16/2009	10/1/1991	9/26/2023	6
065070	City of Walnut Creek	11/8/1974	3/21/2017	10/1/1991	5/1/2011	8

3.12.1. Contra Costa County Floodplain Management Program

The Contra Costa County Floodplain Management Program, coordinated by the Contra Costa County Public Works Department, Engineering Services Division, provides floodplain information for existing structures and proposed projects within the Special Flood Hazard Area (SFHZ). The Program is meant for Unincorporated County areas only.

FEMA produced a Flood Insurance Study (FIS) and printed Flood Insurance Rate Maps (FIRMs) for Contra Costa County in July 1987. These watersheds are studied, updated, and remapped periodically, showing areas with a 1% chance of flooding each year. These areas are commonly referred to as *100-year floodplains* and are shown as SFHAs on the FIRMs. Flood insurance is mandatory for residential, commercial, and industrial developments within SFHAs, and for federally backed mortgages. Flood insurance may also be required by lenders.

In compliance with the NFIP, the County adopted a Floodplain Management Ordinance. This Ordinance requires that the lowest floor, including basement, for all new structures or substantial improvements to existing structures within a SFHA, shall be elevated one (1) to two (2) feet above the 100-year Base

Flood Elevation (BFE) for that area. Lower insurance rates are available when the lowest floor is above the BFE. [44]

3.12.2. Floodplain Managers

All NFIP participating jurisdictions have a designated Floodplain Manager that is charged with enforcing floodplain regulations, routinely monitoring the floodplains, and providing community assistance such as encouraging owners to maintain flood insurance. A list of Contra Costa County Floodplain Managers (County and cities) can be found in **Table 3-21**.

Table 3-20. Floodplain Managers

Jurisdiction	Department	Name	Title	Phone Number
Contra Costa County	Public Works	Larry Gossett	Civil Engineer	(925) 313-2016
City of Antioch	Public Works	Scott Buenting	City Engineer	(925) 779-7035
City of Brentwood	Engineering Development	Allen Baquilar	Director/ City Engineer	(925) 516-5405
City of Clayton	Engineering Department	Larry Theis	City Engineer	(925) 673-7300
City of Concord	Community Development	Kevin Marstall	Director	(925) 671-3257
Town of Danville	Engineering Division	Steven Jones	City Engineer	(925) 314-3310
City of El Cerrito	Building	Raylee Glasser	Building Official	(510) 215-4635
City of Hercules	Public Works	Mike Roberts	Director	(510) 799-8200
City of Lafayette	Engineering Department	Mike Moran	City Engineer	(925) 299-3247
City of Martinez	Public Works	Joe Enke	Director	(925) 372-3562
Town of Moraga	Public Works	Shawn Knapp	Town Engineer	(925) 888-7027
City of Oakley	Public Works	Kevin Rohani	City Engineer	(925) 625-7003
City of Orinda	Public Works	Sivakumar Natarajan	City Engineer	(925) 253-4231
City of Pinole	Public Works	Sanjay Mishra	City Engineer	(510) 724-9017
City of Pittsburg	Public Works	John Samuelson	City Engineer	(925) 252-4930
City of Pleasant Hill	Engineering	Omar Adina	Assistant Engineer	(510) 620-6868
City of Richmond	Community Services	Oscar Dalvalos	Chief Building Inspector	(510) 215-3030
City of San Pablo	Public Works	Allan Panganiban	Director/ City Engineer	(925) 215-3062
City of San Ramon	Public Works (Engineering Services Division)	Chen-hsuan Hsieh	City Engineer	(925) 973-2681
City of Walnut Creek	Public Works	Heather Ballenger	Director	(925) 943-5854

[44] Contra Costa County Public Works. (n.d.). FEMA Floodplain Management Program: Overview. Retrieved from https://www.contracosta.ca.gov/332/FEMA-Floodplain-Program.

3.12.3. Participation Activities

Contra Costa County NFIP participation activities over the last five (5) years include the following:

- Provides the following services – permit review, GIS, inspections, and engineering capability.
- The City educates private owners and other stakeholders about the importance of flood insurance through public outreach events, workshops, and/or seminars.
- Enforces local floodplain regulations and monitors compliance.
- Floodplain management regulations meet or exceed FEMA or State minimum requirements.

3.12.3.1. Substantial Damage

Substantial Damage means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50% of the market value of the structure before the damage occurred *(County Code Title 8, Chapter 82-28 – Floodplain Management)*.

3.12.3.2. Substantial Improvement

Substantial Improvement means any reconstruction, rehabilitation, addition or improvement of a structure, the cost of which equals or exceeds 50% of the market value of the structure before the "start of construction" of the improvement. This term includes structures that have incurred *substantial damage* regardless of the actual repair work performed.

The percentage figure must be added to any successive building permits that may be issued or have been issued within a contiguous 10 year span. Substantial improvement is considered to occur when the first alteration of any wall, ceiling, floor or other structural part of the building commences, whether or not that alteration affects the external dimensions of the structure. However, the term does not include:

- Any project for improvement of a structure to comply (not required because of flood damage) with existing state or local health, sanitary or safety code specifications which are the minimum necessary to assure safe living conditions.
- Any alteration of an "historic structure," provided that the alteration will not preclude the structures continued designation as an "historic structure." (*County Code Title 8, Chapter 82-28 – Floodplain Management)*

CHAPTER 4. HAZARD IDENTIFICATION AND RISK ASSESSMENT

A risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards. It allows emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. The process focuses on the following elements.

- **Hazard Identification:** Use all available information to determine what types of disasters may affect a jurisdiction, how often they can occur, and their potential severity.
- **Vulnerability Identification:** Determine the impact of natural, human-caused, and technological hazard events on the population, environment, economy, and lands of the region.
- **Cost Evaluation:** Estimate the cost of potential damage or cost that can be avoided by mitigation.

This Plan is designated to comply with requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, and Related Authorities and 44 CFR Part 201 (44 CFR § 201.6), which states that local governments must have an approved Hazard Mitigation Plan in place for eligibility of pre-disaster and/or post-disaster mitigation grant funds. This Plan is also designed to comply with the FEMA and the California Office of Emergency Services guidance documents (particularly the Local Mitigation Planning Policy Guide, effective April 19, 2023) and other applicable federal, state, and local regulations. This was accomplished by evaluating the impacts of known natural, human-caused, and technological hazards, prioritizing mitigation alternatives, and coordinating hazard mitigation with other Contra Costa County programs and policies.

4.1 IDENTIFIED HAZARDS

There are a number of hazards that pose a threat to human life, health, and well-being, and this Plan is not meant to compile an exhaustive list. Those addressed in disaster planning are generally categorized as natural, human-caused, or technological. Some hazards are a threat to all geographic areas while others (e.g., flooding) are more limited in their extent.

The Contra Costa County hazards were identified, and their frequency of occurrence was evaluated through a historical analysis using a number of resources, including:

- 2018 Contra Costa County Hazard Mitigation Plan
- 2018 and 2023 State of California Hazard Mitigation Plan
- Hazard planning documents developed by state, federal, and private agencies
- National Centers for Environmental Information data from 2012 through 2022
- National Oceanic and Atmospheric Administration/National Weather Service Space Weather Prediction Center
- United States Geological Survey data
- FEMA National Risk Index data

Although FEMA only requires and reviews natural hazards in hazard mitigation plans, Contra Costa County decided to rank and mitigate against a comprehensive list of hazard events that could impact the

County. Due to the nature of non-natural hazards and the discretionary status regarding their inclusion, the following hazards of interest have been briefly and qualitatively assessed for the sake of public education and informing their inclusion within the hazard ranking and mitigation process. Hazards that have been identified as significant in Contra Costa County and that will be considered in this Plan are listed in **Table 4-1**.

Table 4-1. Contra Costa County Hazards

Natural Hazards
Climate Change
Dam and Levee Failure
Drought
Earthquake
Flood
Landslide
Sea Level Rise *(Coastal Flooding)*
Severe Weather *(Severe Thunderstorms – Hail, Strong Winds, Tornadoes – Heavy Rainfall, Heat Wave/Extreme Heat)*
Tsunami
Wildfire
Human-Caused/Technological Hazards
Cybersecurity Threats
Hazardous Materials Incidents
Utility Interruptions
Active Shooter Incidents
Terrorism (Weapons of Mass Destruction)

Per FEMA's requirement to consider all natural hazards, the following natural hazards were not included because these hazards are not considered significant for the Contra Costa County planning area due to its geographic location and lack of significant historical occurrences.

- Avalanche
- Hurricane
- Ice Storm
- Volcanic Activity
- Winter Weather (specifically related to snow and blizzards)

4.2 PRESIDENTIAL DISASTER AND EMERGENCY DECLARATIONS

Table 4-2 lists all federal disaster and emergency declarations in Contra Costa County between 1950 and 2023, according to FEMA. This lists shows the foundation for identifying what hazards pose the most significant risk within the County. [45]

Table 4-2. State and Federal Disaster Declarations for Contra Costa County

Event	State Proclamation Date	Disaster Number	Federal Declaration Date	FEMA Disaster Number	Location
Severe Winter Storms, Flooding, Landslides, and Mudslides	1/4/2023	2023-01	1/14/2023	DR-4683	Contra Costa County (Countywide)
Severe Winter Storms, Flooding, and Mudslides	1/4/2023	N/A	1/9/2023	EM-3591 *(consolidated into DR-4683)*	Contra Costa County (Countywide)
California Covid-19 Pandemic	3/4/2020	2020-01	3/22/2020	DR-4482	Contra Costa County (Countywide)
California Covid-19 Pandemic	3/4/2020	2020-01	3/13/2020	EM-3428 *(consolidated into DR-4482)*	Contra Costa County (Countywide)
Severe Winter Storms, Flooding, Mudslides	3/7/2017	2017-03	4/1/2017	DR-4308	Contra Costa County (Countywide)
Severe Winter Storms, Flooding, and Mudslides	2/10/2017	2017-02	3/16/2017	DR-4305	Contra Costa County (Countywide)
Severe Storms, Flooding, and Mudslides	1/23/2017	2017-01	2/14/2017	DR-4301	Contra Costa County (Countywide)
Bay Area Oil Spill	11/9/2007	2007-15	Not Declared	N/A	Contra Costa County (Countywide)
Severe Storms, Flooding, Mudslides, and Landslides	1/12/2006	2006-01	2/3/2006	DR-1628	Contra Costa County (Countywide)
Severe Winter Storms and Flooding	Not Available	98-01	2/9/1998	DR-1203	Contra Costa County (Countywide)
Severe Storms, Flooding, Mud and Landslides	1/2/1997 – 1/31/1997	97-01	1/4/1997	DR-1155	Contra Costa County (Countywide)
Winter Storms	Varies from 1/2/1997 – 1/31/1997	97-01	Not Declared	N/A	Contra Costa County (Countywide)
Severe Winter Storms, Flooding Landslides, Mud Flow	Varies from 3/12/1995 – 3/24/1995	95-03	3/12/1995	DR-1046	Contra Costa County (Countywide)

[45] Federal Emergency Management Agency. (2023). Disaster Declarations for States and Counties. Retrieved from https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

Event	State Proclamation Date	Disaster Number	Federal Declaration Date	FEMA Disaster Number	Location
Severe Winter Storms, Flooding, Landslides, Mud Flows	Varies from 1/9/1995 – 2/17/1995	95-01	1/10/1995	DR-1044	Contra Costa County (Countywide)
Severe Winter Storm, Mud and Land Slides, and Flooding	1/7/1993 – 2/19/1993	93-01	1/15/1993	DR-979	Contra Costa County (Countywide)
Loma Prieta Earthquake	10/18/1989 – 10/30/1989	89-05	10/18/1989	DR-845	Contra Costa County (Countywide)
Severe Storms and Flooding	2/18/1986 – 3/12/1986	86-01	2/18/1986	DR-758	Contra Costa County (Countywide)
High Tides/Storms	1/1/1984	83-06	Not Declared	N/A	Contra Costa County (Countywide)
Bradford Levee Failure	12/9/1983 1/18/1984	83-05	Not Declared	N/A	Contra Costa County (Countywide)
Coastal Storms, Floods, Slides, and Tornadoes	12/8/1982 – 3/21/1983	82-18	2/9/1983	DR-677	Contra Costa County (Countywide)
High Tides and Rains	12/8/1982	N/A	Not Declared	N/A	Contra Costa County (Countywide)
Severe Storms, Flood, Mudslides, and High Tide	1/5/1982 – 1/9/1982	N/A	1/7/1982	DR-651	Contra Costa County (Countywide)
Torrential Rain, High Tide, and Winds	Not Proclaimed	N/A	2/1/1980	EM-3078	Contra Costa County (Countywide)
Delta Levee Break	1/23/1980	N/A	1/23/1980	EM-3078	Contra Costa County (Countywide)
Drought	Not Proclaimed	N/A	1/20/1977	EM-3023	Contra Costa County (Countywide)
1976 Drought	2/9/1976 2/13/1976 2/24/1976 3/26/1976 7/6/1976	N/A	Not Declared	N/A	Contra Costa County (Countywide)
1970 Storms and Floods	4/10/1970	N/A	Not Declared	N/A	Contra Costa County (Countywide)

Event	State Proclamation Date	Disaster Number	Federal Declaration Date	FEMA Disaster Number	Location
Severe Storms and Flooding	1/23/1969 1/25/1969 1/28/1969 1/29/1969 2/8/1969 2/10/1969 2/16/1969 3/12/1969	N/A	1/26/1969	DR-253	Contra Costa County (Countywide)
California Severe Storms, Flooding	10/17/1962 10/25/1962 10/30/1962 11/4/1962	N/A	10/24/1962	DR-138	Contra Costa County (Countywide)

4.3 RISK ASSESSMENT METHODOLOGY

As part of the Contra Costa County Office of Emergency Services (OES), the risk assessment identifies the natural, human-caused, and technological hazards that have potential impacts on all or portions of the County. Hazard identification, historical occurrences, and risk modeling (where applicable and available for specific hazards) information was collected from multiple sources including, but not limited to:

- Environmental Systems Research Institute (Esri)
- Federal Emergency Management Agency (FEMA)
- National Centers for Environmental Information (NCEI)
- National Weather Services (NWS)
- United States Geological Survey (USGS)
- Local repositories

This information was analyzed to assess the risk and vulnerability of people, property, the environment, and the jurisdiction's essential operations from these hazards. Furthermore, a risk ranking was performed for the hazards of concern described in this Plan. The risk ranking is an important step in developing an action plan, as it allows jurisdictions to compare the risk factors from one hazard to another. That comparison provides critical information to use in selecting hazard mitigation actions and their priorities. This process is not only intended to help focus actions on the hazards with the highest ranking, but also to ensure that jurisdictions are aware of the hazards that ranked low yet still pose significant risk.

In order to provide an informed and comprehensive ranking of the hazards addressed in this Plan, a number of factors were considered: probability, extent, vulnerability, and impact. The sum of all the weighted factors for the extent, vulnerability, and impact categories was combined into a final consequence score. Probability multiplied by consequence resulted in a total risk score for each hazard.

Extent + Vulnerability + Impact = Consequence

Consequence x Probability = Total Risk Score

These results were determined by following a data driven quantitative assessment, reviewing, and ranking local knowledge from local subject matter experts, and developing other risk elements by the Core Planning Team based on the data collected. These elements were then aggregated to inform the analysis.

At the fundamental level, consequence is an assessment of the potential impact(s) if the hazard incident actually occurs. In this assessment, the consequence of an event (or the impact) will be interdependent on the following factors:

- Vulnerabilities (i.e., social, physical, and community conditions)
- Capabilities and capacities
- Mitigation
- Characteristics of the hazard event (i.e., magnitude, scale)

The frequency/probability of the hazard is not included in assessing the consequence because without the event, there is no consequence or impact.

4.3.1. Probability of Occurrence

The probability of occurrence of a hazard is indicated by a probability factor based on the likelihood of annual occurrence. Numerical probability factors were assigned as follows.

Table 4-3 outlines the probability of occurrence factors used in the risk assessment calculations for this Plan. A significant hazard event is defined as any hazard occurrence that directly or indirectly damages structures or infrastructure, impedes normal business operations, and/or is likely to cause serious or fatal injuries.

Table 4-3. Probability of Occurrence

Probability	Description	Probability Factor
High	Significant hazard event is likely to occur annually.	3
Medium	Significant hazard event is likely to occur within 25 years.	2
Low	Significant hazard event is likely to occur within 100 years.	1
Unlikely	There is little to no probability of significant occurrence, or the recurrence interval is greater than every 100 years.	0

The assessment of hazard frequency is generally based on past hazard events in the area and professional judgment of local subject matter experts.

4.3.2. Extent Factors

Extent was assessed in two (2) categories – extent/intensity potential and catastrophic probability of the hazard. Numerical extent factors were assigned as follows.

4.3.2.1. Extent/Intensity Factor

Extent is defined as the range of anticipated intensities of the identified hazards. This category is most commonly expressed using various scientific scales (e.g., Saffir-Simpson, Enhanced Fujita, Modified Mercalli). Extent/Intensity Factors are hazard-specific and are detailed in each hazard profile. **Table 4-4** outlines the extent/intensity factors used in the risk assessment calculations for this Plan.

Table 4-4. Extent/Intensity Factor

Probability	Description	Extent Factor
High	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a high-intensity incident.	3
Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2
Low	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a low-intensity incident.	1
Unlikely	Historical and/or probabilistic models/studies for this hazard indicate the possibility of little to no intensity.	0

4.3.2.2. Catastrophic Factor

The probability that a hazard could be catastrophic. Catastrophes are defined as significant incidents that cause sudden and great harm or destruction. **Table 4-5** outlines the catastrophic factors used in the risk assessment calculations for this Plan.

Table 4-5. Catastrophic Factor

Probability	Description	Extent Factor
High	Catastrophic hazard event is likely to occur at least once in 10 years.	3
Medium	Catastrophic hazard event is likely to occur at least once between 11 and 50 years.	2
Low	Catastrophic hazard event is likely to occur at least once in 51 or more years.	1
No Impact	Virtually no probability that this hazard could be catastrophic.	0

Each category was assigned a weighting factor to reflect its significance, consistent with this typically used for measuring the benefits of hazard mitigation actions – a weighting factor of three (3) was assigned for *Extent/Intensity* and its potential for *Catastrophe*.

4.3.3. Vulnerability Factors

Vulnerabilities were assessed in three (3) categories – population exposure, property exposure, and exposure based on changes in development. Numerical vulnerability factors were assigned as follows.

4.3.3.1. Population Exposure Factor

Population exposure values were assigned based on the percentage of the total population exposed to the hazard event. **Table 4-6** outlines the population exposure factors used in the risk assessment calculations for this Plan.

Table 4-6. Population Exposure Factor

Probability	Description	Vulnerability Factor
High	30% or more of the population is exposed to the hazard.	3
Medium	15% to 29% of the population is exposed to the hazard.	2
Low	14% or less of the population is exposed to the hazard.	1
No Vulnerability	None of the population is exposed to the hazard.	0

4.3.3.2. Property Exposure Factor

Property exposure values were assigned based on the percentage of the total property value exposed to the hazard event. **Table 4-7** outlines the property exposure factors used in the risk assessment calculations for this Plan.

Table 4-7. Property Exposure Factor

Probability	Description	Vulnerability Factor
High	25% or more of the total assessed property value is exposed to the hazard.	3
Medium	10% to 24% of the total assessed property value is exposed to a hazard.	2
Low	9% or less of the total assessed property value is exposed to a hazard.	1
No Vulnerability	None of the total assessed property value is exposed to a hazard.	0

4.3.3.3. Changes in Development

Changes in development in the past five (5) years have increased or decreased the community's vulnerability/exposure to the hazard. **Table 4-8** outlines the changes in development factors used in the risk assessment calculations for this Plan.

Table 4-8. Changes in Development Factor

Probability	Description	Vulnerability Factor
High	Changes in development have increased the vulnerability/exposure of the community to the hazard by 10% or more.	3
Medium	Changes in development have increased the vulnerability/exposure of the community to the hazard between 5% and 9%.	2

Probability	Description	Vulnerability Factor
Low	Changes in development have increased the vulnerability/exposure of the community to the hazard by 4% or less.	1
No Vulnerability	Changes in development had no effect and/or have decreased the vulnerability/exposure of the community to the hazard.	0

Each category was assigned a weighting factor to reflect the significance, consistent with those typically used for measuring the benefits of hazard mitigation actions – a weighting factor of three (3) was assigned for *Population Exposure*, and a weighting factor of one (1) was assigned for *Property Exposed* and *Changes in Development*.

4.3.4. Impact Factors

Hazard impacts were assessed in eight (8) categories – population and life/safety, underserved/equity, property damages, economic, environmental, essential operations, future development, and climate change. Numerical impact factors were assigned as follows.

4.3.4.1. Population and Life Safety Factor

Population and life safety values were assigned based on the best available data (historical and probabilistic) for people vulnerable to the hazard event and whether the affected population is likely to experience adverse impacts from the hazard incident. **Table 4-9** outlines the population and life safety factors used in the risk assessment calculations for this Plan.

Table 4-9. Population and Life Safety Factor

Probability	Description	Impact Factor
High	Populations exposed to this hazard are likely to experience significant adverse impacts, such as fatalities and severe injuries.	3
Medium	Populations exposed to this hazard are likely to experience some adverse impacts, such as injuries requiring acute medical care.	2
Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1
No Impact	Populations exposed to this hazard are not likely to experience significant adverse impacts.	0

4.3.4.2. Underserved/Equity Factor

Underserved/equity values were assigned based on the best available data for underserved populations vulnerable to the hazard event and whether the affected population is likely to experience adverse/disproportionate impacts from the hazard incident resulting in greater disparity in equity. **Table 4-10** outlines the underserved/equity factors used in the risk assessment calculations for this Plan.

Table 4-10. Underserved/Equity Factor

Probability	Description	Impact Factor
High	Underserved populations exposed to the hazard are likely to experience significant adverse/disproportionate impacts, such as fatalities and severe injuries.	3

Probability	Description	Impact Factor
Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2
Low	Underserved populations exposed to the hazard are likely to experience minimal adverse/disproportionate impacts, such as ambulatory injuries.	1
No Impact	Underserved populations exposed to the hazard are not likely to experience significant adverse/disproportionate impacts.	0

4.3.4.3. Property Damage Factor

Property damage values were assigned based on the expected total property damage incurred from a hazard incident. It is important to note that values represent estimates of the loss from a major incident based on historical data or probabilistic models/studies. **Table 4-11** outlines the property damage factors used in the risk assessment calculations for this Plan.

Table 4-11. Property Damage Factor

Probability	Description	Impact Factor
High	More than $5 Million in property damages is expected from a single major hazard event, or damages are expected to occur to 15% or more of the property value within the jurisdiction.	3
Medium	More than $500,000 but less than $5 Million in property damages is expected from a single major hazard event, or damages are expected to occur to more than 5% but less than 15% of the property value within the jurisdiction.	2
Low	Less than $500,000 in property damages is expected from a single major hazard event or less than 5% of the property value within the jurisdiction.	1
No Impact	Little to no property damage is expected from a single major hazard event.	0

4.3.4.4. Economic Factor

An estimation of the impact, expressed in terms of dollars, on the local economy is based on a loss of business revenue, crops, worker wages, and local tax revenues or on the impact on the local gross domestic product (GDP). **Table 4-12** outlines the economic factors used in the risk assessment calculations for this Plan.

Table 4-12. Economic Factor

Probability	Description	Impact Factor
High	Where the total economic impact is likely to be greater than $10 Million.	3
Medium	Total economic impact is likely to be greater than $500,000, but less than or equal to $10 Million.	2
Low	Total economic impact is not likely to be greater than $100,000.	1
No Impact	Virtually no significant economic impact.	0

4.3.4.5. Environmental Factor

An estimate of the environmental impact from a major hazard event requiring outside resources and support; and/or repair, clean-up, restoration, and/or preservation work. **Table 4-13** outlines the environmental factors used in the risk assessment calculations for this Plan.

Table 4-13. Environmental Factor

Probability	Description	Impact Factor
High	Environmental impact from a single major hazard event is likely to be significant, requiring extensive outside resources and support; and/or repair, clean-up, restoration, and/or preservation work.	3
Medium	Environmental impact from a single major hazard event is likely to be localized, requiring some outside resources and support; and/or repair, clean-up, restoration, or preservation work.	2
Low	Environmental impact from a single major hazard event is likely to be minimal, requiring little to no outside resources and support, and/or minimal repair, clean-up, restoration, or preservation work.	1
No Impact	No environmental impacts from a single major hazard event are likely.	0

4.3.4.6. Essential Operations Factors

The essential operations factor is the impact on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community after a single major hazard event. **Table 4-14** outlines the essential operations factors used in the risk assessment calculations for this Plan.

Table 4-14. Essential Operations Factor

Probability	Description	Impact Factor
High	Impact greater than 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	3
Medium	Impact between 24 and 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	2
Low	Impact less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	1
No Impact	No impact on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	0

4.3.4.7. Future Development Factor

The future development factor is the potential that future development will have on increasing or decreasing the impact/consequence of the hazard. **Table 4-15** outlines the future development factors used in the risk assessment calculations for this Plan.

Table 4-15. Future Development Factor

Probability	Description	Impact Factor
High	Future development trends will significantly increase the impact/consequence of this hazard.	3
Medium	Future development trends will increase the impact/consequence of this hazard, but not significantly.	2
Low	Future development trends will minimally increase impact/consequence of this hazard.	1
No Impact	Future development trends will not increase the impact/consequence of the hazard, and/or may even decrease the impact/consequence of this hazard.	0

4.3.4.8. Climate Change Factor

The potential that climate change will increase the risk of the hazard (i.e., type, location, and range of anticipated intensities of the hazard and impacts). **Table 4-16** outlines the climate change factors used in the risk assessment calculations for this Plan.

Table 4-16. Climate Change Factor

Probability	Description	Impact Factor
High	Climate Change trends will significantly increase the risk of this hazard and its impacts.	3
Medium	Climate Change trends will increase the risk of this hazard and its impacts, but not significantly.	2
Low	Climate Change trends will minimally increase the risk of this hazard and its impacts.	1
No Impact	Climate change trends will not increase the risk of the hazard and its impacts.	0

Each category was assigned a weighting factor to reflect its significance, consistent with those typically used for measuring the benefits of hazard mitigation actions – a weighting factor of three (3) was assigned for *Population and Life Safety*, and *Underserved/Equity*, and a weighting factor of two (2) was assigned for *Property Damage*. A weighting factor of one (1) was assigned for *Economic*, *Environmental*, *Essential Operations, Future Development*, and *Climate Change*.

4.4 FEMA NATIONAL RISK INDEX SCORES

The National Risk Index (NRI) is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards. These include:

- Avalanche
- Coastal Flooding
- Cold Wave
- Drought
- Earthquake
- Hail
- Heat Wave
- Hurricane
- Ice Storm
- Landslide
- Lightning
- Riverine Flooding
- Strong Wind
- Tornado
- Tsunami
- Volcanic Activity
- Wildfire
- Winter Weather

Not all the hazards on this list are applicable to Contra Costa County; therefore, only those hazards with a defined risk to the County will be included in this Plan, as listed in *Section 4.1 (Identified Hazards)*. The NRI's goal is to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision-makers as they develop risk reduction strategies.

In the NRI, risk is defined as the potential for negative impacts as a result of a natural hazard. The Risk Index is based on three (3) components – a natural hazards component (Expected Annual Loss), a consequence enhancing component (Social Vulnerability), and a consequence reduction component (Community Resilience). Using these components, the composite and hazard type Risk Index values are calculated for each community (county and Census Tract). Risk Index values form an absolute basis for measuring Risk within the NRI and are used to generate Risk Index percentiles and ratings across communities.[46] **Table 4-17** illustrates the Risk Index rating and score for Contra Costa County.

Table 4-17. Risk Index Score for Contra Costa County *(FEMA National Risk Index)*

Jurisdiction	Rating	Score
Contra Costa County	Very High	99.6
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

4.4.1. Expected Annual Loss

The Expected Annual Loss (EAL), the natural hazards component of the NRI, represents the average economic loss in dollars resulting from natural hazards each year. It is calculated for each hazard type and quantified loss for relevant consequence types such as, buildings, people, and agriculture. The EAL score and rating represents a community's relative level of expected losses each year when compared to other communities at the same level. Since the score is associated to a community's risk; the higher EAL score results in a higher Risk Index score.[47] **Table 4-18** illustrates the EAL rating and score for Contra Costa County.

[46] Federal Emergency Management Agency. (2023). Determining Risk. Retrieved from https://hazards.fema.gov/nri/determining-risk.
[47] Federal Emergency Management Agency. (2023). Expected Annual Loss. Retrieved from https://hazards.fema.gov/nri/expected-annual-loss.

Table 4-18. Expected Annual Loss for Contra Costa County *(FEMA National Risk Index)*

Jurisdiction	Rating	Score
Contra Costa County	Very High	99.6
Expected Annual Loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).		

An EAL score and rating is calculated independently for each consequence type (i.e., buildings, population, and agriculture) for each county and Census Tract. The population EAL is measured in fatalities and injuries while the building and agriculture values are measured in dollars. However, for consistency in the unit of measurement, the population EAL was monetized into population equivalence using a value of statistical life (VSL) approach where each fatality or 10 injuries is treated as $11.6 Million of economic loss.

4.4.2. Social Vulnerability

Social vulnerability, the consequence enhancing risk component of the NRI, measures the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. The Social Vulnerability score and rating represent the relative level of a community's social vulnerability compared to all other communities at the same level. A higher Social Vulnerability score results in a higher Risk Index score.[48] **Table 4-19** illustrates the Social Vulnerability rating and score for Contra Costa County.

Table 4-19. Social Vulnerability for Contra Costa County *(FEMA National Risk Index)*

Jurisdiction	Rating	Score
Contra Costa County	Relatively Moderate	47.4
Social Vulnerability is measured using the Social Vulnerability Index (SoVI) published by the University of South Carolina's Hazards and Vulnerability Research Institute (HVRI).		

4.4.3. Community Resilience

Community resilience, the consequence reduction risk component, measures the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The Community Resilience score and rating represent the relative level of a community's resilience compared to all other communities at the same level. Since the score is inversely proportional to a community's risk; the higher Community Resilience score results in a lower Risk Index score.[49] **Table 4-20** illustrates the Community Resilience rating and score for Contra Costa County.

[48] Federal Emergency Management Agency. (2023). Social Vulnerability. Retrieved from https://hazards.fema.gov/nri/social-vulnerability.
[49] Federal Emergency Management Agency. (2023). Community Resilience. Retrieved from https://hazards.fema.gov/nri/community-resilience.

Table 4-20. Community Resilience for Contra Costa County *(FEMA National Risk Index)*

Jurisdiction	Rating	Score
Contra Costa County	Relatively High	75.0
Community Resilience is measured using the Baseline Resilience Indicators for Communities (HVRI BRIC) published by the University of South Carolina's Hazards and Vulnerability Research Institute (HVRI).		

4.5 TOTAL RISK SCORES

Table 4-21 represents the overall risk scores for Contra Costa County, based on the Risk Assessment Methodology defined at the beginning of this section. Following a data-driven quantitative assessment, reviewing and ranking local knowledge from local subject matter experts, and developing other risk elements by the Core Planning Team based on data collected. These elements were aggregated to inform the analysis. The hazards are ranked from highest to lowest based on the Total Risk Score. However, if the Risk Score is the same, then it is ranked by the Probability Factor. If the Probability Factor is the same, then it is ranked by the sum of the Impact Factor. If the Impact Factor is the same, then it is ranked by the sum of the Vulnerability Factor.

Table 4-21. 2024 Hazard Risk Score for Contra Costa County

Hazard Event	Probability	Consequence (Sum of weighted factors)				Total Risk
	Probability Factor	Extent (sum of the weighted Extent factors)	Vulnerability (sum of the weighted Vulnerability factors)	Impact (sum of the weighted Impact factors)	Consequence Score	Total Risk Score (Probability x Consequence)
Earthquake	2	18	17	36	71	68
Wildfire	2	18	12	31	61	59
Heavy Rainfall *(Severe Weather)*	3	9	14	15	38	56
Flood (Urban/Flash Flood)	2	15	12	29	56	55
Landslide	3	9	6	22	37	55
Strong Winds/ Damaging Winds *(Severe Weather)*	3	9	11	16	36	54
Severe Thunderstorm *(Severe Weather)*	3	6	16	14	36	54
Utility Interruptions	3	9	7	18	34	51
Heat Wave/Extreme Heat *(Severe Weather)*	3	9	10	15	34	51
Drought	2	18	12	20	50	50
Flood (Riverine/Creek Flood)	2	12	7	29	48	48
Hazardous Materials Incidents	2	15	9	16	40	41
Climate Change	2	9	12	15	36	38
Sea Level Rise	2	12	6	17	35	37
Cybersecurity Threats	2	12	7	13	32	34

Hazard Event	Probability	Consequence *(Sum of weighted factors)*				Total Risk
	Probability Factor	**Extent** *(sum of the weighted Extent factors)*	**Vulnerability** *(sum of the weighted Vulnerability factors)*	**Impact** *(sum of the weighted Impact factors)*	**Consequence Score**	**Total Risk Score** *(Probability x Consequence)*
Active Shooter Incidents	2	9	5	15	29	32
Terrorism (Weapons of Mass Destruction)	1	18	11	27	56	31
Dam and Levee Failure	1	18	6	31	55	30
Tsunami	1	6	6	22	34	20
Tornado *(Severe Weather)*	1	6	6	14	26	16

Total Risk Score Legend

Classification	Probability Factor	Extent *(sum if the weighted Extent factors)*	Vulnerability *(sum if the weighted Vulnerability factors)*	Impact *(sum if the weighted Impact factors)*	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6 HAZARD PROFILES

4.6.1. Climate Change

4.6.1.1. Description

The National Oceanic and Atmospheric Administration (NOAA) defines climate change as any significant change in the measures of climate for extended periods of time, usually over decades or longer (e.g., major long-term changes in temperature, precipitation, ocean heat, sea level, sea ice extent) that affect life on Earth. [50]

In California, annual temperatures have increased over one (1) degree Fahrenheit (1°F) while some areas have exceeded two (2) degrees Fahrenheit (2°F). [51] The State can expect warmer and drier conditions, reduction in winter snow, an increase in winter rainfall, sea level rise, changes in the water cycle, and an increase in extreme weather events. However, due to the geographical differences throughout the State, impact may vary from location to location. In Contra Costa County, an increase in extreme heat events, reduced air quality, sea level changes, water supply issues, and an increase in storm severity and frequency resulting in flood events are expected due to climate change. [52] The San Francisco Bay Region, which includes Contra Costa County, average temperatures are expected to increase between three (3) and 4.5 degrees Fahrenheit by 2050. [53]

The five (5) main greenhouse gases consist of carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, and water vapor. These gases are naturally part of the Earth's atmosphere creating the greenhouse effect which allows conditions to be livable. However, increasing the levels of these greenhouse gases in the atmosphere results in heat being trapped near the Earth's surface causing the global average temperature to increase. [54] Carbon dioxide is a crucial component of the Earth's atmosphere and human activities have increased its amount in the air by 50% since the start of the Industrial Revolution, in the late 1700s. Additionally, other greenhouse gases amounts continue to increase. [55]

Climate Change Indicators

Earth's climate has changed throughout its history, it is part of Earth's cycle. However, scientists from agencies such as NASA, NOAA, and the Intergovernmental Panel on Climate Change (IPCC) agree that climate change is occurring at a faster rate than expected. Global surface temperatures continue to rise unequivocally as a result of greenhouse gas emissions from human activities. Between 2011 and 2020, global surface temperatures were 1.1 degrees Celsius (1.1°C) higher than between 1850 through 1900 average, with larger increases over land (1.6°C) than over the ocean (0.9°C). Global surface temperatures have increased at a faster rate since 1970 than any other 50-year period over the last 2,000

[50] National Oceanic and Atmospheric Administration. (n.d.). What's the Difference Between Climate and Weather? Retrieved from https://www.noaa.gov/explainers/what-s-difference-between-climate-and-weather.
[51] California Climate Adaptation Strategy. (2023). Summary of Projected Climate Change Impacts on California. Retrieved from https://climateresilience.ca.gov/overview/impacts.html.
[52] Contra Costa County. (2015) Contra Costa County Climate Action Plan. Retrieved from https://www.contracosta.ca.gov/DocumentCenter/View/39791/Contra-Costa-County-Climate-Action-Plan?bidId=.
[53] California Climate Adaptation Strategy. (2023). Region: San Francisco Bay Area. Retrieved from https://climateresilience.ca.gov/regions/sf-bay-area.html.
[54] National Aeronautics and Space Administration. (n.d.). What is the Greenhouse Effect? Retrieved from https://climate.nasa.gov/faq/19/what-is-the-greenhouse-effect/.
[55] National Aeronautics and Space Administration. (n.d.). The Causes of Climate Change. Retrieved from https://scied.ucar.edu/learning-zone/how-climate-works/carbon-dioxide.

years.[56] The warmest years on record were between 2015 and 2023 with 2023 on track to be the warmest year on record.[57]

Increasing global temperatures have affected weather patterns throughout the planet. In the United States, since 1950, the number of extreme heat events have increased while record low temperatures events have decreased, and an increase of heavy rainfall events has been recorded. Other climate change impacts include increasing ocean temperatures and ocean acidification, shrinking ice sheets, retreading glaciers, decreasing snow cover, sea level rise, and declining artic sea ice.[58] The United States Environmental Protection Agency, in collaboration with other data contributors, compiled seven (7) climate indicators that provide evidence of changes and their impacts on the population and environment. The seven (7) climate indicators are listed in **Table 4-22**.[59]

Table 4-22. Climate Change Indicators in the United States

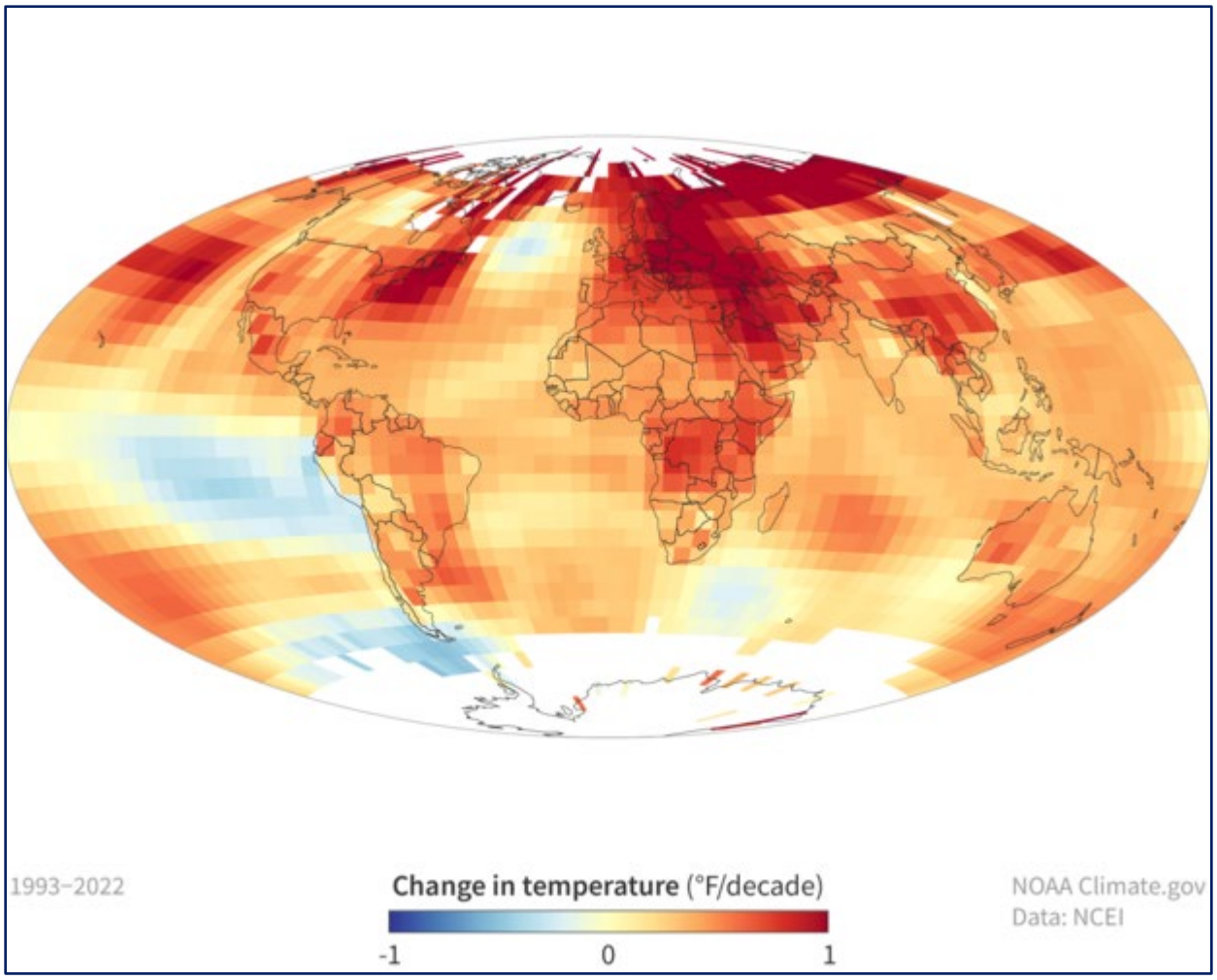
Indicator	Description
Greenhouse Gases	This indicator characterizes emissions of major greenhouse gases (i.e., carbon dioxide, nitrous oxide, methane, chlorofluorocarbons (CFCs), and water vapor) resulting from human activities, the concentration of these gases in the atmosphere, and how emissions and concentrations have changed over time.
Weather and Climate	Rising global temperatures are associated with widespread changes in weather patterns. Extreme weather events (e.g., heat waves and heavy precipitation) are likely to become more frequent or more intense as a result of climate change.
Oceans	Weather is heavily influenced on local and global scales by oceans while changes in climate change can alter many of the ocean's properties.
Snow and Ice	Earth's snow and ice coverage can be significantly altered with relatively minor changes in temperatures. As a result of increasing temperatures, snow and ice coverage has decreased globally.
Health and Society	Changes in climate can have adverse effects on public health, agriculture, water supplies, energy production and use, land use and development, and recreation.
Ecosystems	Ecosystems are what provides humans with food, clean water, and a variety of other services. Changes in climate can disrupt the functioning ecosystems.

4.6.1.2. Hazard Location

Climate change is occurring globally with wide variations based on location and latitude. The polar regions have experienced particularly rapid changes in climate with increased ice melting and more sea ice free days. **Figure 4-1** illustrates the global average temperature between 1993 and 2022 in degrees Fahrenheit per decade.

[56] Intergovernmental Panel on Climate Change. (2023). Climate Change 2023 Synthesis Report: Summary for Policymakers. Retrieved from https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.
[57] World Meteorological Organization. (2023). 2023 Shatters Climate Records, With Major Impacts. Retrieved from https://wmo.int/news/media-centre/2023-shatters-climate-records-major-impacts.
[58] National Aeronautics and Space Administration. (n.d.). How Do We Know Climate Change Is Real? Retrieved from https://climate.nasa.gov/evidence/.
[59] United States Environmental Protection Agency. (n.d.). Climate Change Indicators: View the Indicators. Retrieved from https://www.epa.gov/climate-indicators/view-indicators.

Figure 4-1. Global Temperature Trends (1993 – 2022) [60]



4.6.1.3. Hazard Extent/Intensity

In 1990 and 1992, the Intergovernmental Panel on Climate Change (IPCC) developed long-term emission scenarios which have been extensively used in climate change, its impact, and climate change mitigation analysis. [61] Throughout the years, these scenarios have been evaluated and updated based on the current scientific data and technology available at the time of the update. These scenarios were developed to account for the uncertainty on how societies and government will deal with human emission of greenhouse gases in the future. **Table 4-23** provides an overview of the five (5) major IPCC scenarios used in the 2021 Report. [62]

[60] Climate.gov. (2023). Climate Change: Global Temperature. Retrieved from https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature.
[61] Intergovernmental Panel of Climate Change. (2000). IPCC Special Report: Emissions Scenarios. Retrieved from https://www.ipcc.ch/site/assets/uploads/2018/03/sres-en.pdf.
[62] University Corporation for Atmospheric Research. (2021). Compare IPCC Scenarios Interactive. Retrieved from https://scied.ucar.edu/interactive/compare-ipcc-scenarios.

Table 4-23. IPCC Scenarios

Scenario	Description	Expected Temperature Increase
SSP1-1.9 (Most Optimistic)	No increase in greenhouse gas emissions. Global carbon dioxide emissions do not increase (are cut to net zero) by approximately 2050.	1.5°C
SSP1-2.6 (Next Best)	Small levels of greenhouse gas emissions. Severe carbon dioxide emissions cuts, and no longer increase (are cut to net zero) after 2050.	1.8°C
SSP2-4.5 (Middle of the Road)	Medium greenhouse gas emissions scenario. Carbon dioxide emissions start to fall around mid-century but do not reach net zero until after 2100.	2.7°C
SSP3-7.0 (Dangerous)	Medium to high greenhouse gas emissions scenario. Emissions rise steadily, with total carbon dioxide double the current level by 2100.	3.6°C
SSP5-8.5 (Avoid at All Costs)	Highest greenhouse gas emissions scenario. Yearly emissions amounts are double current levels by 2100.	4.4°C
The Scenarios are based on Shared Socioeconomic Pathways (SSPs), which determine likely emissions of greenhouse gases based on different climate policies.		

4.6.1.4. Warning Time

Though warming has not been uniform across the planet, the upward trend in the globally averaged temperature shows that more areas are warming than cooling. According to NOAA's 2021 Annual Climate Report the combined land and ocean temperature has increased at an average rate of 0.14 degrees Fahrenheit (0.08 degrees Celsius) per decade since 1880; however, the average rate of increase since 1981 has been more than twice as fast: 0.32 °F (0.18 °C) per decade.

The amount of future warming Earth will experience depends on how much carbon dioxide and other greenhouse gases we emit in coming decades. Today, our activities—burning fossil fuels and clearing forests—add about 11 billion metric tons of carbon (equivalent to a little over 40 billion metric tons of carbon dioxide) to the atmosphere each year. Because that is more carbon than natural processes can remove, atmospheric carbon dioxide increases each year.

4.6.1.5. Probability and Frequency

According to the 2017 U.S. Climate Science Special Report, if yearly emissions continue to rapidly increase, as they have since 2000, models project that by the end of this century, global temperature will be at least 5 degrees Fahrenheit (5°F) warmer than the 1901 – 1960 average, and possibly as much as 10.2 degrees Fahrenheit (10.2°F) warmer. If annual emissions increase at a slower rate and begin to significantly decline by 2050, models project temperatures would still be at least 2.4 degrees (2.4°F) warmer than the first half of the 20th century, and possibly up to 5.9 degrees Fahrenheit (5.9°F) warmer.

Figure 4-2 illustrates hypothetical pathways of carbon emissions (i.e., representative concentration pathways or RCPs) throughout the 21st century based on different possible energy policies and economic growth patterns. **Figure 4-3** illustrates projected temperature increase relative to the 1901-1960 average depending on which RCP we eventually follow. [63]

[63] U.S. Global Change Research Program. (2017). Fourth National Climate Assessment: Executive Summary. Retrieved from https://science2017.globalchange.gov/chapter/executive-summary/.

Figure 4-2. Projected Annual Global Carbon Emissions

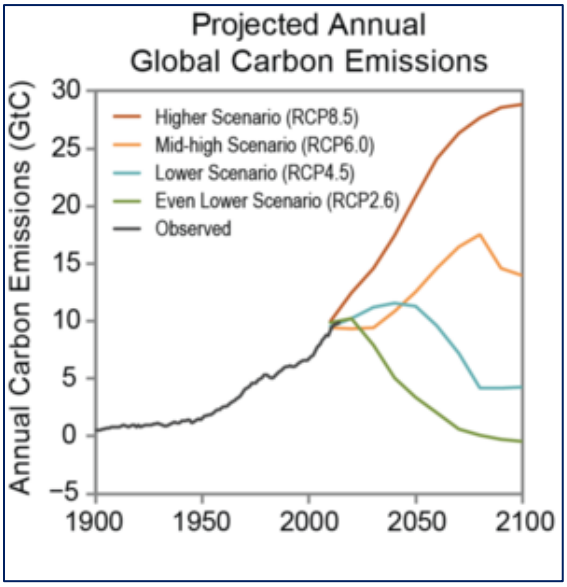
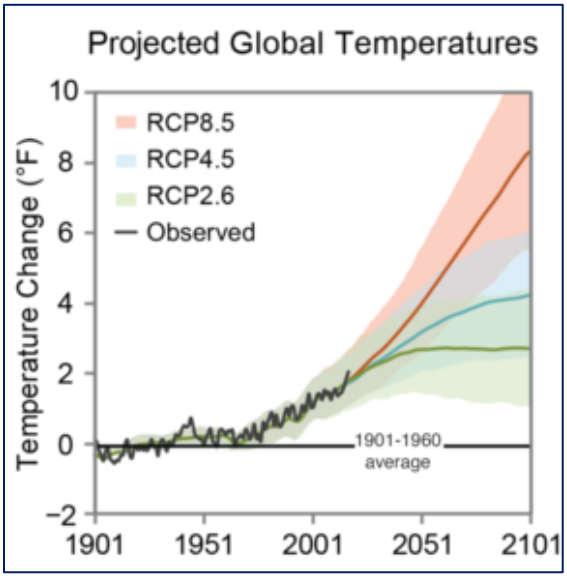


Figure 4-3. Projected Global Temperatures



Probability of Future Hazard Events

In California and western North America, climate observations have shown a trend toward warmer temperatures with an increase in extremely hot days and nights, an increase in the area burned by wildfires, a smaller fraction of precipitation falling as snow, an increase in frequency of drought and an increase in consecutive dry years, and sea level rise is expected to continue to increase flooding and erosion on beaches, bluffs, and cliffs. Research suggests that California will continue to experience hotter and drier conditions, reductions in winter snow and increases in winter rains, sea level rise, significant changes to the water cycle, and an increase in extreme weather events. **Table 4-24** summarizes the potential impacts in California due to climate change.

Table 4-24. Climate Change Impacts in California [64]

Climate Impact	Historical Trends	Future Direction of Change	Confidence for Future Change
Temperature	Warming	Warming	Very High
Sea Level Rise	Rising	Rising	Very High
Annual Precipitation	No significant trends	Unknown	Low
Intensity of Heavy Precipitation Events	No significant trends	Increasing	Medium-High
Frequency of Droughts Increasing	No significant trends	Increasing	Medium-High
Acres Burned by Wildfire	Increasing	Increasing	Medium-High

4.6.1.6. Past Events

Climate change has occurred throughout Earth's history due to variations in the Earth's inclination to the sun, volcanic activity, and other factors (e.g., asteroid impacts and the amount of solar radiation reaching the earth's surface rises and falls). Earth's temperature correlates to the amount of solar radiation arriving at the surface and the climate with it.

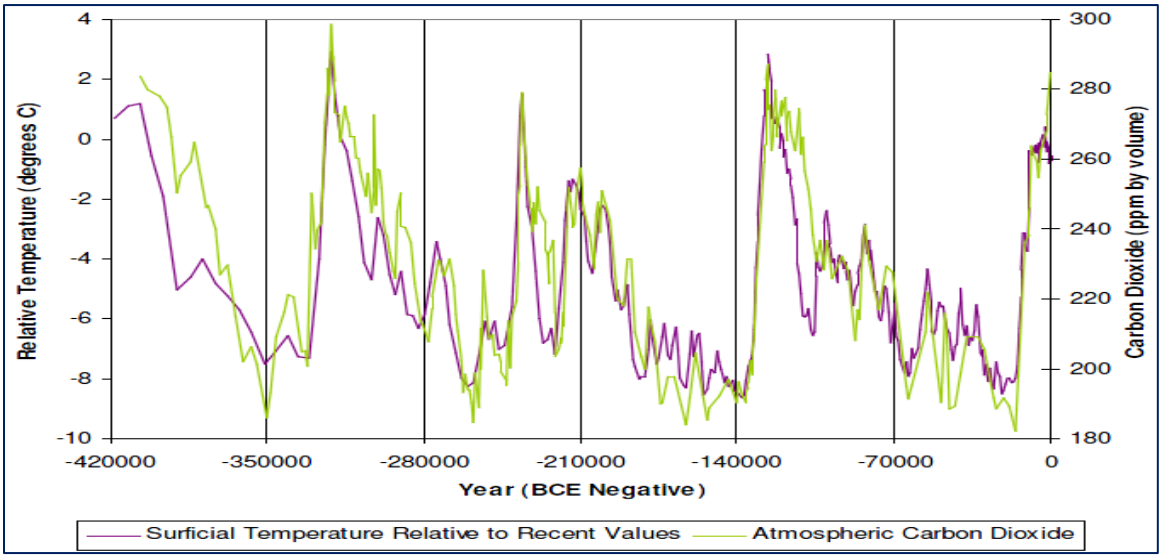
In relatively recent history, the last glacial period (i.e., the Ice Age), occurred from c. 110,000 to 12,000 years ago. This most recent glacial period is part of a larger pattern of glacial and interglacial periods known as the Quaternary glaciation (c. 2,588,000 years ago to present). From this point of view, scientists consider this "ice age" to be merely the latest glaciation event in a much larger ice age that dates back over two (2) million years and is still ongoing.

During this last glacial period, there were several changes between glacier advance and retreat. The Last Glacial Maximum, the maximum extent of glaciation within the last glacial period, was approximately 22,000 years ago. While the general pattern of global cooling and glacier advance was similar, local differences in the development of glacier advance and retreat make it difficult to compare the details from continent to continent. Generally, temperature variation and glaciation patterns have lagged in atmospheric carbon dioxide (CO_2) content.

Figure 4-4 depicts global variations during the past 400,000 years as a correlation between temperature and atmospheric CO_2 content in part per million. [65]

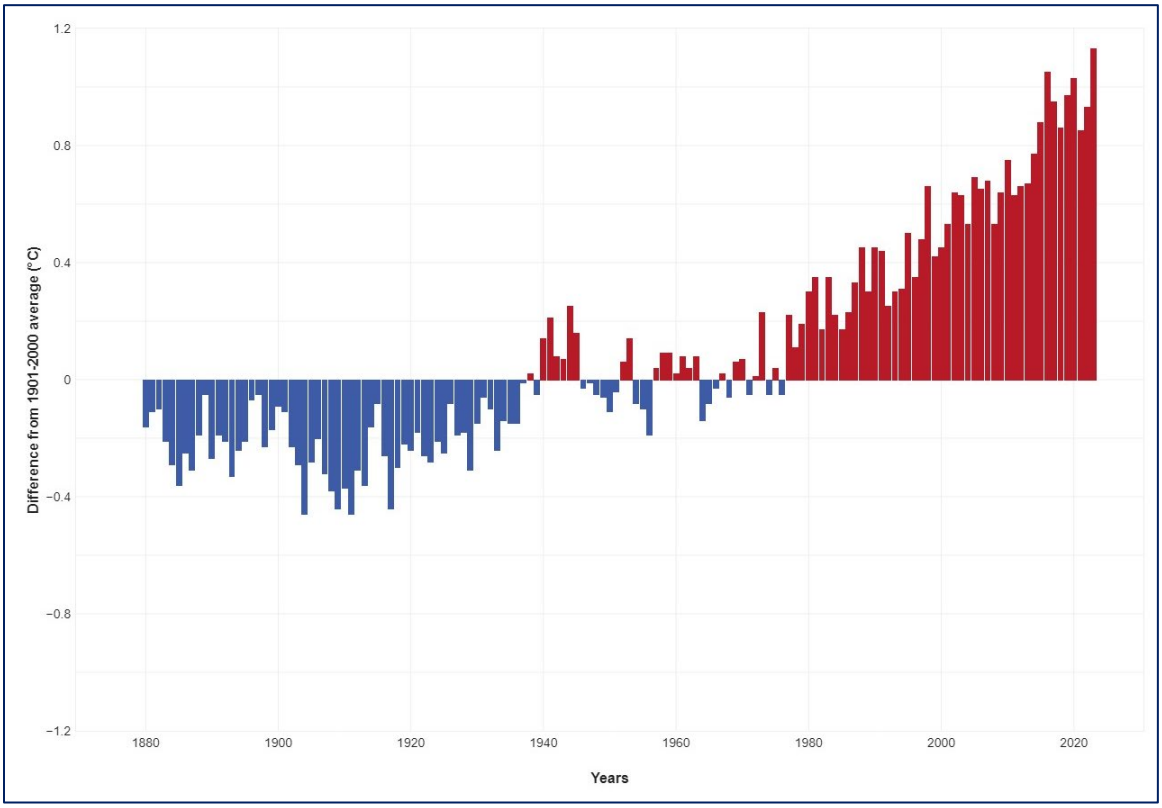
[64] Contra Costa County. (2023). Draft Contra Costa County Climate Action Plan. Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.
[65] Hogg, A.M. (2008). Glacial Cycles and Carbon Dioxide: A Conceptual Model. Retrieved from https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2007GL032071.

Figure 4-4. Temperature and Atmospheric CO_2 Variation the Past 400,000 Years



For 22,000 years ago, the planet has slowly warmed, and the glaciers retreated to high northern latitudes and mountains. In the last several decades, human activity has likely led to a rapid increase in atmospheric CO_2 and a matching rise in global temperature. The result has been that climate change may be accelerating. **Figure 4-5** provides a graphical depiction of yearly average surface temperature compared to the 20th century average.

Figure 4-5. Global Average Surface Temperature (1880 – 2022)



4.6.1.7. Vulnerability and Impacts

Climate change is expected to alter many aspects of the County's climate, including temperature, precipitation patterns, and sea levels, potentially exacerbating both the severity and geographic scope of climate hazards. Contra Costa County is most vulnerable to hazards associated with changes in air quality, drought, extreme heat, flooding, human health hazards, landslides, severe storms, sea level rise, shoreline flooding, and wildfire. [66] Drought, flood, landslides, sea level rise, severe weather (includes heat wave/extreme heat), and wildfire are individual hazards in this Hazard Mitigation Plan. Vulnerability and impacts for each of these hazards are discussed in further detail under each hazard profile.

Life Safety and Health: Although climate change will affect everyone, some populations in the County are likely to be affected more than others. This can include the risk of injury, death, property damage or destruction, and can also include economic impacts and loss of income, behavioral and mental health impacts, and an overall decrease in quality of life. Impacted Communities, who have been historically under-resourced and are already more likely to face constraints (e.g., limited financial resources, reduced access to education and job opportunities, and increased exposure to environmental hazards), are likely to be further impacted as climate change related hazards increase in frequency and severity. Populations especially vulnerable to climate change are concentrated along the northern waterfront of the County, within unincorporated communities such as North Richmond, Bay Point, and Pacheco. Additionally, this population faces greater vulnerabilities because they may be less able to withstand a temporary loss of income if jobs are affected by these hazards.

Lack of access to resources not only includes financial resources, but also communication, transportation, education, and other community services. Even people who are relatively financially stable can be disproportionately affected by climate change related hazards if physically or socially isolated. For example, individuals with limited English proficiency may not be able to interact with officials, and those without lifelines (e.g., transportation, broadband internet or other forms of reliable communication), may not be able to get accurate and timely information about hazardous situations (e.g., evacuation order). This often delays this population's ability to obtain the resources needed to prepare for or respond to an emergency. Renters face similar vulnerabilities and impacts because even if they have the financial resources to adapt to changing conditions, they have limited control over their home.

Physical constraints can also make people more susceptible to climate change. Individuals with disabilities may find it harder to prepare for hazardous events, and some hazards can exacerbate chronic health conditions and create a greater threat for people with these conditions. Young children (under 10 years old) and seniors (65 years old and over) are disproportionately affected by some hazards (e.g., extreme heat and air pollution) even if they are entirely healthy. The senior population that lives alone is often at greater risk because they are more likely to be socially isolated. People with physical constraints are also more likely to need assistance during evacuations. The health equity of populations is also closely associated with racism, historic discrimination, and a wide range of socioeconomic conditions.

The Contra Costa County Climate Action Plan, updated in 2024, has identified the following underserved and at risk population that could be uniquely vulnerable to the climate change related hazards within this Plan:[67]

[66] Contra Costa County. (2023). Draft Contra Costa County Climate Action Plan. Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.
[67] Ibid.

- **Children (under 10 years old)** are susceptible to allergens and pollution due to wildfires, extreme heat, flooding, and landslides. Children are known to spend more time outdoors which exposes them to more of these hazards. Furthermore, children are physiologically less able to regulate their body temperatures than adults and may not be able to recognize the need to hydrate and cool down when overheated. In Contra Costa County, there are approximately 130,099 (11.2%) children under 10 years old as of 2022.[68] The highest concentration of children live in parts of the cities of Concord, Richmond, Pittsburg, Brentwood, and San Ramon.
- **Households in Poverty** are households with an income below the poverty line which is $24,300 for a household of four (4) people. This population is exposed to extreme heat, flooding, landslides, severe weather, sea level rise, and wildfires. Approximately 7,600 households in Contra Costa County live in poverty. The areas with the highest concentrations of poverty in Contra Costa County occur in central Richmond, North Richmond and San Pablo, tracts of Concord and Martinez, and in Bay Point, Pittsburg, and Antioch.
- **Low Income Households** are those with an income of 80% or less of the median income in Contra Costa County ($104,400). Approximately 25,340 households (41.0%) in the County are within the low income category. Low income households may have fewer financial resources to devote to preparing for and recovering from the effects of climate change. This population is extremely vulnerable to flooding because many of these households are located within or near a flood zone or dam inundation areas, especially in the north and east portions of the County. High concentrations of low income households vulnerable to shoreline flooding occur in Rodeo, Crockett, the islands in the Delta, and Discovery Bay.
- **Outdoor Workers** are directly exposed to poor air quality, extreme heat, and drought, are facing increased health risks and economic hardships. These include, but are not limited to, constructions workers, agriculture workers, and recreation.
- **Individuals Experiencing Homelessness** are those who do not have a permanent home, including those who live in their vehicles or temporary shelters. This population is highly exposed to extreme heat, flooding, sea level rise, severe weather, and wildfires. Furthermore, they face the risk of health complications, minimal access to healthcare, and loss of temporary shelters. In 2024, there are 2,843 people experiencing homelessness in Contra Costa County, an 18.5% increase from 2023.[69]
- **Individuals Living on Single Access Roads** are those living in areas with a single route in and out (i.e., accessible via one (1) roadway) of the neighborhood or area. This includes several communities in the Delta and in the hillside areas of central and western Contra Costa County. This population is uniquely vulnerable to landslides, wildfires, flooding, and sea level rise because these hazards can cause damage and/or block essential roadways. These communities can become isolated from the community and emergency services. For example, in Contra Costa County, Bethel Island and Delta islands are accessible via a single road.
- **Seniors (65 years old and over) and Seniors Living Alone** are uniquely vulnerable to extreme heat, flooding, severe weather, landslides, and wildfires. The physiology of seniors makes them especially vulnerable to the health effects of extreme heat and wildfires. Furthermore, physical limitations may not allow seniors to evacuate in the event of an emergency. In Contra Costa

[68] United States Census Bureau. (2022). S0101: Age and Sex (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S0101?g=050XX00US06013.
[69] Contra Costa Health. (2024). Health, Housing, and Homelessness Data Reports (Point-in-Time Count). Retrieved from https://www.cchealth.org/services-and-programs/homeless-services/data.

County, there are approximately 201,136 seniors (17.4%).[70] Due to institutional and residential retirement communities, central Contra Costa County, Bethel Island, the eastern part of the City of Richmond, and several part of the City of Walnut Creek have a particularly high concentration of seniors. Seniors living alone may have caretakers, but for the most part are living alone. This population is generally more vulnerable compared to other seniors because they may lack access to social connections and community support to assist in preparedness and responding to emergency events (e.g., evacuations). In 2022, there were approximately 33,102 (8.0%) seniors living alone.[71]

- **Individuals with Chronic Illnesses** are those that have long term or permanent health conditions that can be exacerbated by climate change related hazards. These health problems include, but are not limited to cancer, respiratory and cardiovascular diseases, and arthritis. This population is uniquely vulnerable to flooding, extreme heat, severe weather, and wildfires.
- **People with Limited English Proficiency** may not be aware of climate related hazards and emergency situations in a timely manner. Other languages spoken in the County are primarily Spanish, Mandarin, Cantonese, Tagalog, and Persian. Other than English, the most commonly spoken language in Contra Costa County is Spanish (18.7%). The United States Census Bureau estimates that 14.5% of the County's residents speak English "less than very well."[72] The higher proportion with limited English proficiency occurs in the cities of Richmond, Concord, and San Pablo.
- **Individuals without Access to Lifelines** are those who do not have access to basic technology or services (e.g., transportation or modern communication). These individuals may live in areas where these lifelines are not available or feasible, may not be able to afford these, or for personal reasons may choose to not have them. This population is uniquely vulnerable to flooding and wildfire. Furthermore, those without access to lifelines may be unaware of an approaching emergency, may be unable to evacuate in a timely manner, and may become isolated if power services or transit systems are not working.
- **Undocumented Individuals** includes people who do not have formal permission to live in the United States (i.e., do not have citizenship, permanent residency, visas, or other similar status). This population is uniquely vulnerable to extreme heat, flooding, landslides, severe weather, and wildfire. Many individuals within this population have outdoor occupations or work in highly unregulated environments which make them vulnerable to extreme heat and poor air quality due to wildfires. Additionally, many of the undocumented population are likely to fall in the household in poverty or low income categories and are more likely to live in low lying areas making vulnerable to flood and severe weather events. There are no official counts of the number of undocumented individuals within Contra Costa County.

Table 4-25 outlines the population in Contra Costa County where vulnerabilities to climate change exceed the County median, as compared to United States percentages and the differences thereof. There are 42 Census Tracts in Contra Costa County that are identified as *disadvantaged* by the United States Council on Environmental Quality (ACEQ). According to the ACEQ, a *disadvantaged community* is

[70] United States Census Bureau. (2022). S0101: Age and Sex (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S0101?g=050XX00US06013.
[71] United States Census Bureau. (2022). DP02: Selected Social Characteristics in the United States (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP02?g=050XX00US06013.
[72] United States Census Bureau. (2022). S1601: Language Spoken at Home (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S1601?g=050XX00US06013.

identified if it is located in a Census Tract that is at or above the threshold for one (1) or more environmental, climate, or other burdens, and at or above the threshold for associated socioeconomic burdens, including poverty and language barriers. [73]

Table 4-25. Neighborhoods At Risk Table (Contra Costa County, CA)

Indicators 2022*	Population	Percentage	United States Percentage	Percent Difference *(County vs. United States)*
People under 5 years old	62,829	6.0%	5.7%	5.0%
People over 65 years old	190,307	12.5%	16.5%	-28.0%
People of color *(including Hispanic)*	690,897	80.6%	41.1%	65.0%
People who do not speak English well	65,143	11.6%	4.1%	96.0%
People without a high school degree	83,135	20.1%	10.9%	59.0%
Families in poverty	16,650	10.2%	8.8%	15.0%
Housing units that are rentals	134,149	51.0%	35.2%	37.0%
Households with no car	20,801	7.3%	8.3%	-13.0%
People with disabilities	130,100	12.5%	12.9%	-3.0%
People without health insurance	53,839	8.4%	8.7%	-4.0%

** ACS 5-year estimates: 2022 represents average characteristics between 2018 and 2022.*

Table 4-28 outlines the vulnerability of the total population exposed to climate change, and **Table 4-29** outlines the climate change impacts to population and life safety, underserved/equity population, and essential operations, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Property Damage and Critical Infrastructure: The loss of key buildings and infrastructure systems can create potentially severe effects throughout the County. The loss of homes in a natural disaster means that a potentially large group of people must be temporarily housed while their homes go through the lengthy reconstruction process. Meanwhile, some people may choose not to return to their former community. Damages to businesses can cause economic harm to business owners and employees as well as members of various communities. For example, sea level rise and coastal flooding can interrupt many of the industrial and manufacturing centers located along the Contra Costa County shoreline, creating temporary or permanent loss of income for their employees, with possible cascading impacts such as harming the tax base and well-being of various communities.

Contra Costa County's infrastructure networks are connected to much larger regional, State, and national systems. These systems are vulnerable to disruption from outside of Contra Costa County, resulting in a loss of service to community members. For example, most of the water used in the unincorporated areas of the County is imported from the Sierra Nevada through a complex system of pumps, aqueducts, and reservoirs. Damage at any point along this system can affect Contra Costa County's water supply,

[73] United States Council of Environmental Quality. (n.d.). Climate and Economic Justice Screening Tool: Methodology. Retrieved from https://screeningtool.geoplatform.gov/en/methodology.

causing restricted water service. Many components of this system pass through eastern Contra Costa County and other low-lying areas of the Delta region, where they are particularly vulnerable to sea level rise. Buildings and infrastructure do not need to be physically damaged to trigger a loss of service. For example, extreme heat makes the machinery of the power grid run less efficiently and simultaneously increases demand to meet greater cooling needs. This combination raises the risk of grid overloading and causing brownouts or blackouts. Similarly, drought conditions harm water delivery services but do not cause physical damage to pipes or water treatment plants. Economic drivers can also be affected without experiencing physical damage, such as when businesses are forced to close because of a public health emergency. [74]

Table 4-28 outlines the total property value exposed to climate change and how the changes in development in the past five (5) years, have affected the vulnerability of the community to climate change. **Table 4-29** outlines the climate change impact on total property damage, potential future development, and the economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Environment: The unprecedented rate of change in the climate system can rapidly create local conditions unfavorable to ecosystems, killing them or forcing them out of the area before they have the chance to adapt. Damage or loss of local ecosystems and natural resources is harmful for its own sake, but it also affects the people and economy of Contra Costa County. Many ecosystems provide important services for communities, such as protection against floods and high winds, groundwater recharge and filtration, and home for pollinators and beneficial species. The natural environment provides recreational and tourism opportunities, contributes to the valued character of Contra Costa County, and helps maintain a high quality of life.

Climate change often results in species and even entire ecosystems being forced out of their historical range and moving to areas that provide their preferred living conditions. In some cases, there may no longer be places in Contra Costa County that can support these ecosystems, and they disappear from the area. For example, the conifer forests in the hills of western portion of the County depend on fog and its cooling benefit in summer temperatures. As temperatures increase and coastal fog is expected to decrease, these trees may not survive. Habitat loss can also exacerbate this problem. For example, in a natural system, wetlands will migrate inland as sea levels rise. However, if the inland areas are blocked by development or other barriers, the wetlands cannot migrate and could disappear.

Even if overall temperature and precipitation patterns remain favorable to key ecosystems and natural resources, the increased frequency and severity of some climate change related hazards can harm these important community assets. For example, many ecosystems in the State (e.g., forests) rely on naturally occurring wildfires to remove dead vegetation and return nutrients to the soil, and some species rely on fires reproduction. However, as wildfires are increasing in intensity, trees that could survive relatively low level fires may not be able to survive much more severe blazes.

Table 4-29 outlines climate change's impact on the environment, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

[74] Contra Costa County. (2023). Draft Contra Costa County Climate Action Plan. Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.

Table 4-26. Probability of Occurrence

Hazard Event	Probability of Occurrence		Probability Factor	Weighted Factor
Climate Change	Medium	Significant hazard event is likely to occur within 25 years.	2	N/A

Table 4-27. Extent Factors

Hazard Event	Extent Factor	Extent		Extent Factor	Weighted Factor
Climate Change	***Extent/Intensity***	Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2	6
	Catastrophic	Low	Catastrophic hazard event is likely to occur at least once in 51 or more years.	1	3

Table 4-28. Vulnerability Factors

Hazard Event	Vulnerability Factor	Vulnerability		Vulnerability Factor	Weighted Factor
Climate Change	***Population Exposure***	High	30% or more of the population is exposed to the hazard.	3	9
	Property Exposure	Low	9% or less of the total assessed property value is exposed to a hazard.	1	2
	Changes in Development	Low	Changes in development have increased the vulnerability/exposure of the community to the hazard by 4% or less.	1	1

Table 4-29. Impact Factors

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
Climate Change	***Population and Life Safety***	Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3
	Underserved/Equity	Low	Underserved populations exposed to the hazard are likely to experience minimal adverse/disproportionate impacts, such as ambulatory injuries.	1	3
	Property Damage	Low	Less than $500,000 in property damages is expected from a single major hazard event or less than 5% of the property value within the jurisdiction.	1	2
	Economic	Low	Total economic impact is not likely to be greater than $100,000.	1	1

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
	Environmental	Low	Environmental impact from a single major hazard event is likely to be minimal, requiring little to no outside resources and support, and/or minimal repair, clean-up, restoration, or preservation work.	1	1
	Essential Operations	Low	Impact less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	1	1
	Future Development	Low	Future development trends will minimally increase impact/consequence of this hazard.	1	1
	Climate Change	High	Climate Change trends will significantly increase the risk of this hazard and its impacts.	3	3

4.6.1.8. FEMA NRI Expected Annual Loss Estimates

There are no clear, quantitative assessments of losses due solely to climate change. Losses from drought, flood, landslides, severe weather, sea level rise, and wildfire are almost certainly exacerbated by climate change. The impacts of climate change not only result in more frequent and intense disaster incidents, but they also result in secondary impacts in areas such as public health, water quality, and the cost of food and other essential resources.

4.6.1.9. FEMA Climate Change Risk Index Scores

The FEMA NRI does not assess climate change events. **Table 4-30** represents the Climate Change Total Risk Score for Contra Costa County, based on the Risk Assessment Methodology, as defined in this Plan. For further details on how the probability, extent, vulnerability, and impact factors were calculated, please refer to **Table 4-26** through **Table 4-29**. Additional details on how the Total Risk Score was calculated can be found in the Risk Assessment Methodology in Section 4.3 of this Plan.

Table 4-30. Climate Change Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Climate Change	2	9	12	15	36	38

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.2. Dam and Levee Failure

4.6.2.1. Description

Dams are a critical and vital part of the nation's infrastructure as they provide a range of benefits, such as irrigation, electrical generation, flood control, renewable/clean energy, water storage, sediment/hazardous materials control, navigation, fisheries, and recreation.[75] Dams are artificial/manmade structures built across a watercourse for the purpose of retaining water.[76] A levee is a human-made structure, usually an earthen embankment or concrete floodwall, designed and constructed to contain, control, or divert the flow of water to provide reasonable assurance of excluding temporary flooding from the levee area.[77]

Dam Failure

The sudden rapid and uncontrolled release of impounded water or liquid-borne solids characterizes failure. The term "dam failure" encompasses a wide variety of circumstances. Situations that would constitute a dam failure vary widely, from developing problems to a partial or catastrophic collapse of the entire dam. Potential causes of a dam failure are numerous and can be attributed to deficiencies in the original design of the dam, the quality of construction, the maintenance of the dam, operation of the appurtenances and acts of nature including precipitation in excess of the design, flood, and damage from earthquakes. Dam failures are most likely to happen for one (1) of five (5) reasons listed in **Table 4-31**.

Table 4-31. Dam Failure Types[78]

Failure Type	Description
Overtopping	Caused by water spilling over the top of a dam. Overtopping of a dam is often a precursor of dam failure. National statistics show that overtopping due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest account for approximately 34% of all dam failures in the United States.
Foundation Defects	Include settlement and slope instability, cause about 30% of all dam failures.
Cracking	Caused by movements like the natural settling of a dam.
Inadequate Maintenance and Upkeep	Inadequate Maintenance and Upkeep
Piping	When seepage through a dam is not properly filtered and soil particles continue to progress, and form sink holes in the dam. Another 20% of United States dam failures have been caused by piping (internal erosion caused by seepage). Seepage often occurs around hydraulic structures, such as pipes and spillways, through animal burrows, around roots of woody vegetation, and through cracks in dams, dam appurtenances, and dam foundations.

Dam failure is potentially extremely dangerous if it occurs catastrophically with little or no warning. Dam inundation areas may contain large populations and significant critical infrastructure. During a catastrophic failure, the water flow may be dozens of feet high and move at high velocity. For large dams, evacuation procedures may not be adequate to prevent large loss of life and property damage.

[75] FEMA. (2020). The National Dam Safety Program: 25 Years of Excellence. Retrieved from https://www.fema.gov/sites/default/files/2020-08/national-dam-safety-25-years.pdf.
[76] Merriam-Webster. (n.d.). Dam. Retrieved from https://www.merriam-webster.com/dictionary/dam https://www.oregon.gov/owrd/programs/streamslakessanddams/dams/Pages/default.aspx.
[77] United States Army Corps of Engineers. (n.d.). Levees and Flood Risk Management. Retrieved from https://www.nwp.usace.army.mil/Missions/Flood-Risk-Management/Levees/.
[78] Association of State Dam Safety Officials. (n.d.). Understanding Dam Failures. Retrieved from https://damsafety.org/dam-failures.

A jurisdictional dam (one that falls under the jurisdiction of the State dam regulations) is defined by the California Water Code as a dam with a height greater than six (6) feet that impounds 50 acre-feet or more, or a height greater than 25 feet with storage capacity of 15 acre-feet or more. Over 1,250 jurisdictional dams are under the jurisdiction of California's Department of Water Resources (DWR), Division of Safety of Dams (DSOD). Dams and reservoirs operated by the Federal government are not subject to State jurisdiction except as otherwise provided by Federal Law. In California, there are currently 220 dams operated by federal government agencies such as the United States Forest Service, United States Bureau of Reclamation, United States Army Corps of Engineers (USACE). [79]

Levee Failure

A levee failure can occur when flood waters exceed the height of a levee and flows over its crown (i.e., overtopping); or when breaching occurs. A levee breach can occur gradually or suddenly when part of the levee gives way, resulting in an opening through which floodwater may pass. The most dangerous breaches happen quickly during periods of high water. The resulting stream of water can quickly flood a large area behind the failed levee with little to no warning. [80]

Earthen levees can be damaged in several ways and if severe enough these scenarios can lead to a zone of weakness that could cause a levee breach.

- Strong river currents and waves can erode the surface.
- Trees growing on a levee can blow over, leaving a hole where the root ball and soil used to be.
- Burrowing animals (e.g., California ground squirrel, the salt marsh harvest mouse, or the western burrowing owl) can create holes that enable water to pass through a levee.
- In seismically active areas like Contra Costa County, earthquakes and ground shaking can cause a loss of soil strength, weakening the levee potentially resulting in a levee failure. Seismic activity can also cause levees to slide or slump, both of which can lead to failure. [81]

USACE operates, maintains, and evaluates flood protection levees to determine if they meet accreditation requirements. Most levees are owned by local communities and flood control districts that must ensure proper operation and maintenance of the levee system as well. Two (2) types of levees are present in the San Joaquin-Sacramento River Delta area of Contra Costa County.

- Levees that are part of an authorized federal flood control project on the Sacramento-San Joaquin River Delta systems that deliver irrigation and drinking water are designated as "project" levees. The 385 miles of project levees are built to the highest level of flood protection standards, are maintained mainly by the County, and are inspected by USACE.
- All other levees in the Delta are "non-project" or "local" levees. These levees, totaling 730 miles in length, are maintained by local reclamation districts. The non-project levees incorporate modern techniques and materials as the reclamation districts work to bring the old agricultural levees up to current standards. As land has subsided and sea levels have risen, a lot of the land

[79] California Governor's Office of Emergency Services. (2023). California State Hazard Mitigation Plan. Retrieved from https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-1_11.10.2023.pdf.
[80] American Society of Civil Engineers. (2010). So, You Live Behind a Levee! Retrieved from https://www.spl.usace.army.mil/Portals/17/SoYouLiveBehindLevee.pdf.
[81] Ibid.

behind these levees is now 10 to 15 feet below sea level, making the efforts of continual improvements essential to avoid overtopping and consequent flooding.

Levees in Contra Costa County are maintained by the Contra Costa Flood Control and Water Conservation District (CCFCWCD), USACE, 13 reclamation districts, and private landowners. These levees and drainage systems protect agricultural and rural areas, critical infrastructure like highways, and important environmental resources. [82]

4.6.2.2. Hazard Location

The National Inventory of Dams (NID) consists of dams meeting at least one (1) of the following criteria:

- High hazard potential classification – loss of human life is likely if the dam fails.
- Significant hazard potential classification – no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.
- Equal or exceed 25 feet in height and exceed 15 acre-feet in storage.
- Equal or exceed 50 acre-feet storage and exceed six (6) feet in height.

Although the goal of the NID is to include all dams in the United States that meet these criteria, in reality, this inventory is limited to information that can be gathered and properly interpreted. In most cases, dams within the NID criteria are regulated (e.g., construction permit, inspection, and/or enforcement) by federal or state agencies, who have basic information on the dams within their jurisdiction. All high hazard dams have Emergency Action Plans (EAP) in place, however due to data privacy and protected information, this information is not included in this Plan. Existing EAPs include inundation data for all listed High Hazard dams. According to the NID, most High Hazard dams do not include a USACE risk assessment as outlined via the NID tool's risk tab. Those that have risk assessments available are noted in the Summary Vulnerability Assessment section in the following pages.

According to the NID, there are 27 dams within Contra Costa County of which 23 are classified as high hazard dams. **Table 4-32** lists the high hazard dams within Contra Costa County and **Table 4-33** lists additional dams within the County classified as low hazard potential. [83] **Figure 4-6** displays the high and significant dams located within five (5) miles of Contra Costa County.

Table 4-32. High Hazard Dams in Contra Costa County

Name	National ID	Location	Owner	Type	Condition Assessment	Condition Assessment Date	Height *(feet)*	Normal Storage *(acre-feet)*	Max Discharge *(cubic feet / second)*	EAP
Antioch Reservoir	CA00057	Contra Costa County	City of Antioch	Earth	Satisfactory	9/1/2017	30	722	Not Available	Yes
Argyle No. 2	CA00186	Contra Costa County	East Bay Municipal Utility District	Other	Satisfactory	9/1/2017	27	22	Not Available	
Briones	CA00172	Contra Costa County	East Bay Municipal Utility District	Earth	Satisfactory	9/1/2017	273	67,520	Not Available	Yes

[82] Contra Costa County. (2023). Public Review Draft Contra Costa County 2045 General Plan. Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2024/02/Contra-Costa-County-General-Plan_Public-Review-Draft_Combined.pdf.
[83] United States Army Corps of Engineers. (n.d.). National Inventory Dams. Retrieved from https://nid.sec.usace.army.mil/#/.

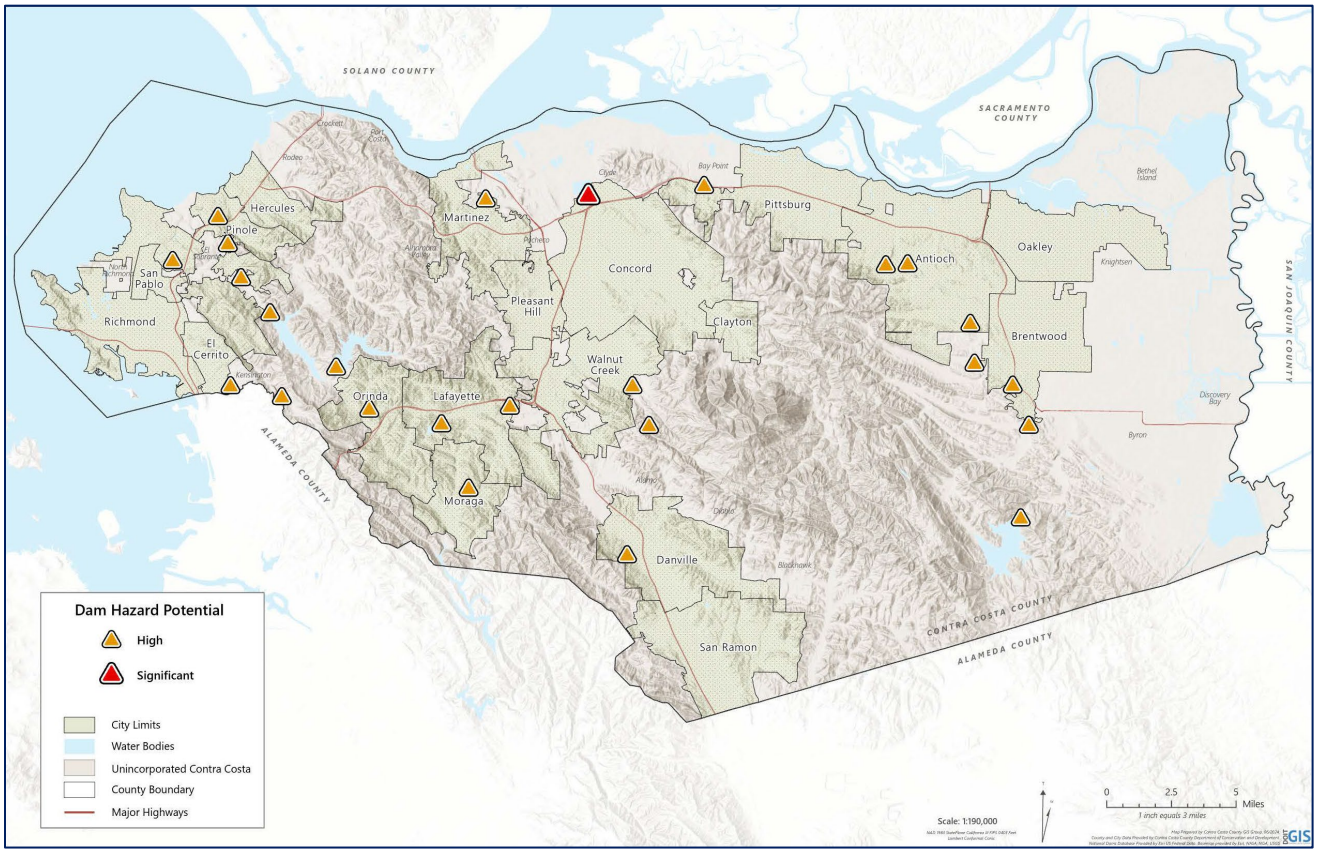
Name	National ID	Location	Owner	Type	Condition Assessment	Condition Assessment Date	Height *(feet)*	Normal Storage *(acre-feet)*	Max Discharge *(cubic feet / second)*	EAP
C.L. Tilden Park	CA00161	Contra Costa County	East Bay Municipal Utility District	Earth	Satisfactory	9/1/2017	88	268	Not Available	Yes
Contra Loma	CA10143	Contra Costa County	United States Bureau of Reclamation	Earth	Not Available	Not Available	107	2,630	838	Yes
Danville	CA00184	Contra Costa County	East Bay Municipal Utility District	Earth	Satisfactory	9/1/2017	75	45	Not Available	Yes
Dry Creek	CA00811	Contra Costa County	Contra Costa County Flood Control and Water Conservation District	Earth	Satisfactory	9/1/2017	30	330	Not Available	Yes
Lafayette	CA00163	Contra Costa County	East Bay Municipal Utility District	Earth	Fair	9/1/2017	132	4,250	Not Available	Yes
Lake Orinda	CA00659	Contra Costa County	Orinda Country Club	Earth	Satisfactory	8/20/2019	45	111	474	Yes
Leland	CA00177	Contra Costa County	East Bay Municipal Utility District	Earth	Satisfactory	9/1/2017	41	60	Not Available	Yes
Los Vaqueros	CA01396	Contra Costa County	Contra Costa Water District	Earth	Satisfactory	9/1/2017	231	160,000	Not Available	Yes
Mallard	CA00838	Contra Costa County	Contra Costa Water District	Earth	Satisfactory	9/1/2017	30	3,113	Not Available	Yes
Maloney	CA00180	Contra Costa County	East Bay Municipal Utility District	Earth	Satisfactory	9/1/2017	107	68	Not Available	Yes
Marsh Creek	CA00809	Contra Costa County	Contra Costa County Flood Control and Water Conservation District	Earth	Satisfactory	9/1/2017	59	4,425	Not Applicable	Yes
Martinez	CA10168	Contra Costa County	United States Bureau of Reclamation	Earth	Not Available	Not Available	62	296	272	Yes
Moraga	CA00178	Contra Costa County	East Bay Municipal Utility District	Earth	Satisfactory	9/1/2017	37	36	Not Available	Yes
North	CA00183	Contra Costa County	East Bay Municipal Utility District	Earth	Satisfactory	9/1/2017	82	244	Not Available	Yes
Pine Creek	CA00808	Contra Costa County	Contra Costa County Flood Control and Water Conservation District	Earth	Satisfactory	9/1/2017	87	225	Not Available	Yes
Pine Creek Detention	CA01252	Contra Costa County	Contra Costa County Flood Control and Water Conservation District	Gravity	Satisfactory	9/1/2017	30	320	Not Available	Yes
San Pablo	CA00166	Contra Costa County	East Bay Municipal Utility District	Earth	Satisfactory	9/1/2017	170	43,193	Not Available	Yes
Sobrante Clearwell	CA00179	Contra Costa County	East Bay Municipal Utility District	Earth	Satisfactory	9/1/2017	28	25	Not Available	Yes
Upper Sand Creek Detention Basin	CA01555	Contra Costa County	Contra Costa County Flood Control and Water Conservation District	Earth	Satisfactory	9/1/2017	40	895	Not Available	Yes

Name	National ID	Location	Owner	Type	Condition Assessment	Condition Assessment Date	Height *(feet)*	Normal Storage *(acre-feet)*	Max Discharge *(cubic feet / second)*	EAP
Vista Del Mar Detention Basin	CA01489	Contra Costa County	William Lyon Homes, Inc.	Earth	Satisfactory	9/1/2017	42	33	Not Available	Yes

Table 4-33. Additional Dams in Contra Costa County

Name	National ID	Location	Owner	Type	Condition Assessment	Condition Assessment Date	Height *(feet)*	Normal Storage *(acre-feet)*	Max Discharge *(cubic feet / second)*
Clearwell Phase 2	CA01109	Contra Costa County	Central Contra Costa Sanitary District	Earth	Satisfactory	9/1/2017	30	100	Not Available
Clifton Court Forebay	CA00050	Contra Costa County	California Department of Water Resources	Earth	Fair	1/8/2021	34	29,000	Not Available
Deer Creek	CA00810	Contra Costa County	Contra Costa County Flood Control and Water Conservation District	Earth	Satisfactory	9/1/2017	29	233	Not Available
San Pablo Clearwell	CA00185	Contra Costa County	East Bay Municipal Utility District	Earth	Satisfactory	9/1/2017	42	17	Not Available

Figure 4-6. High and Significant Hazard Dams in the Contra Costa County Area

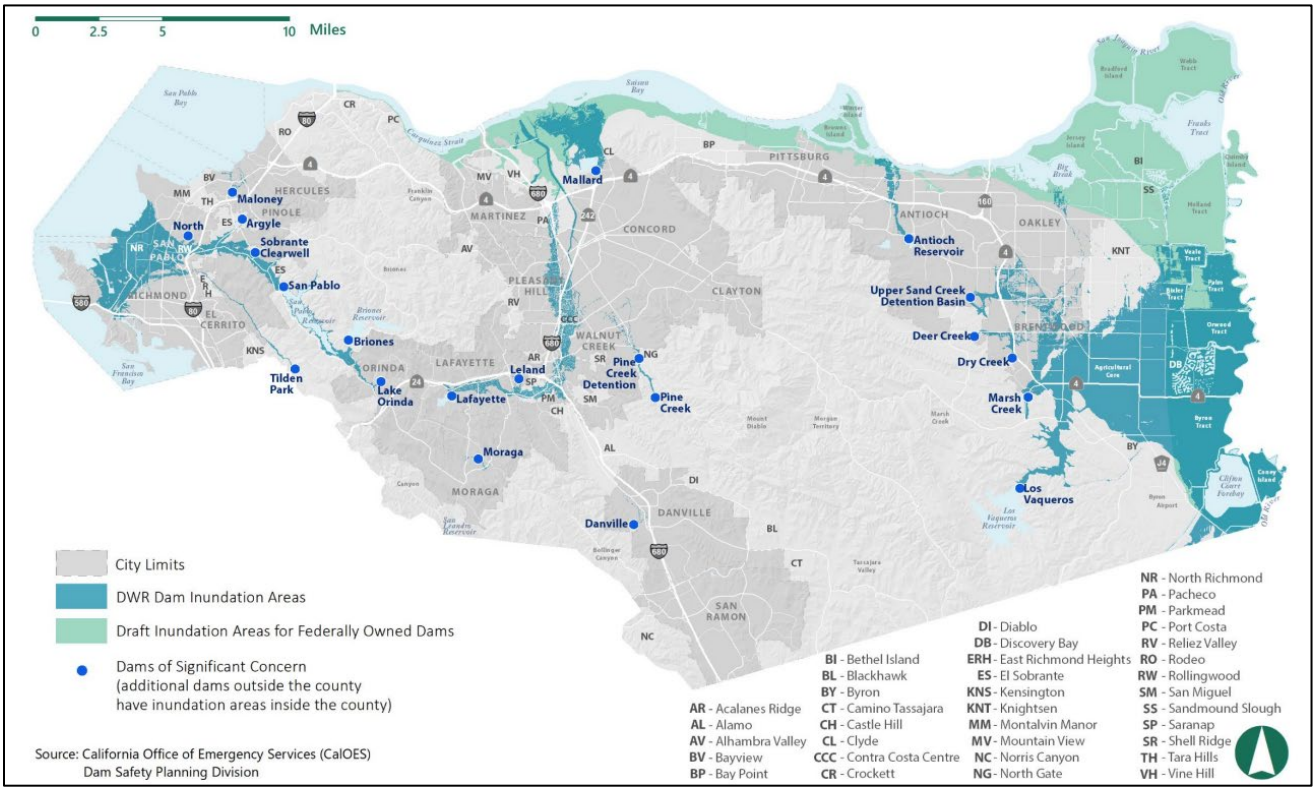


Additionally, there are six (6) high hazard dams, listed in **Table 4-34**, that although located outside of the County, they have inundation areas within the County. **Figure 4-7** illustrates areas in the County that would be inundated in the event that a dam fails.

Table 4-34. Dams Outside of Contra Costa County

Name	National ID	Location	Owner	Type	Condition Assessment	Condition Assessment Date	Height *(feet)*	Normal Storage *(acre-feet)*	Max Discharge *(cubic feet / second)*	EAP
Exchequer Main	CA00240	Mariposa, California	Merced Irrigation District	Rockfill, Earth	Not Available	Not Available	490	1,100,000	531,600	Yes
New Hogan	CA10109	Calaveras, California	USACE (Sacramento District)	Rockfill, Earth	Not Available	Not Available	210	348,598	106,400	Yes
New Melones	CA10246	Calaveras, California	United States Bureau of Reclamation	Rockfill, Earth	Not Available	Not Available	625	2,870,000	Not Available	Yes
Pine Flat	CA10112	Fresno, California	USACE (Sacramento District)	Gravity	Not Available	Not Available	440	1,091,700	391,000	Yes
San Luis Reservoir (B.F. Sisk)	CA10183	Merced, California	United States Bureau of Reclamation	Earth	Not Available	Not Available	382	2,118,380	Not Available	Yes
Summit	CA00146	Solano, California	City of Vallejo	Earth	Satisfactory	9/1/2017	124	220	Not Available	Yes

Figure 4-7. Dams Inundation Areas in the Contra Costa County Area



DSOD classifies dams slightly differently than NID. The DSOD scale defines the intensity or potential severity of dam failure solely based on potential downstream impacts to life and property and the hazard is not related to the condition of the dam or its pertinent structures. *Refer to the Hazard Extent/Intensity section for further details on the DSOD's classification.* **Table 4-35** lists the 25 dams within jurisdiction in Contra Costa County with DSOD's classification.

Table 4-35. Dams Within Jurisdiction in Contra Costa County with DSOD Downstream Hazard Potential Classifications

Name	National ID	Downstream Hazard Potential
Antioch Reservoir	CA00057	Extremely High
Argyle No. 2	CA00186	High
Briones	CA00172	Extremely High
C.L. Tilden Park	CA00161	Extremely High
Clearwell Phase 2	CA01109	Low
Clifton Court Forebay	CA00050	Low
Danville	CA00184	Extremely High
Dry Creek	CA00811	High
Lafayette	CA00163	Extremely High
Lake Orinda	CA00659	High
Leland	CA00177	High
Los Vaqueros	CA01396	Extremely High
Mallard	CA00838	High
Maloney	CA00180	Extremely High
Marsh Creek	CA00809	Extremely High
Moraga	CA00178	High
North	CA00183	Extremely High
Pine Creek	CA00808	High
Pine Creek Detention	CA01252	High
San Pablo	CA00166	Extremely High
San Pablo Clearwell	CA00185	Low
Sobrante Clearwell	CA00179	High
Upper Sand Creek Detention Basin	CA01555	Extremely High
Vista Del Mar Detention Basin	CA01489	High

According to the National Levee Database, there are 17 project levees in the County that are included in the USACE Levee Program, listed in **Table 4-36**.[84] An additional 18 non-project levees owned by reclamation districts in the County are listed in **Table 4-37**.[85] There are over 1,100 miles of earthen levees

[84] United States Army Corps of Engineers. (n.d.). National Levee Database. Retrieved from https://levees.sec.usace.army.mil/#/.
[85] Contra Costa County Department of Conservation & Development Draft Levee Shapefile.

and revetments managed by CCFCWCD and reclamation districts in the County.[86] **Figure 4-8** displays the levee systems within five (5) miles of Contra Costa County, per USACE.

Table 4-36. Project Levees in Contra Costa County

Levee Name	Levee Owner	Segment Length *(miles)*
Wildcat Creek (Right Bank)	Contra Costa County Public Works	0.86
Wildcat Creek (Left Bank)	Contra Costa County Public Works	0.29
Walnut Creek and Pacheco Creek (Right Bank)	Contra Costa County Flood Control and Water Conservation District	1.74
Walnut Creek and Pacheco Creek (Left Bank)	Contra Costa County Flood Control and Water Conservation District	1.86
Walnut Creek and Grayson Creek (Right Bank)	Contra Costa County Flood Control and Water Conservation District	2.88
Walnut Creek and Grayson Creek (Left Bank)	Contra Costa County Flood Control and Water Conservation District	1.49
Walnut Creek and Clayton Valley Drain (Right Bank)	Contra Costa County Flood Control and Water Conservation District	0.56
Walnut Creek and Clayton Valley Drain (Left Bank)	Contra Costa County Flood Control and Water Conservation District	1.68
San Pablo Creek (Right Bank)	Contra Costa County Public Works	1.00
San Pablo Creek (Left Bank)	Contra Costa County Public Works	0.92
Rodeo Creek (Right Bank)	Contra Costa County Public Works	0.19
Rodeo Creek (Left Bank)	Contra Costa County Public Works	0.25
Rheem Creek (Right Bank)	Contra Costa County Public Works	0.46
Rheem Creek (Left Bank)	Contra Costa County Public Works	0.47
Reclamation District No. 800 (Byron Tract)	Reclamation District No. 800 (Byron Tract)	8.90
Pinole Creek (Right Bank)	Contra Costa County Public Works	0.35
Pinole Creek (Left Bank)	Contra Costa County Public Works	0.41

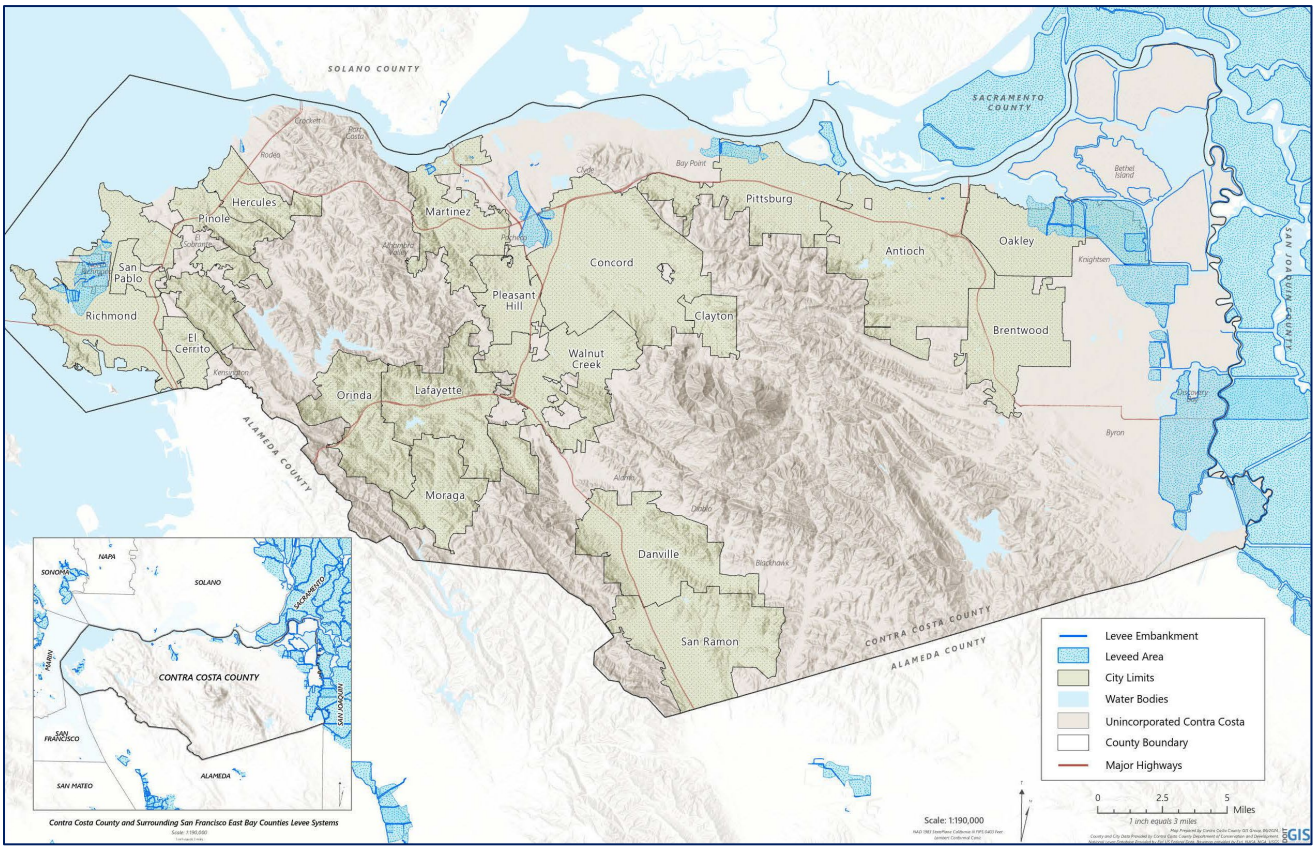
Table 4-37. Non-Project Reclamation District Levees in Contra Costa County

Levee Name	Segment Length *(miles)*
Bixler Tract	2.04
Bethel Island	11.62
Bradford Island	7.41
Byron Tract / Discovery Bay	9.40
Coney Island	5.49

[86] Contra Costa County. (2023). Public Review Draft Contra Costa County 2045 General Plan. Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2024/02/Contra-Costa-County-General-Plan_Public-Review-Draft_Combined.pdf.

Levee Name	Segment Length *(miles)*
Contra Costa Canal	8.15
Cypress Corridor	3.82
Cypress Flood Control	1.32
Cypress Flood Control	1.88
Holland Tract	10.97
Hotchkiss Tract	6.91
Jersey Island	15.52
Palm Tract / Orwood Tract	14.42
Quimby Island	7.02
Summer Lake	3.10
Veale Tract	6.01
Webb Tract	12.96

Figure 4-8. Levee Systems in Contra Costa County Area



4.6.2.3. Hazard Extent/Intensity

Federal guidelines provide for a three (3) level classification system that defines low, significant, and high-hazard potential classifications depending on the potential for loss of life, economic loss, and

environmental damage resulting from a hypothetical dam failure. The USACE dam hazard categories are listed in **Table 4-38**.

Table 4-38. USACE Dam Hazard Categories

Hazard Category	Direct Loss of Life	Lifeline Losses	Property Losses	Environmental Losses
Low	None *(rural location, no permanent structures for human habitation).*	No disruption of services *(cosmetic or rapidly repairable damage).*	Private agricultural lands, equipment, and isolated buildings.	Minimal incremental damage.
Significant	Rural location, only transient or day-use facilities.	Disruption of essential facilities and access.	Major public and private facilities.	Major mitigation required.
High	Certain (one or more) extensive residential, commercial, or industrial development.	Disruption of essential facilities and access.	Extensive public and private facilities.	Extensive mitigation cost or impossible to mitigate.

The hazard categories are assigned to overall projects, not individual structures at a project. The four (4) general categories are described below.

- **Direct Loss of Life:** The loss of life potential based on inundation mapping of area downstream of the project. Analyses of loss of life potential should take into account the population at risk, time of flood wave travel, and warning time.
- **Lifeline Losses:** Indirect threats to life caused by the interruption of lifeline services due to project failure or operational disruption; for example, loss of critical medical facilities or access to them.
- **Property Losses:** Damage to project facilities and downstream property and indirect impact due to loss of project services, such as impact due to loss of a dam and navigation pool, or impact due to loss of water or power supply.
- **Environmental Losses:** Environmental impact downstream caused by the incremental flood wave produced by the project failure, beyond what would normally for the magnitude flood event under which the failure occurs.

DSOD uses its own scale for defining the intensity or potential severity of dam failure solely based on potential downstream impacts to life and property. Additionally, the hazard is not related to the condition of the dam or its pertinent structures. This scale has four (4) categories which include the Federal categories and adds a fourth category of “extremely high”. **Table 4-39** outlines the downstream hazard potential classifications used by DSOD. [87]

[87] California Department of Water Resources, Division of Safety of Dams. (2021). Downstream Hazard. Retrieved from https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/All-Programs/Division-of-Safety-of-Dams/Files/Publications/Division-of-Safety-of-Dams-Definitions-for-Downstream-Hazard-and-Condition-Assessment.pdf.

Table 4-39. DSOD's Downstream Hazard Potential Classifications

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

The United States Army Corps of Engineers (USACE) Levee Safety Program key activities include levee inspections, risk assessments, and sharing levee information.[88] To better inform stakeholders and residents of the residual risk within their communities, USACE utilizes the Levee Safety Action Classification (LSAC) tool.[89] **Table 4-40** outlines the LSAC risk levels, actions, and risk characteristics for each level. The LSAC is not a levee rating or grade, but a classification system designed to consider the following:

- Probability of the levee being loaded (hazard).
- Existing condition of the levee.
- The current and future maintenance of the levee (performance).
- The consequences if the levee were to fail or be overwhelmed.

For example, a levee that reduces risk for a dense population will have a different classification from an equally constructed levee with a smaller population because the consequences associated with failure are greater.[90]

Table 4-40. USACE Levee Safety Action Classification (LSAC)[91]

Risk	Actions for Levee Systems and Leveed Areas in this Class *(Adapt actions to specific levee system conditions)*	Risk Characteristics of this Class
Very High (1)	Based on risk drivers, take immediate action to implement interim risk reduction measures. Increase frequency of levee monitoring, communicate risk characteristics to the community within an expedited timeframe; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning systems and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions as very high priority.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences result in very high risk.

[88] United States Army Corps of Engineers. (n.d.). Levee Safety Program. Retrieved from https://www.usace.army.mil/Missions/Civil-Works/Levee-Safety-Program/.
[89] United States Army Corps of Engineers. (n.d.). Levee Safety Action Classification (LSAC). Retrieved from https://www.mvn.usace.army.mil/LSAC/.
[90] Ibid.
[91] United States Army Corps of Engineers. (n.d.). Levee Safety Action Classification (LSAC). Retrieved from https://www.mvn.usace.army.mil/Portals/56/docs/PAO/LSACs/LSAC%20Table.pdf.

Risk	Actions for Levee Systems and Leveed Areas in this Class *(Adapt actions to specific levee system conditions)*	Risk Characteristics of this Class
High (2)	Based on risk drivers, implement interim risk reduction measures. Increase frequency of levee monitoring; communicate risk characteristics to the community within an expedited timeframe; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions as high priority.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in high risk.
Moderate (3)	Based on risk drivers, implement interim risk reduction measures as appropriate. Verify risk information is current and implement routine monitoring program; assure O&M is up to date; communicate risk characteristics to the community in a timely manner; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions as a priority.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in moderate risk.
Low (4)	Verify risk information is current and implement routine monitoring program and interim risk reduction measures if appropriate; assure O&M is up to date; communicate risk characteristics to the community as appropriate; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions to further reduce risk to as low as practicable.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in low risk.
Very Low (5)	Continue to implement routine levee monitoring program, including operation and maintenance, inspections, and monitoring of risk. Communicate risk characteristics to the community as appropriate; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in very low risk.
No Verdict	Not enough information is available to assign an LSAC.	

**Levee risk is the risk that exists due to the presence of the levee system, and this is the risk used to inform the decision on the LSAC assignment.*

The information presented in this table does not reflect the overtopping without breach risk associated with the presence or operation of the levee system.

4.6.2.4. Warning Time

Dam and levee failure may occur with little or no warning time.

For a dam failure, warning time varies depending on the cause of the failure. For example, in the event of extreme precipitation or massive snowmelt, evacuations can be planned with sufficient time. On the other hand, in the event of a structural failure due to earthquake, there may be no warning time. A dam's structural type also affects warning time. Earthen dams tend to not fail completely or instantaneously, the time of breach formation ranges from a few minutes to a few hours. Once a breach is initiated, discharging water erodes the breach until either the reservoir water is depleted, or the breach resists further erosion. Concrete gravity dams also tend to have a partial breach as one or more monolith sections are forced apart by escaping water.

Contra Costa County and its planning partners have established protocols for flood warning and response to imminent dam failure in the flood warning portion of its adopted Emergency Operations Plan. These protocols are tied to the emergency action plans created by the dam owners.

Warning time for levee failures also depends on the cause of the failure. A levee failure caused by structural failure can be sudden and occur with little to no warning. If heavy rains are impacting a levee system, communities located in the immediate danger zone can be evacuated before a failure occurs. If the levee failure is caused by overtopping, the community may or may not be able to recognize the impending failure and evacuate. If a levee failure occurs suddenly, evacuation may not be possible.

4.6.2.5. Probability and Frequency

Dam failure has a low probability of occurrence and it usually coincides with events that cause them (e.g., earthquakes, landslides, excessive rain, and snowmelt). Between 1950 and 2023, there have been three (3) Federal disaster declarations due to dam failure, one (1) of which has occurred in California. [92] This represents an average of one (1) event every 23 years. However, dam safety incidents, which are less severe than dam failures, have occurred.

Like dams, levee failures have a low probability of occurrence and usually coincide with events that cause them (e.g., earthquakes and heavy rainfall). Between 1950 and 2023, there has been one (1) Federal disaster declarations due to a levee failure, which occurred in California in 2004. [93] According to the 2023 California State Hazard Mitigation Plan, in the last 120 years, there have been 124 levee failures in the State. This represents about one (1) occurrence per year.

Probability of Future Hazard Events

As previously states, dam failure and levee failure are infrequent. A levee failure is more likely to occur than a dam failure.

4.6.2.6. Past Events

There are no dam failure events reported in Contra Costa County. However, there have been two (2) recent levee failures in the San Joaquin-Sacramento River Delta, listed in **Table 4-41**.

Table 4-41. Dam and Levee Failure Past Events

Date	Event Summary
August 27, 2009	A levee breach occurred when a bulk carrier ship was outbound from Port of Stockton and it lost steering, grounded, and hit the levee at Bradford Island. The collision damaged approximately 150 feet of levee, causing a serious breach. Of note, Bradford Island has been flooded numerous times over the past 100 years due to levee failure.
June 3, 2004	The Upper Jones Tract levee near Woodward Island failed, inundating the entire island with more than 150,000 acre feet of water. Repairs required three (3) weeks. The island, which lies 10 feet below sea level, required an additional five (5) months of de-watering. The failure resulted in approximately $90 Million in repairs.

4.6.2.7. Vulnerability and Impacts

Life Safety and Health: All residents within dam and levee inundation areas would be vulnerable and impacted by a dam or levee failure event. The potential for loss of life is affected by the capacity and number of evacuation routes available to those living in potential dam inundation areas. In a dam and

[92] Federal Emergency Management Agency. (n.d.). Declared Disasters. Retrieved from https://www.fema.gov/disaster/declarations.
[93] Ibid.

levee failure event, the vulnerable populations are all of those downstream from the dam or levee failure that are unable to evacuate the area within the allowable time frame. However, the underserved and at risk population face unique vulnerabilities and impacts in the event of flooding are a result of a dam or levee failure. These groups include, but are not limited to, households in poverty, low income population, population living in single access roads, people with limited English proficiency, individuals without access to lifelines, the elderly population (including those with access and functional needs), and undocumented individuals.[94]

- **Households in Poverty and Low Income Population:** Households in poverty include those with an income at or below $24,300 for a household of four (4). In Contra Costa County, most households considered to live in poverty are located within or near 100-year flood zones. Flooding from a dam and levee failure can damage homes, cause mildew, and mold to grow. The low income population includes households with an income of 80% or less of the median income ($104,400) in Contra Costa County. This population tends to be less likely to evacuate in response to emergency incidents, such as a dam and levee failure. Furthermore, households in poverty and low income households may have fewer financial resources to complete preparedness and recovery activities (i.e., fix flood damage) and the structures are not waterproofed or built above the current 100-year flood elevation. High concentration of this population is located within or near a flood zone or dam inundation area, mostly in the north and east portion of the County.
- **Individuals Living on Single Access Roads:** Includes the population living in areas with a single route in and out (i.e., accessible via one (1) roadway) of the neighborhood or area. This population is uniquely vulnerable to dam and levee failure because the flooding can block, damage, and destroy roadways which can isolate this population from the community and emergency services. In Contra Costa County, several neighborhoods and communities in the Delta and in the hillside areas in the central and western side of the County are only accessible via one (1) roadway.
- **Limited English Proficiency:** This group includes those that speak English “less than very well”, per the United States Census Bureau definition. In Conta Costa County, 158,965 people (38.2%) have limited English proficiency (i.e., speak English “less than very well”). This population are more likely to live in low income areas which are also most likely to be located within low lying areas. Flooding due to dam and levee failures can cause significant damage to homes resulting in uninhabitable and unhealthy conditions to live in. Additionally, individuals with limited English proficiency may have limited access to information and resources designed to prevent or mitigate flooding risk due to language or cultural differences.
- **Individuals Without Access to Lifelines:** Includes individuals who do not have access to basic technology or services (e.g., transportation, modern communication). This population is vulnerable because not having access to these can create barriers to prepare and respond to emergency events, including dam and levee failure, may be unable to evacuate in a timely manner, and may become isolated if transit services are not operating. For example, this population may be unaware of an impending or occurring failure of a dam or levee potentially resulting in being unable to evacuate in a timely manner in the event an evacuation order is issued.
- **Senior (65 years old and over):** The elderly population (i.e., seniors), especially those with access and functional needs, may have physical limitations that make it harder to evacuate in the event of an emergency, such as a dam and levee failure. Furthermore, the elderly population may

[94] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.

lack access to social connections and community support that can assist in preparing for and responding to emergency events, evacuating, improving home resiliency, managing medical needs, and locating support services. A high concentration of the elderly population lives in central Contra Costa County, Bethel Island, eastern part of Richmond, and several parts of Walnut Creek.

- **Undocumented Individuals:** Includes people who do not have formal permission to live in the United States (i.e., do not have citizenship, permanent residency, visas, or other similar status). This population is most likely to fall in the households in poverty and low income categories, which are considered to be at risk populations during a flooding event and are more likely to live in low lying areas in structures that are not waterproofed or build above the 100-year flood elevations.

Table 4-42 summarizes the vulnerable and at-risk population for dam and levee failure in Contra Costa County.

Table 4-42. Vulnerability and At Risk Population

Category	Estimate	Percent
Households in Poverty[95]	7,600	12.0%
Low Income Households[96]	25,340	41.0%
Spanish Spoken at Home[97]	204,442	18.7%
Speak English "Less than very well"[98]	158,965	38.2%
Language Other than English[99]	416,505	38.0%
Foreign Born[100]	312,050	27.0%
Households Without Vehicle[101]	8,872	1.6%
65 Years and Over[102]	201,136	17.4%
Seniors (65 years and over) Living Alone[103]	45,672	22.7%
Undocumented Individuals[104]	There are no official counts of how many undocumented individuals live in Contra Costa County, but in 2019 there was an estimate of 63,000.	

[95] Ibid.
[96] Ibid.
[97] United States Census Bureau. (2022). S1601: Language Spoken at Home (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S1601?g=050XX00US06013.
[98] Ibid.
[99] Ibid.
[100] United States Census Bureau. (2022). DP02: Selected Social Characteristics in the United States (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP02?g=050XX00US06013.
[101] United States Census Bureau. (2022). S0801: Commuting Characteristics by Sex. Retrieved from https://data.census.gov/table/ACSST1Y2022.S0801?g=050XX00US06013.
[102] United States Census Bureau. (2022). DP05: Demographics and Housing Estimates (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP05?g=050XX00US06013.
[103] United States Census Bureau. (2022). DP02: Selected Social Characteristics in the United States (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP02?g=050XX00US06013.
[104] Migration Policy Institute. (2019). Profile of the Unauthorized Population: Contra Costa County, CA. Retrieved from https://www.migrationpolicy.org/data/unauthorized-immigrant-population/county/6013.

Table 4-49 outlines the vulnerability of the total population exposed to dam and levee failure, and **Table 4-50** outlines the dam and levee failure impacts to population and life safety, underserved/equity population, and essential operations, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Property Damage and Critical Infrastructure: Vulnerable properties are those closest to the dam and levee, and within the inundation area. These properties would experience the largest, most destructive surge of water. Low lying areas are also vulnerable since they are where the dam and levee waters would collect. In Contra Costa County, there is a range from the large, state-owned bridges that carry interstate freeways, to locally owned bridges that carry rural roads and pedestrians over small creeks. Countywide, there are over 400 bridges where approximately 80 are owned by the County and 160 owned by Caltrans. There are 26 bridges that are within the 100-year flood zone and dam inundation areas. Some of these bridges are located in low lying areas that could become flooded during a dam or levee failure event if located within the inundation areas. Additionally, Interstate 680 and 80, and State Route 4, along with many regional roadways, are within dam and levee inundation areas. Flooding to these roadways and local roadways can cause major disruptions to local and regional transportation, transit, and commuters.

There are 10 wastewater treatment plants in the County which treat wastewater for residents within cities and unincorporated County. One (1) of the wastewater treatment plants is located within a dam inundation area. In Contra Costa County, there are 99 industrial buildings that are within dam inundation areas. Other industrial buildings located outside the 100-year floodplain, and dam and levee inundation areas are unlikely to be waterproofed or flood resistant. If any of these structures are damaged due to flooding, it can increase the potential of a hazardous materials release.

There are a total of 554 critical assets (i.e., schools, nursing homes, fire stations, police stations, and hospitals) throughout the County and 41 (7.4%) are located within a dam inundation area. **Table 4-43** provides a breakdown of critical assets that are located within dam inundation areas in Contra Costa County.

Table 4-43. Critical Assets in Vulnerable to Dam Failure

Asset	Estimate	Percent *(of total asset)*
Schools *(public schools, private schools)*	27	7.5%
Nursing Homes	2	2.6%
Fire Stations	8	9.9%
Police Stations	4	16.7%
Hospitals	0	0.0%

According to the National Levee Database, there are 58 levees in the County, which are included in the USACE Levee Program. **Table 4-44** lists the levees within the County along with the number of buildings, population, property value, and number of critical infrastructure that is deemed vulnerable in the event of a levee failure.[105]

Table 4-44. Levee and Vulnerability in the Leveed Area

[105] United States Army Corps of Engineers. (n.d.). National Levee Database. Retrieved from https://levees.sec.usace.army.mil/.

Levee Name	System ID	Operations / Maintenance Organization *(or Floodplain Management)*	Location	Flooding Source	Behind Levee
Contra Costa County Levee 6	1905004482	Contra Costa Flood Control and Water Conservation District	City of Oakley	Marsh Creek	**7** Buildings **9** People **$10 M** Property Value **0** Critical Structures
Contra Costa County Levee 7	1905004044	FEMA Region 9	Knightsen	Not Available	**81** Buildings **187** People **$60 M** Property Value **0** Critical Structures
Contra Costa County Levee 9	1905004332	FEMA Region 9	Town of Discovery Bay	Not Available	**7** Buildings **65** People **$50 M** Property Value **0** Critical Structures
Contra Costa County Levee 14	1905004480	Contra Costa Flood Control and Water Conservation District	City of Oakley	Marsh Creek	**13** Buildings **37** People **$50 M** Property Value **1** Critical Structures
Contra Costa County Levee 15	1905004159	FEMA Region 9	Bethel Island	Not Available	**14** Buildings **42** People **$8 M** Property Value **0** Critical Structures
Contra Costa County Levee 16	1905004423	Reclamation District No. 799	City of Oakley	Unknown	**131** Buildings **708** People **$100 M** Property Value **0** Critical Structures
Contra Costa County Levee 17	1905004133	FEMA Region 9	Bethel Island	Not Available	**3** Buildings **18** People **$2 M** Property Value **0** Critical Structures
Contra Costa County Levee 19	1905004126	Reclamation District No. 830	Bethel Island	Not Available	**16** Buildings **8** People **$30 M** Property Value **0** Critical Structures
Contra Costa County Levee 20	1905004130	FEMA Region 9	Bethel Island	Not Available	**1,114** Buildings **2,419** People **$700 M** Property Value **2** Critical Structures
Contra Costa County Levee 22	1905004016	FEMA Region 9	City of Oakley	Not Available	**609** Buildings **1,666** People **$500 M** Property Value **0** Critical Structures
Contra Costa County Levee 24	1905004051	FEMA Region 9	City of Oakley	Not Available	**15** Buildings **0** People **$30 M** Property Value **0** Critical Structures
Contra Costa County Levee 25	1905004400	Town of Discovery Bay Community Services District	Town of Discovery Bay	Not Available	**134** Buildings **1,627** People **$100 M** Property Value **0** Critical Structures
Contra Costa County Levee 28	1905004333	FEMA Region 9	Town of Discovery Bay	Not Available	**2** Buildings **74** People **$2 M** Property Value **0** Critical Structures

Levee Name	System ID	Operations / Maintenance Organization *(or Floodplain Management)*	Location	Flooding Source	Behind Levee
Contra Costa County Levee 29	1905004019	City of Oakley	City of Oakley	Not Available	**336** Buildings **24** People **$200 M** Property Value **0** Critical Structures
Contra Costa County Levee 32	1905004008	City of Oakley	City of Oakley	Contra Costa Canal	**825** Buildings **1,196** People **$500 M** Property Value **0** Critical Structures
Contra Costa County Levee 35	1905004443	FEMA Region 9	Knightsen	Not Available	**2** Buildings **15** People **$1 M** Property Value **0** Critical Structures
Contra Costa County Levee 39	1905004334	FEMA Region 9	Town of Discovery Bay	Not Available	**16** Buildings **80** People **$20 M** Property Value **1** Critical Structures
Contra Costa County Levee 40	1905004020	FEMA Region 9	City of Oakley	Not Available	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
Contra Costa County Levee 41	1905004158	FEMA Region 9	Bethel Island	Not Available	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
Contra Costa County Levee 42	1905004095	FEMA Region 9	Byron	Unknown	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
Contra Costa County Levee 47	1905004157	FEMA Region 9	City of Pittsburg	Not Available	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
Contra Costa County Levee 52	1905004129	FEMA Region 9	City of Pittsburg	Not Available	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
Contra Costa County Levee 55	1905004081	FEMA Region 9	City of Pittsburg	Not Available	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
Contra Costa County Levee 64	1905004119	FEMA Region 9	City of Martinez	Not Available	**3** Buildings **1** People **$3 M** Property Value **0** Critical Structures
Contra Costa County Levee 73	1905004261	FEMA Region 9	City of Richmond	Not Available	**0** Buildings **0** People **$0 M** Property Value **0** Critical Structures
Contra Costa County Levee 81	1905004310	FEMA Region 9	City of Antioch	Not Available	**0** Buildings **0** People **$0** Property Value **0** Critical Structures

Levee Name	System ID	Operations / Maintenance Organization *(or Floodplain Management)*	Location	Flooding Source	Behind Levee
Contra Costa County Levee 88	1905004270	FEMA Region 9	City of Richmond	Not Available	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
Contra Costa County Levee 108	1905004272	FEMA Region 9	City of Richmond	Not Available	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
Contra Costa County Levee 151	1905004322	FEMA Region 9	City of Antioch	Not Available	**1** Buildings **3** People **$100,000** Property Value **0** Critical Structures
Contra Costa County Levee 198	1905004090	FEMA Region 9	City of Pittsburg	Not Available	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
Contra Costa County Levee 208	1905004149	FEMA Region 9	City of Pittsburg	Not Available	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
Contra Costa County Levee 215	1905004420	FEMA Region 9	City of Martinez	Not Available	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
Contra Costa County Levee 217	1905004420	FEMA Region 9	City of Pittsburg	Not Available	**0** Buildings **0** People **$0 M** Property Value **0** Critical Structures
Contra Costa County Levee 218	1905004271	FEMA Region 9	City of Richmond	Not Available	**0** Buildings **0** People **$0 M** Property Value **0** Critical Structures
Contra Costa County Levee 245	1905004262	FEMA Region 9	City of Richmond	Not Available	**1** Buildings **0** People **$20 M** Property Value **0** Critical Structures
Contra Costa County Levee 251	1905004125	FEMA Region 9	Byron	Not Available	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
Contra Costa County Levee 253	1905004365	FEMA Region 9	Mountain House	Not Available	**2** Buildings **13** People **$1 M** Property Value **0** Critical Structures
Contra Costa County Levee 255	1905004452	FEMA Region 9	Byron	Not Available	**5** Buildings **0** People **$10 M** Property Value **0** Critical Structures
Lakeshore Dry Levee	1905004128	Town of Discovery Bay Community Services District	Town of Discovery Bay	Unknown	**207** Buildings **1,245** People **$200 M** Property Value **0** Critical Structures

Levee Name	System ID	Operations / Maintenance Organization *(or Floodplain Management)*	Location	Flooding Source	Behind Levee
Pinole Creek (Left Bank)	5305000027	Contra Costa County Public Works Department	City of Pinole	Pinole Creek	**20** Buildings **47** People **$6 M** Property Value **0** Critical Structures
Pinole Creek (Right Bank)	5305000028	Contra Costa County Public Works Department	City of Pinole	Pinole Creek	**16** Buildings **52** People **$6 M** Property Value **0** Critical Structures
Reclamation District No. 800 (Byron Tract)	5205000071	Reclamation District No. 800	Town of Discovery Bay	Discovery Bay, Italian Slough, Old River, Vasco Hills runoff, Vasco Hills runoff drain	**1,704** Buildings **3,599** People **$1 B** Property Value **7** Critical Structures
Rheem Creek (Left Bank)	5305000031	Contra Costa County Public Works Department	City of Richmond	Rheem Creek	**0** Buildings **12** People **$0** Property Value **0** Critical Structures
Rheem Creek (Right Bank)	5305000032	Contra Costa County Public Works Department	City of Richmond	Rheem Creek	**0** Buildings **4** People **$0** Property Value **0** Critical Structures
Rodeo Creek (Left Bank)	5305000033	Contra Costa County Public Works Department	Rodeo	Rodeo Creek	**198** Buildings **412** People **$70 M** Property Value **0** Critical Structures
Rodeo Creek (Right Bank)	5305000034	Contra Costa County Public Works Department	Rodeo	Rodeo Creek	**12** Buildings **40** People **$4 M** Property Value **0** Critical Structures
Sacramento County Levee 1	1905004132	FEMA Region 9	Bethel Island	Not Available	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
San Pablo Creek (Left Bank)	5305000043	Contra Costa County Public Works Department	North Richmond	San Pablo Creek	**0** Buildings **12** People **$0** Property Value **0** Critical Structures
San Pablo Creek (Right Bank)	5305000044	Contra Costa County Public Works Department	North Richmond	San Pablo Creek	**18** Buildings **470** People **$30 M** Property Value **0** Critical Structures
Walnut Creek – Clayton Valley Drain (Left Bank)	5205001391	Contra Costa Flood Control and Water Conservation District, Contra Costa County Public Works Department	City of Concord	Walnut Creek	**168** Buildings **1,365** People **$100 M** Property Value **0** Critical Structures
Walnut Creek – Clayton Valley Drain (Right Bank)	5205001392	Contra Costa Flood Control and Water Conservation District, Contra Costa County Public Works Department	City of Concord	Walnut Creek	**142** Buildings **528** People **$70 M** Property Value **0** Critical Structures

Levee Name	System ID	Operations / Maintenance Organization *(or Floodplain Management)*	Location	Flooding Source	Behind Levee
Walnut Creek – Grayson Creek (Left Bank)	5205001394	Contra Costa Flood Control and Water Conservation District, Contra Costa County Public Works Department	Vine Hill	Walnut Creek	**22** Buildings **638** People **$80 M** Property Value **1** Critical Structures
Walnut Creek – Grayson Creek (Right Bank)	5205001393	Contra Costa Flood Control and Water Conservation District, Contra Costa County Public Works Department	Pacheco	Walnut Creek	**785** Buildings **2,375** People **$200 M** Property Value **1** Critical Structures
Wildcat Creek	1905004525	Contra Costa Flood Control and Water Conservation District	North Richmond	Wildcat Creek	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
Wildcat Creek	1905004520	Contra Costa Flood Control and Water Conservation District	City of Richmond	Wildcat Creek	**4** Buildings **0** People **$30 M** Property Value **1** Critical Structures
Wildcat Creek	1905004521	Contra Costa Flood Control and Water Conservation District	North Richmond	Wildcat Creek	**0** Buildings **0** People **$0** Property Value **0** Critical Structures
Wildcat Creek (Left Bank)	5305000045	Contra Costa County Public Works Department	North Richmond	Wildcat Creek	**1,120** Buildings **3,894** People **$300 M** Property Value **6** Critical Structures
Wildcat Creek (Right Bank)	5305000046	Contra Costa County Public Works Department	City of Richmond	Wildcat Creek	**16** Buildings **159** People **$20 M** Property Value **1** Critical Structures

Table 4-49 outlines the total property value exposed to dam and levee failures and how the changes in development in the past five (5) years have affected the vulnerability of the community to dam and levee failures. **Table 4-50** outlines the dam and levee failure impacts on total property damage, potential future development, and the economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Environment: All of the environmental assets that are within dam and levee inundation areas are vulnerable to flooding as a result of a dam or levee failure. Loss estimation platforms (e.g., Hazus) are not currently equipped to measure environmental impacts of flood hazards. The best gauge of vulnerability of the environment would be a review of damage from past dam and levee failures events. Data on losses that segregate damage to the environment was not available at the time of this Plan. Capturing this data from future events could be beneficial in measuring the vulnerability of the environment for future Plan updates.

Agriculture, a major economic driver for the County, is located within low lying areas that are located within dam inundation areas. Field crops (i.e., tomatoes, sweet corn, and other vegetables), fruit and nut orchards, vineyards, and plant nurseries are part of the agriculture in the County. Flooding can cause significant damage to crop production by damaging plants, washing away topsoil nutrients, and degrading

essential microbial activity. As a result, plants can be harmed, and agricultural productivity will be reduced; subsequently harming the agricultural economy. Furthermore, rangeland, lands where livestock species (i.e., cattle) are raised, located in Bethel Island and the Delta areas are within the 100-year floodplain and dam inundation areas. In Contra Costa County, rangeland is primarily located in the eastern portion of the County. Flood waters can damage important rangeland infrastructure and the natural grassland that feeds cattle and livestock which can harm the local economy in the County.

Table 4-50 outlines dam and levee failure impacts on the environment and the economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Changes in Development and Impact of Future Development: There have been no significant changes in development that have affected the risks associated with dam and levee failure. Future increases in population within dam and levee inundation areas may expose more of the population to these events. Growth over the past decade has considerably increased. Between 2010 and 2022, as outlined in **Table 3-3**, the population in Contra Costa County grew 10.6%, from 1,046,025 to 1,156,966 residents. The Bay Area Association of Governments (ABAG) growth forecasts predict a steady increase in households through 2050. From 2015 to 2050, ABAG projects that the County's number of households will grow by 44%.[106] This increase in population can add an additional strain to first responders in the event of a dam and levee failure evacuation. The impact of future development should not significantly change the vulnerability to dam or levee failure. Most of the expected development will occur in the eastern portions of the County which are less susceptible to these hazards.

Table 4-49 outlines how the changes in development in the past five (5) years have affected the vulnerability of the community to dam and levee failure. **Table 4-50** outlines the dam and levee failure impacts on potential future development, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Effects of Climate Change in Severity of Impacts: Although climate change does not have a direct impact on dam and levee failures, flood frequency and magnitude are expected to increase as a result of climate change. Subsequently increasing the probability of dam and levee failures. **Table 4-45** indicates the 25-year precipitation projections in Contra Costa County.[107] **Table 4-46** outlines the flood associated climate indicators for Contra Costa County projected through the end of the century.[108]

[106] Bay Area Association of Government. (2020). Plan Bay Area 2050 Final Blueprint Growth Pattern. Retrieved from https://planbayarea.org/digital-library/plan-bay-area-2050-final-blueprint-growth-pattern.
[107] Northeast Regional Climate Center. (n.d.). Neighborhoods at Risk: Climate Projections. Retrieved from https://nar.headwaterseconomics.org/.
[108] Climate Mapping for Resilience and Adaptation. (n.d.). Climate Mapping for Resilience and Adaptation Assessment Tool. Retrieved from https://livingatlas.arcgis.com/assessment-tool/explore/details.

Table 4-45. 25-Year Precipitation Projections for Contra Costa County

Higher Emissions (RCP8.5)
Contra Costa County is expected to experience a 7% increase in days with heavy precipitation within 25 years.
By 2048, Contra Costa County is expected to experience 0.18 more days of heavy precipitation per year (from 2.77 days to 2.95 days per year).
Lower Emissions (RCP4.5)
Contra Costa County is expected to experience an 8% increase in days with heavy precipitation within 25 years.
By 2048, Contra Costa County is expected to experience 0.2 more days of heavy precipitation per year (from 2.5 days to 2.7 days per year).

Table 4-46. Future Climate Indicators for Contra Costa County

Indicators	Modeled History (1976 – 2005)	Early Century (2015 – 2044)		Mid Century (2035 – 2064)		Late Century (2070 – 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min – Max	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*
Precipitation							
Average annual total precipitation	**19 inches**	**19 inches**	**20 inches**	**20 inches**	**20 inches**	**20 inches**	**21 inches**
	17 – 21	16 – 25	17 – 24	17 – 26	16 – 25	16 – 25	14 – 27
Days per year with precipitation *(Wet Days)*	**84 days**	**82 days**	**82 days**	**80 days**	**80 days**	**80 days**	**77 days**
	80 – 88	74 – 91	74 – 91	68 – 91	69 – 98	70 – 90	58 – 94
Maximum period of consecutive wet days	**11 days**	**11 days**	**12 days**	**11 days**	**11 days**	**11 days**	**11 days**
	10 – 12	10 – 14	10 – 14	9 – 14	9 – 15	10 – 15	8 – 17
Temperature Thresholds							
Annual days with total precipitation greater than 1 inch	**2 days**	**3 days**	**3 days**	**3 days**	**3 days**	**3 days**	**4 days**
	2 – 3	2 – 4	2 – 4	2 – 5	2 – 5	2 – 5	2 – 7
Annual days with total precipitation greater than 2 inches	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**
	0 – 0	0 – 1	0 – 1	0 – 1	0 – 1	0 – 1	0 – 1
Annual days with total precipitation greater than 3 inches	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**
	0 – 0	0 – 0	0 – 0	0 – 0	0 – 0	0 – 0	0 – 0
Annual days that exceed 99th percentile precipitation	**4 days**	**5 days**	**5 days**	**5 days**	**5 days**	**5 days**	**6 days**
	3 – 7	3 – 8	3 – 8	3 – 8	3 – 9	3 – 9	4 – 11
Days with maximum temperature below 32°F	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**
	0 – 0	0 – 0	0 – 0	0 – 0	0 – 0	0 – 0	0 – 0

Table 4-50 outlines the climate change impacts to dam and levee failures in Contra Costa County, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Table 4-47. Probability of Occurrence

Hazard Event	Probability of Occurrence		Probability Factor	Weighted Factor
Dam and Levee Failure	Low	Significant hazard event is likely to occur within 100 years.	1	N/A

Table 4-48. Extent Factors

Hazard Event	Extent Factor	Extent		Extent Factor	Weighted Factor
Dam and Levee Failure	***Extent/Intensity***	High	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a high-intensity incident.	3	9
	Catastrophic	High	Catastrophic hazard event is likely to occur at least once in 10 years.	3	9

Table 4-49. Vulnerability Factors

Hazard Event	Vulnerability Factor	Vulnerability		Vulnerability Factor	Weighted Factor
Dam and Levee Failure	***Population Exposure***	Low	14% or less of the population is exposed to the hazard.	1	3
	Property Exposure	Low	9% or less of the total assessed property value is exposed to a hazard.	1	2
	Changes in Development	Low	Changes in development have increased the vulnerability/exposure of the community to the hazard by 4% or less.	1	1

Table 4-50. Impact Factors

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
Dam and Levee Failure	***Population and Life Safety***	Medium	Populations exposed to this hazard are likely to experience some adverse impacts, such as injuries requiring acute medical care.	2	6
	Underserved/Equity	Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2	6
	Property Damage	High	More than $5 Million in property damages is expected from a single major hazard event, or damages are expected to occur to 15% or more of the property value within the jurisdiction.	3	6
	Economic	High	Where the total economic impact is likely to be greater than $10 Million.	3	3

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
	Environmental	High	Environmental impact from a single major hazard event is likely to be significant, requiring extensive outside resources and support; and/or repair, clean-up, restoration, and/or preservation work.	3	3
	Essential Operations	High	Impact greater than 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	3	3
	Future Development	Medium	Future development trends will increase the impact/consequence of this hazard, but not significantly.	2	2
	Climate Change	Medium	Climate Change trends will increase the risk of this hazard and its impacts, but not significantly.	2	2

4.6.2.8. FEMA NRI Expected Annual Loss Estimates

The FEMA NRI does not assess dam and levee failure events.

4.6.2.9. FEMA Dam and Levee Failure Risk Index Score

The FEMA NRI does not assess dam and levee failure. **Table 4-51** represents the Dam and Levee Failure Total Risk Score for Contra Costa County, based on the Risk Assessment Methodology, as defined in this Plan. For further details on how the probability, extent, vulnerability, and impact factors were calculated, please refer to **Table 4-47** through **Table 4-50**. Additional details on how the Total Risk Score was calculated can be found in the Risk Assessment Methodology in Section 4.3 of this Plan.

Table 4-51. Dam and Levee Failure Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Dam and Levee Failure	1	18	6	31	55	30

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.3. Drought

4.6.3.1. Description

Drought can be difficult to define. Some definitions are an idea or concept which can be important in establishing drought policy, and others can be operational. Operational drought definitions describe how drought functions or operates in a way that can be measured. The National Integrated Drought Information System (NIDIS) defines drought as the deficiency of precipitation over an extended period of time (usually a season or more), resulting in a water shortage. [109] The National Weather Service (NWS) defines drought as a deficiency of moisture that results in adverse impacts on people, animals, or vegetation over a sizeable area. [110]

Drought is part of the climate cycle, and it is an underestimated slow-moving hazard that can cause as much damage as other faster-moving hazards (e.g., hurricanes, flooding). Drought can impact agriculture, public health, transportation, ecosystems, wildfire, and water quality. In order to assist with drought classification and monitoring, scientists have defined five (5) types of droughts, listed on **Table 4-52**. [111]

Table 4-52. Types of Drought

Type	Description
Meteorological	Occurs when dry weather patterns dominate the area.
Hydrological	Occurs when low water supply becomes evident in the water system
Agricultural	Occurs when crops become affected by drought.
Socioeconomic	Occurs when the supply and demand of various commodities is affected by drought.
Ecological	Occurs when natural ecosystems are affected by drought.

A drought's severity depends on numerous factors, including duration, intensity, and geographic extent, as well as regional water supply demands by humans and vegetation. Drought differs from other natural hazards in three (3) ways.

- The onset and end of a drought are difficult to determine due to the slow accumulation and lingering effects of an event after its apparent end.
- The lack of an exact and universally accepted definition adds to the confusion about its existence and severity.
- In contrast with other natural hazards, the impact of drought is less obvious and may spread over a larger geographic area. These characteristics have hindered many governments' preparation of drought contingency or mitigation plans.

[109] National Integrated Drought Information System. (2023). What is a Drought? Drought Basics. Retrieved from https://www.drought.gov/what-is-drought/drought-basics.
[110] National Oceanic and Atmospheric Administration, National Weather Service. (2009). National Weather Service Glossary. Retrieved from https://w1.weather.gov/glossary/.
[111] National Integrated Drought Information System. (2023). What is a Drought? Drought Basics. Retrieved from https://www.drought.gov/what-is-drought/drought-basics.

4.6.3.2. Hazard Location

A drought can occur anywhere in the Contra Costa County region and affect the entire planning area. Due to the dynamic nature of droughts, drought conditions are experienced differently based on where someone lives and their sources of water. For example, ranchers grazing livestock on non-irrigated rangeland and rural residents relying on private wells for groundwater can quickly be impacted by dry conditions. On the other hand, large urban water agencies with multiple water resources are able to manage for several dry years. However, if drought conditions in the area continue for an extended period of time, everyone will experience the effects. [112]

4.6.3.3. Hazard Extent/Intensity

Many drought indices have been developed; however, the Palmer Drought Severity Index (PDSI) is the most prominent index of meteorological drought utilized in the United States for drought monitoring. PDSI uses readily available temperature and precipitation data to estimate relative dryness to indicate the prolonged and abnormal moisture deficiency or excess. As an important climatological tool, the PDSI assists in evaluating the scope, severity, and frequency of prolonged periods of abnormally dry or wet weather. Furthermore, it can be utilized to identify disaster areas and indicate the availability of irrigation water supplies, reservoir levels, range conditions, amount of stock water and potential intensity of wildfires. [113, 114]

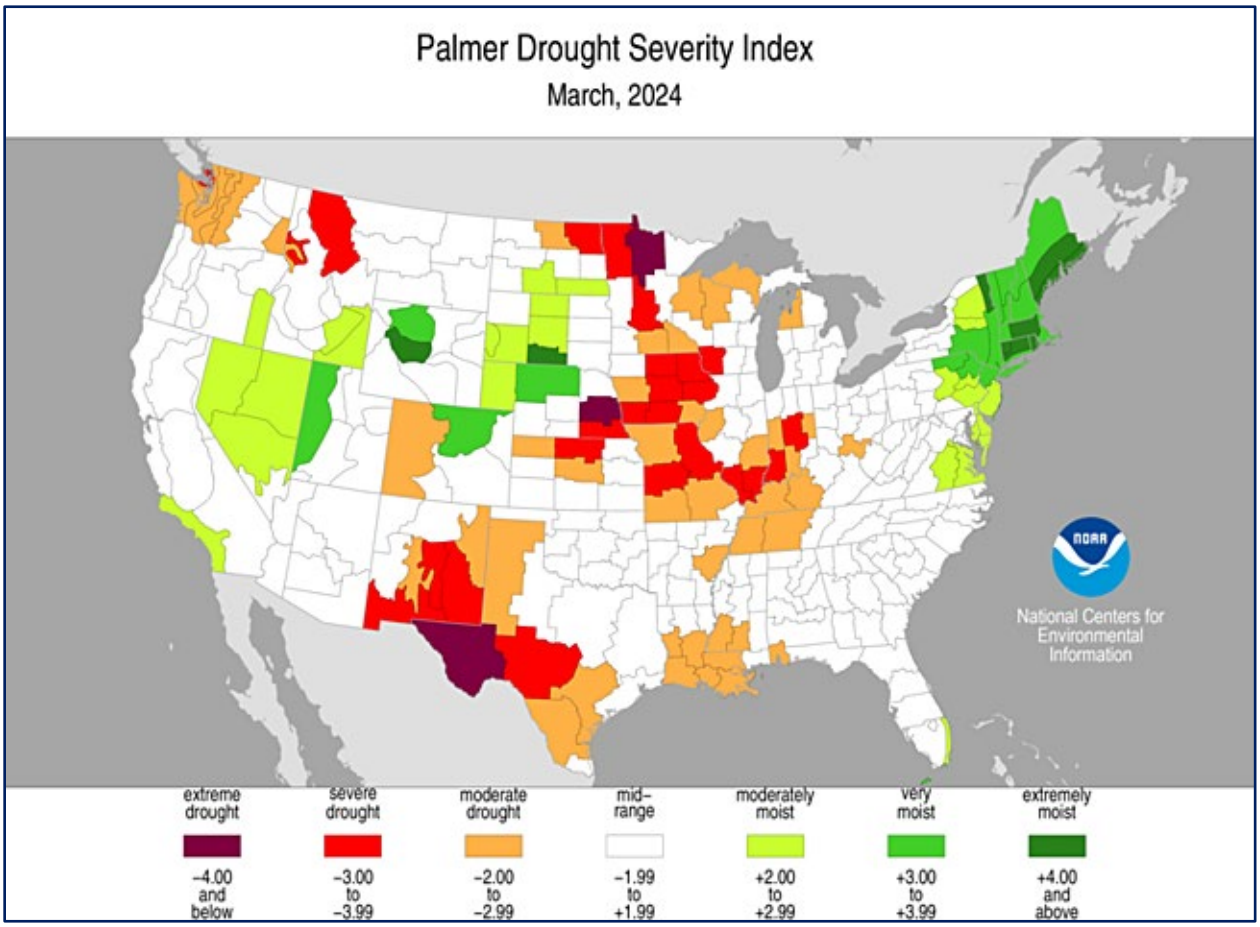
The PDSI is a standardized measure that compares moisture deficiency and excess on a numerical scale that usually ranges from positive five (5) to a negative five (5). Positive values mean there is an excess in moisture supplies and conversely, negative values indicate moisture demands in excess of supplies. **Table 4-53** displays the PDSI categories and **Figure 4-9** illustrates the drought conditions in the contiguous United States as measured by the PDSI for the month of March 2024.

Table 4-53. Palmer Drought Severity Index

Palmer Drought Severity Index	Category
- 4.00 and below	Extreme Drought
- 3.00 to - 3.99	Severe Drought
- 2.00 to - 2.99	Moderate Drought
- 1.99 to + 1.99	Mid-Range
+ 2.00 to + 2.99	Moderately Moist
+ 3.00 to + 3.99	Very Moist
+ 4.00 and above	Extremely Moist

[112] California Department of Water Resources. (n.d.). California Water Watch. Retrieved from https://cww.water.ca.gov/droughtindicator.
[113] National Weather Service, Climate Prediction Center. (2005). Drought Indices: Explanation. Retrieved from https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/palmer_drought/wpdanote.shtml.
[114] National Center for Atmospheric Research. (n.d.). Climate Data Guide: Palmer Drought Severity Index (PDSI). Retrieved from https://climatedataguide.ucar.edu/climate-data/palmer-drought-severity-index-pdsi.

Figure 4-9. Palmer Drought Severity Index Map (March 2024)



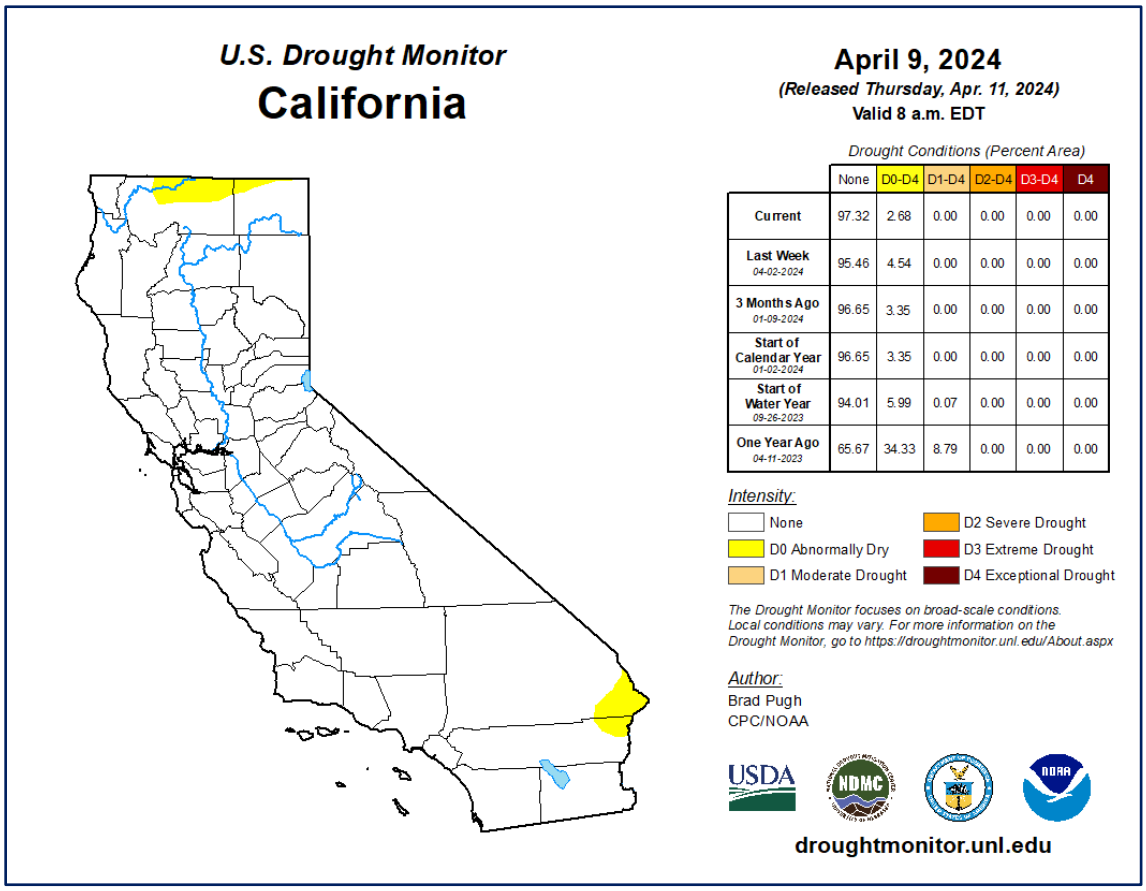
The U.S. Drought Monitor (USDM) is a collaboration between the National Drought Mitigation Center (NDMC), United Stated Department of Agriculture, and NOAA. They also rate drought nationwide by intensity utilizing a D0 (Abnormally Dry) to D4 (Exceptional Drought) scale, shown in **Table 4-54**.[115] The map updates weekly to show the location and intensity of drought across the country.[116] **Figure 4-10** illustrates the USDM map for the State of California which shows where drought conditions are occurring and its severity.[117]

[115] National Drought Mitigation Center. (n.d.). What is USDM. Retrieved from https://droughtmonitor.unl.edu/About/WhatistheUSDM.aspx.
[116] National Integrated Drought Information System. (2023). U.S. Drought Monitor (USDM). Retrieved from https://www.drought.gov/data-maps-tools/us-drought-monitor.
[117] U.S. Drought Monitor. (2023). California. Retrieved from https://droughtmonitor.unl.edu/Maps/MapArchive.aspx.

Table 4-54. U.S. Drought Monitor Classification

Category	Description	Possible Impacts	PDSI Range
D0	Abnormally Dry	Used for areas showing dryness, but not yet in drought, or for areas recovering from drought. ***Going into drought:*** • Short-term dryness slowing planting, growth of crops or pastures. ***Coming out of drought:*** • Some lingering water deficits. • Pastures or crops not fully recovered.	-1.0 to -1.9
D1	Moderate Drought	• Some damage to crops and pastures. • Streams, reservoirs, or wells are low, and some water shortages are developing or imminent. • Voluntary water use restrictions requested.	-2.0 to -2.9
D2	Severe Drought	• Crop or pasture losses are likely. • Water shortages are common. • Water restrictions imposed.	-3.0 to -3.9
D3	Extreme Drought	• Major crop/pasture losses. • Widespread water shortages or restrictions.	-4.0 to -4.9
D4	Exceptional Drought	• Exceptional and widespread crop/pasture losses. • Shortages of water in reservoirs, streams, and wells are creating water emergencies.	-5.0 or less

Figure 4-10. California U.S. Drought Monitor (April 9, 2024)



4.6.3.4. Warning Time

Droughts develop gradually over long periods of time which can make it complicated to recognize when a drought will occur. However, understanding how large-scale climate patterns (e.g., El Niño–Southern Oscillation (ENSO)) affect the potential of drought in an area can help forecast when drought conditions will occur. DWR maintains the California Water Watch website which offers current local, at the regional and neighborhood level, and statewide water conditions. The website includes information on precipitation, temperature, reservoirs, streamflow, groundwater, snowpack, soil moisture, and vegetation conditions, and California drought updates. In California, drought is based on impacts to water users and observing and monitoring water availability can help have a better understanding of when and where drought can occur. DWR's California Water Watch can be accessed via the following link cww.water.ca.gov.

4.6.3.5. Probability and Frequency

Meteorological drought can begin and end rapidly while hydrological drought develops a lot slower and takes a lot longer to recover. Due to the significant differences in the types of droughts, different indices have been developed to measure and monitor droughts in the various sectors. The U.S. Drought Monitor depicts drought integrated across all time scales and differentiates between agricultural and hydrological impacts. [118] Meanwhile, NOAA utilizes the PDSI to measure drought conditions (**Table 4-53**).

[118] National Oceanic and Atmospheric Administration. (n.d.). Did You Know? Index (Definition of Drought). Retrieved from https://www.ncei.noaa.gov/access/monitoring/dyk/drought-definition.

Estimating drought probability and frequency continues to be difficult, regardless of the improvements in science and technology. According to the 2023 California State Hazard Mitigation Plan, the normal occurrence droughts and documentation of past events and losses determine that the probability for drought events throughout the State will continue. [119]

Probability of Future Hazard Events

The drought annualized frequency value represents the average number of recorded drought hazard occurrences, in event days, per year over the period of record (22 years). **Table 4-55** outlines the annualized frequency for drought, based on FEMA NRI data, for Contra Costa County.

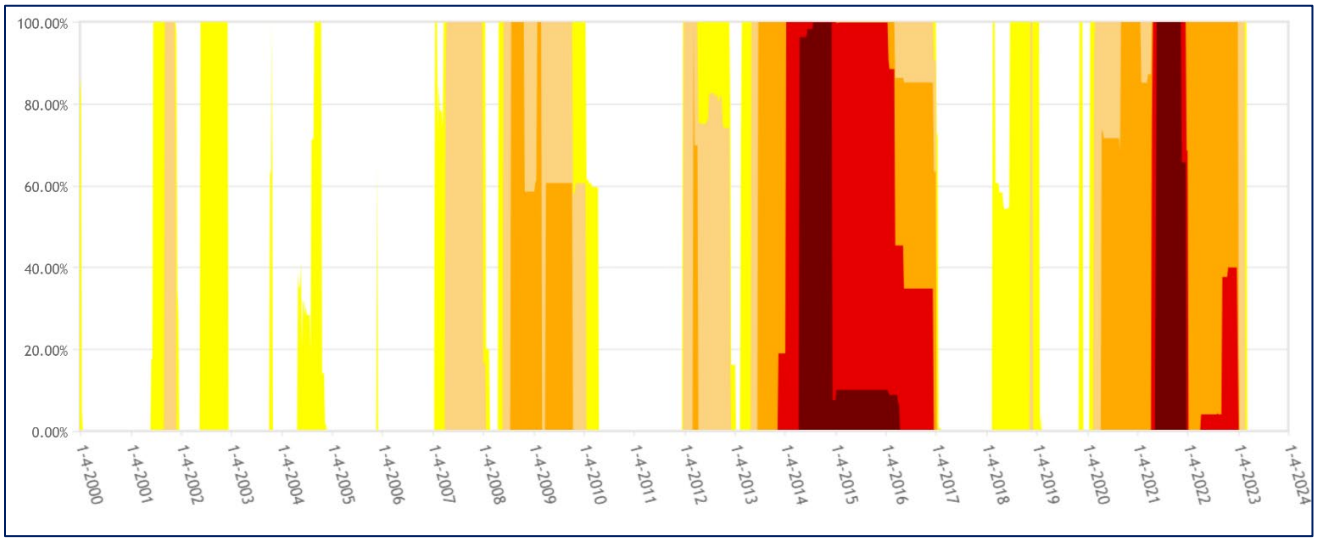
Table 4-55. Drought Annualized Frequency for Contra Costa County
(FEMA National Risk Index)

Location	Events on Record *(2000 – 2021)*	Annualized Frequency
Contra Costa County	1,386	52 events per year (in days)
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

4.6.3.6. Past Events

Droughts reoccur every few years. Unlike other hazards (e.g., floods and earthquakes), droughts are not easily defined as “events”. Contra Costa County has experienced multiple droughts between 2000 and 2023, as illustrated in **Figure 4-11**. Contra Costa County has experienced severe drought from August 2008 through October 2009 and severe to exceptional drought from November 2013 through January 2017 and again from April 2021 through January 2023. A Presidentially Disaster Declaration for drought has never been declared in the State of California.

Figure 4-11. U.S. Drought Monitor for Contra Costa County [120]



[119] California Governor’s Office of Emergency Services. (2023). California State Hazard Mitigation Plan. Retrieved from https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-1_11.10.2023.pdf.
[120] U.S Drought Monitor. (2023). Time Series (Contra Costa County, CA). Retrieved from https://droughtmonitor.unl.edu/DmData/TimeSeries.aspx.

California hydrologic data shows multi-year droughts from 1912 to 1913, 1918 to 1920, 1922 to 1924, and 1928 to 1934. Since then, prolonged periods of drought continued to occur in California, all of which impacted Contra Costa County to some degree, are listed in **Table 4-56**.

Table 4-56. Drought Past Events

Date	Event Summary
2021 – 2022	Water Year 2022 (October 1, 2021, through September 30, 2022) was the third driest year on record. Although it did not record the highest temperatures or lowest precipitation amounts, it preceded Water Year 2021. The years 2020 through 2022 were the driest on record for the State of California. For maximum temperature, August 2020 came in second to 1967. For September, the maximum temperature ranked sixth warmest. On August 16, Death Valley recorded a temperature of 130 ºF. Five (5) of the State's largest six (6) fires in history were ignited in August and September. The 2021 water year was the second driest on record, with extreme heat and lack of precipitation. By the end of 2021, all 58 counties in California were placed under a drought emergency proclamation (State of California 2022d). The drought continued through April 2022; the snowpack of the Sierra Nevada was at 38% of its statewide average (Becker 2022). The State experienced $1.2 Billion in crop damage as a result of this drought period.
2012 – 2016	California's last drought set several records for the State. The period from 2012 to 2014 ranked as the driest three (3) consecutive years for statewide precipitation. Calendar year 2014 set new climate records for statewide average temperatures and for record-low water allocations from State Water Project and federal Central Valley Project contractors. Calendar year 2013 set minimum annual precipitation records for many communities. The State has detailed executive orders and regulations concerning water conservation and management. Total impacts of the drought have not yet been determined.
2007 – 2009	The Governor issued an executive order that proclaimed a statewide drought emergency on June 4, 2008, after spring 2008 was the driest spring on record, with low snowmelt runoff. On February 27, 2009, the governor proclaimed a state of emergency for the entire state as severe drought conditions continued. The largest court-ordered water restriction in state history (at the time) was imposed.
1987 – 1992	California received precipitation well below average levels for four (4) consecutive years. While the Central Coast was most affected, the Sierra Nevada in Northern California and the Central Valley counties were also affected. During this drought, only 56% of average runoff for the Sacramento Valley was received, totaling just 10 million acre-feet. In 1991, the State Water Project sharply decreased deliveries to water suppliers, including the San Francisco Bay area. By February 1991, all 58 counties in California were experiencing drought conditions. Urban areas as well as agricultural areas were impacted.
1976 – 1977	This was the worst drought in the State's history at the time. 1976 was the fourth driest year on record followed by 1977, the driest period on record in California. The cumulative impact led to widespread water shortages and severe water conservation measures throughout the State. Only 37% of the average Sacramento Valley runoff was received, with just 6.6 million acre-feet recorded. Over $2.6 Billion in crop damage was recorded in 31 counties. FEMA declared an Emergency Declaration (EM-3023-CA) on January 20, 1977, for all 58 California counties.

4.6.3.7. Vulnerability and Impacts

Life Safety and Health: All residents within Contra Costa County would be vulnerable and impacted by a drought. Drought can affect people's health and safety, including health problems related to low water flows, poor water quality, or dust. Other possible impacts include recreational risks; effects on air quality;

diminished living conditions related to energy, air quality, and hygiene; compromised food and nutrition; and increased incidence of illness and disease. Droughts can also lead to reduced local firefighting capabilities. However, the underserved and at risk population face unique vulnerabilities and impacts to drought. These groups include, but are not limited to, outdoors workers and undocumented individuals.[121]

- **Outdoor Workers:** Includes, but are not limited to, construction workers, agriculture workers, and recreation. Drought can reduce water availability for agricultural operations, parks, and recreation areas, which can indirectly harm outdoor workers. Agricultural operations and Delta recreational opportunities can be halted, which may cause outdoor workers to lose jobs. Additionally, drought events are accompanied by extreme heat which outdoor workers are extremely vulnerable to. Outdoor workers are disproportionately impacted by extreme heat because they are required to be outside and risk heat related illnesses (e.g., heat cramps, heat exhaustion, heat stroke). Furthermore, outdoor work may also be halted during high temperatures, which can cause significant economic hardships.
- **Undocumented Individuals:** Includes people who do not have formal permission to live in the United States (i.e., do not have citizenship, permanent residency, visas, or other similar status). Most of this population has outdoor occupations or work in highly unregulated environment which leaves them susceptible to harm from extreme heat conditions that accompany drought events. Outdoor work may also be halted during high temperatures and droughts, which can cause significant economic hardships. Undocumented agricultural workers may face economic hardship if crops, vineyards, or rangeland are damaged by drought conditions. Furthermore, agricultural workers who are undocumented are more likely to be let go when farms experience economic hardship. There are no official counts of how many undocumented individuals live in Contra Costa County, but in 2019 there was an estimate of 63,000.[122]
- **Individuals with Chronic Illnesses:** Includes those that have long term or permanent health conditions that can be exacerbated by drought conditions (e.g., cardiovascular disease, respiratory conditions, mental illness). This population is most vulnerable to the health impacts of droughts. During droughts, air quality can decrease as a result of wildfires and dust which produce air particulates that irritate the lungs and bronchial passages exacerbating chronic respiratory conditions. Additionally, drought conditions can also increase the incidence of illness and disease (e.g., mosquito-borne diseases, anxiety, depression, and other adverse mental health outcomes).[123]

East Contra Costa County is more susceptible to the effects of drought due to extensive agricultural areas which impact the County's economy. Additionally, these conditions can also impact low income populations, as food and water prices increase, or agricultural workers who rely on agriculture for their livelihood.

Table 4-61 outlines the vulnerability of the total population exposed to drought. **Table 4-62** outlines the drought impacts to population and life safety, underserved/equity population, and essential operations, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

[121] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.
[122] Migration Policy Institute. (2019). Profile of the Unauthorized Population: Contra Costa County, CA. Retrieved from https://www.migrationpolicy.org/data/unauthorized-immigrant-population/county/6013.
[123] National Integrated Drought Information System. (n.d.). Drought.gov, By Sector: Public Health. Retrieved from https://www.drought.gov/sectors/public-health.

Property Damage and Critical Infrastructure: No structures will be directly affected by drought conditions, though some structures may become vulnerable to wildfires, which are more likely following years of drought. Droughts can also have significant impacts on landscapes, which could cause a financial burden to property owners. However, these impacts are not considered critical in planning for impacts from the drought hazard. Additionally, buildings and infrastructure does not need to be physically damaged to trigger a loss of service. For example, extreme heat, which accompanies drought, makes the machinery of the power grid run less efficiently and simultaneously increases demand to meet greater cooling needs. This combination raises the risk of grid overloading and causing brownouts or blackouts. Similarly, drought conditions harm water delivery services but do not cause physical damage to pipes or water treatment plants.

Table 4-61 outlines the total property value exposed to drought and how the changes in development in the past five (5) years, have affected the vulnerability of the community to drought. **Table 4-62** outlines the drought impact on total property damage, potential future development, and the economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Environment: Environmental losses from drought are associated with damage to plants, animals, wildlife habitat, and air and water quality, forest and range fires, degradation of landscape quality, loss of biodiversity, and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for a longer time or may even become permanent. In Contra Costa County, the following ecosystems and natural resources are vulnerable to droughts:[124]

- **Aquatic:** Aquatic habitat (i.e., streams, reservoirs, ponds, and sloughs or channels) are impacted by droughts. This ecosystem includes the Delta and shoreline areas that are submerged by water. In Contra Costa County, the three (3) large reservoirs include San Pablo Reservoir, Briones Reservoir, and Los Vaqueros Reservoir. Aquatic wildlife species include various duck species, California red-legged frog, western pond turtle, and juvenile and spawning adult Chinook salmon. A drought can lower water levels and water quality and raise water temperatures in aquatic habitants. Subsequently these conditions can cause algal blooms in the Delta areas, harm salmonoid populations, and cause other systemwide failures. Aquatic species can also be harmed by lower dissolved oxygen levels and increase algae growth in the Delta.
- **Riparian Woodland and Shrub:** Riparian woodland and shrub ecosystems consist of Valley foothill riparian, undetermined shrub, and riverine habitat. These areas are scattered throughout Contra Costa County and have numerous wildlife species (e.g., gray fox, striped skunk, broad-handed mole, mule deer, dusky-footed woodrat, yellow warbler, northern flicker, white tailed kite, and Cooper's hawk). Drought conditions can cause smaller streams to run dry, which can subsequently harm the plants and animal habitat within the ecosystem. Additionally, trees may not have adequate water during drought periods, which can lead to pests and diseases destroying important habitat for the Gray fox, Cooper's hawk, and mule deer. Soil erosion can also occur on the banks of streams.
- **Wetland:** Wetland ecosystems, located adjacent to the San Francisco Bay and Delta, include permanent wetland, seasonal wetland, fresh emergent wetland, alkali wetland, and marshes. Drought conditions can directly affect the wetland ecosystems by reducing water quantity and quality, contributing to algal blooms, low streamflow, higher temperatures, and increased erosion

[124] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.

in the Delta and inland wetland habitats. As a result, wildlife that depends on these ecosystems (e.g., California red-legged frog and western pond turtle) can be harmed. Wildlife within these ecosystems includes great blue heron, great egret, wood duck, green-winged teal, mallard, California red-legged frog, western pond turtle, garter snakes, western spadefoot toad, western toad, California tiger salamander, tri-colored blackbird, and vernal pool fairy shrimp.

Additionally, agriculture may be directly harmed from drought conditions due to an increase in soil salinity, topsoil erosion, and reduced water supply which can limit crop production and in turn result in a loss of income for agriculture owners. Agricultural operations are primarily located in eastern Contra Costa County, between the Mt. Diablo State Park and the Delta, and the economy in this area can be especially harmed by limited water for agricultural production. For example, in 2017, Contra Costa County farms and orchards produced approximately $95 Million in agriculture products. These impacts can result in reduced income for farmers and agribusiness, increased prices for food and lumber, unemployment, reduced tax revenues, increased crime, migration, and foreclosures on bank loans to farmers and businesses.

Rangeland is primarily located on grassland habitats, which can lose topsoil and productivity due to the drier conditions created by droughts. This can reduce the available foraging habitat for livestock and cause economic hardship for rangeland owners. Rangeland, primary located in the eastern Contra Costa County, are lands where many livestock species (e.g., cattle) are raised. In 2017, rangeland produced approximately $26 Million in livestock products. Furthermore, the Sacramento-San Joaquin River Delta, primarily encompasses the northern and easternmost borders of Contra Costa County and provides opportunities for boating, fishing, transportation, and a water source for the County. Drought conditions can reduce the streamflow of the Delta, reducing the water quality which can decrease commercial fishing, agricultural production, and recreation opportunities. Additionally, changes in water conditions can kill certain fish species and drought conditions can increase the salinity of the Delta which will affect the water supply for agricultural irrigation.[125]

Table 4-62 outlines drought impacts on the environment and the economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Changes in Development and Impact of Future Development: There have been no significant changes in development that have affected the risks associated with drought. Future increases in population that result in greater water consumption may exacerbate the impacts of drought. Growth over the past decade has considerably increased. Between 2010 and 2022, as outlined in **Table 3-3**, the population in Contra Costa County grew 10.6%, from 1,046,025 to 1,156,966 residents. The Bay Area Association of Governments (ABAG) growth forecasts predict a steady increase in households through 2050. From 2015 to 2050, ABAG projects that the County's number of households will grow by 44%.[126] This increase in population can add an additional strain to the water supply and power grid when drought conditions are present.

Table 4-61 outlines how the changes in development in the past five (5) years have affected vulnerability of the community to droughts. **Table 4-62** outlines the drought impacts on potential future development, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

[125] Ibid.
[126] Bay Area Association of Government. (2020). Plan Bay Area 2050 Final Blueprint Growth Pattern. Retrieved from https://planbayarea.org/digital-library/plan-bay-area-2050-final-blueprint-growth-pattern.

Effects of Climate Change in Severity of Impacts: In California and western United States, observations of climate change have shown an increase in frequency of drought and an increase in consecutive dry days. Climate change will not result in less frequency and intensity of precipitation in the County, while average annual temperatures may increase by as much as 2.0°F within 25 years. **Table 4-57** indicates the 25-year climate projections in Contra Costa County.[127]

Table 4-57. 25-Year Climate Projections for Contra Costa County

Higher Emissions (RCP8.5)
Contra Costa County is expected to experience a 43% increase in extremely hot days and a 7% increase in days with heavy precipitation within 25 years.
By 2049, Contra Costa County is expected to experience 11 more days that reach above 95°F (from 23 days to 33 days per year).
Lower Emissions (RCP4.5)
Contra Costa County is expected to experience a 29% increase in extremely hot days and an 8% increase in days with heavy precipitation within 25 years.
By 2049, Contra Costa County is expected to experience seven (7) more days that reach above 95°F (from 22 days to 29 days per year).

Climate change is already profoundly impacting California's water resources, as evidenced by changes in snowpack, sea level, and river flows. These changes are expected to continue, and more precipitation will likely fall as rain instead of snow, decreasing snowpack levels. This potential change in weather patterns will add additional challenges to water supply reliability.[128]

The California Department of Water Resources states climate change is responsible for the decrease in the Sierra snowpack levels which provides as much as a third of California's water supply by accumulating snow during wet winters and releasing it slowly during the spring and summer when the need is the greatest. Warmer temperatures will cause snow to melt faster and earlier, making it more difficult to store and use. By the end of this century, the Sierra snowpack is projected to experience a 48% to 65% loss from the historical April 1st average. This loss of snowpack means less water will be available for water users in the State.[129]

Climate change is also expected to result in more variable weather patterns throughout the State. More variability can lead to longer and more severe droughts. In addition, rising sea levels will continue to threaten the Sacramento-San Joaquin Delta, the heart of the California water supply system and the source of water for 25 million Californians and millions of acres of prime farmland.[130] **Table 4-58** outlines the drought associated climate indicators for Contra Costa County projected through the end of the century.[131]

[127] Northeast Regional Climate Center. (n.d.). Neighborhoods at Risk: Climate Projections. Retrieved from https://nar.headwaterseconomics.org/.
[128] California Department of Water Resources. (n.d.). Climate Change Basics. Retrieved from https://water.ca.gov/Water-Basics/Climate-Change-Basics.
[129] California Department of Water Resources. (n.d.). Climate Change and Water. Retrieved from https://water.ca.gov/Programs/All-Programs/Climate-Change-Program/Climate-Change-and-Water.
[130] Ibid.
[131] Climate Mapping for Resilience and Adaptation. (n.d.). Climate Mapping for Resilience and Adaptation Assessment Tool. Retrieved from https://livingatlas.arcgis.com/assessment-tool/explore/details.

Table 4-58. Future Climate Indicators for Contra Costa County

Indicators	Modeled History (1976 – 2005)	Early Century (2015 – 2044)		Mid Century (2035 – 2064)		Late Century (2070 – 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min – Max	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*
Precipitation							
Average annual total precipitation	**19 inches**	**19 inches**	**20 inches**	**20 inches**	**20 inches**	**20 inches**	**21 inches**
	17 – 21	16 – 25	17 – 24	17 – 26	16 – 25	16 – 25	14 – 27
Days per year with precipitation *(Wet Days)*	**84 days**	**82 days**	**82 days**	**80 days**	**80 days**	**80 days**	**77 days**
	80 – 88	74 – 91	74 – 91	68 – 91	69 – 98	70 – 90	58 – 94
Days per year with no precipitation *(Dry Days)*	**281 days**	**283 days**	**283 days**	**285 days**	**285 days**	**285 days**	**288 days**
	277 – 285	275 – 291	274 – 291	275 – 298	267 – 296	275 – 296	271 – 307
Maximum number of consecutive dry days	**95 days**	**97 days**	**98 days**	**97 days**	**99 days**	**98 days**	**102 days**
	85 – 113	84 – 113	88 – 110	83 – 118	82 – 117	90 – 121	76 - 139
Temperature Thresholds							
Annual days with maximum temperature greater than 90°F	**36 days**	**55 days**	**57 days**	**62 days**	**68 days**	**70 days**	**90 days**
	36 – 43	47 – 63	51 – 65	51 – 74	55 – 84	57 – 91	72 – 124
Annual days with maximum temperature greater than 100°F	**5 days**	**10 day**	**11 days**	**13 days**	**16 days**	**17 days**	**29 days**
	4 – 6	7 – 14	8 – 16	9 – 22	9 – 28	10 – 22	19 – 57

Table 4-62 outlines the climate change impacts to drought in Contra Costa County, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Table 4-59. Probability of Occurrence

Hazard Event	Probability of Occurrence		Probability Factor	Weighted Factor
Drought	Medium	Significant hazard event is likely to occur within 25 years.	2	N/A

Table 4-60. Extent Factors

Hazard Event	Extent Factor	Extent		Extent Factor	Weighted Factor
Drought	***Extent/Intensity***	High	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a high-intensity incident.	3	9
	Catastrophic	High	Catastrophic hazard event is likely to occur at least once in 10 years.	3	9

Table 4-61. Vulnerability Factors

Hazard Event	Vulnerability Factor	Vulnerability		Vulnerability Factor	Weighted Factor
Drought	***Population Exposure***	High	30% or more of the population is exposed to the hazard.	3	9
	Property Exposure	Low	9% or less of the total assessed property value is exposed to a hazard.	1	2
	Changes in Development	Low	Changes in development have increased the vulnerability/exposure of the community to the hazard by 4% or less.	1	1

Table 4-62. Impact Factors

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
Drought	***Population and Life Safety***	Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3
	Underserved/Equity	Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2	6
	Property Damage	Low	Less than $500,000 in property damages is expected from a single major hazard event or less than 5% of the property value within the jurisdiction.	1	2
	Economic	Medium	Total economic impact is likely to be greater than $500,000, but less than or equal to $10 Million.	2	2

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
	Environmental	Low	Environmental impact from a single major hazard event is likely to be minimal, requiring little to no outside resources and support, and/or minimal repair, clean-up, restoration, or preservation work.	1	1
	Essential Operations	Low	Impact less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	1	1
	Future Development	Medium	Future development trends will increase the impact/consequence of this hazard, but not significantly.	2	2
	Climate Change	High	Climate Change trends will significantly increase the risk of this hazard and its impacts.	3	3

4.6.3.8. FEMA NRI Expected Annual Loss Estimates

A drought NRI EAL score, and rating represent a community's relative level of expected agriculture loss each year due to droughts when compared to the rest of the United States. The EAL score is positively associated with a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-63** outlines the drought EAL for Contra Costa County.

Table 4-63. Drought Expected Annual Loss *(FEMA National Risk Index)*

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Contra Costa County	n/a	n/a	$10.8 Million	$10.8 Million	99.4	Very High
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.3.9. FEMA Drought Risk Index Score

The drought Risk Index score and rating represent a community's relative risk for droughts when compared to the rest of the United States. **Table 4-64** illustrates the drought Risk Index rating and score for Contra Costa County.

Table 4-64. Drought Risk Index *(FEMA National Risk Index)*

Jurisdiction	Rating	Score
Contra Costa County	Very High	99.3
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

Table 4-65 represents the Drought Failure Total Risk Score for Contra Costa County, based on the Risk Assessment Methodology, as defined in this Plan. For further details on how the probability, extent, vulnerability, and impact factors were calculated, please refer to **Table 4-59** through **Table 4-62**. Additional details on how the Total Risk Score was calculated can be found in the Risk Assessment Methodology in Section 4.3 of this Plan.

Table 4-65. Drought Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Drought	2	18	12	20	50	50

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.4. Earthquake

4.6.4.1. Description

Earthquakes are rapid shaking of the earth caused by the release of energy stored in rocks. The United States Geological Survey (USGS) defines an earthquake as the sudden slip on a fault and the resulting ground shaking and radiated seismic energy caused by the slip, or by volcanic or magmatic activity, or other sudden stress changes in the earth. Ground shaking is a term utilized to describe the vibration of the ground during an earthquake. Other than the initial ground shaking, additional earthquake hazards include building collapses, displacement or cracking of the earth's surface, landslides, liquefaction, tsunamis, seiches, flooding as a result of damage to dams or levees, and fires from ruptured gas lines, downed power lines and other sources.[132] *Landslides, tsunamis, and flooding will be addressed separately in this Plan.* Earthquakes cause both vertical and horizontal ground shaking which varies both in amplitude (the amount of displacement of the seismic waves) and frequency (the number of seismic waves per unit time), usually lasting less than 30 seconds.[133]

Buildings with foundations resting on unconsolidated landfill and other unstable soil, and trailers or homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths, injuries, and extensive property damage.

Regulatory Environment

The Alquist-Priolo Earthquake Fault Zoning Act was signed into California Law on December 22, 1972, to mitigate the hazard of surface faulting to structures for human occupancy. The Act was a direct result of the significant damage to homes and businesses that occurred in the 1971 San Fernando Earthquake. It enforces the following to increase earthquake safety:[134]

- Directs the California Geological Survey (CGS) to create maps of known fault zones.
- Requires the sale of any home located within the fault zone designated on the maps to disclose that the property lies adjacent to a known fault.
- Prohibits new construction of homes within these zones unless geologic studies are performed to prove that the fault will not pose a hazard to new structures proposed in these zones.

The State provides extensive regulations on earthquake-related issues. A key area for regulation is the California Building Standards Commission (CBSC). It is authorized by California Building Standards Law to administer the development, adoption, approval, publication, and implementation of California's building codes.

The California Building Standards Code, Title 24, serves as the basis for the design and construction of buildings in California. Improved safety, sustainability, maintaining consistency, new technology, construction methods, and reliability are paramount to the development of building codes. California's building codes are published in their entirety every three (3) years. Intervening Code Adoption Cycles produce supplement pages halfway (18 months) into each triennial period. Amendments to California's

[132] U.S Geological Survey. (n.d.). Earthquake Hazards Program Glossary. Retrieved from https://www.usgs.gov/glossary/earthquake-hazards-program.
[133] U.S Geological Survey. (n.d.). What are the Effects of Earthquakes. Retrieved from https://www.usgs.gov/programs/earthquake-hazards/what-are-effects-earthquakes.
[134] Structural Engineers Association of Northern California. (1972). Events/Alquist-Priolo Earthquake Fault Zoning Act. Retrieved from https://legacy.seaonc.org/event/alquistprioloact/.

building standards are subject to a lengthy and transparent public participation process throughout each code adoption cycle.

The California Seismic Safety Commission provides an array of regulatory and advisory information regarding seismic safety via the following link ssc.ca.gov.

4.6.4.2. Hazard Location

Contra Costa County is located in an area with high seismic activity with numerous local faults, as illustrated in **Figure 4-12** which shows the active geologic faults in the San Francisco Bay region. [135] There are five (4) primary active faults that can produce significant earthquakes in the Contra Costa County area – Hayward Fault, Calaveras North Fault, Concord-Green Valley Fault, Mount Diablo Fault, and Greenville Fault. These faults are described in **Table 4-66**.

Table 4-66. Active Faults Within the Contra Costa County Area

Fault	Description
San Andreas Fault	The San Andreas Fault, the largest fault in California, is the major tectonic boundary between the Pacific and North American plates. The Pacific plate is moving northwest relative to North America, while the North American plate is moving southward. The fault is approximately 808 miles long and extends, at least, 16 miles deep. The San Andreas Fault has a maximum earthquake potential of 8.0.
Calaveras North Fault	The Calaveras (North Central) Fault is a major branch of the San Andreas Fault, located east of the Hayward Fault. It extends 76 miles from the San Andreas Fault near Hollister to Danville at its northern end. The Calaveras Fault is one of the most geologically active and complex faults in the San Francisco Bay Area (USGS, 2003). There is a 26% probability of a magnitude 6.7 or greater earthquake along the Calaveras Fault to occur in the next 30 years.
Concord-Green Valley Fault	The Concord-Green Valley Fault, named for being located under the City of Concord, is connected to the main Green Valley Fault. The fault extends approximately 11 miles east of West Napa Fault, from Mount Diablo to the Carquinez Strait. It is considered to be under high stress and has a 16 percent probability of experiencing a Magnitude 6.7 or greater earthquake in the next 30 years.
Greenville-Marsh Creek Fault	The Greenville Fault is in the eastern Bay Area in Contra Costa and Alameda Counties. This dextral strike-slip fault zone borders the eastern side of Livermore Valley and is considered to be part of the larger San Andreas fault system in the central Coast Ranges. The fault zone extends from northwest of Livermore Valley along the Marsh Creek and Clayton faults toward Clayton Valley.
Hayward Fault	The Hayward Fault is an approximately 45-mile-long fault that runs through densely populated areas on the East Bay, parallel to the San Andreas Fault. The Hayward Fault extends through some of the Bay Area's most populated areas, including San Jose, Oakland, and Berkeley. The Hayward Fault is a right-lateral slip fault. The Hayward Fault is increasingly becoming a hazard priority throughout the Bay Area because of its increased chance for activity and its intersection with highly populated areas and critical infrastructure. The probability of experiencing a Magnitude 6.7 or greater earthquake along the Hayward Fault in the next 30 years is 33 percent. An earthquake of this magnitude has regional implications for the entire Bay Area, as the Hayward Fault crosses transportation and resource infrastructure, such as multiple highways and the Hetch-Hetchy Aqueduct.

[135] United States Geological Survey. (n.d.). Map of Known Active Geologic Faults in the San Francisco Bay Region. Retrieved from https://www.usgs.gov/media/images/map-known-active-geologic-faults-san-francisco-bay-region.

Fault	Description
Mount Diablo Thrust Fault	The Mount Diablo thrust fault is in the vicinity of Mount Diablo in Contra Costa County. The fault lies between the Calaveras Fault, the Greenville Fault, and the Concord Fault, all right-lateral strike slip faults, and appears to transfer movement from the Calaveras and Greenville Faults to the Concord Fault, while continuing to uplift Mount Diablo.

Figure 4-12. Faults Located in the San Francisco Bay Region

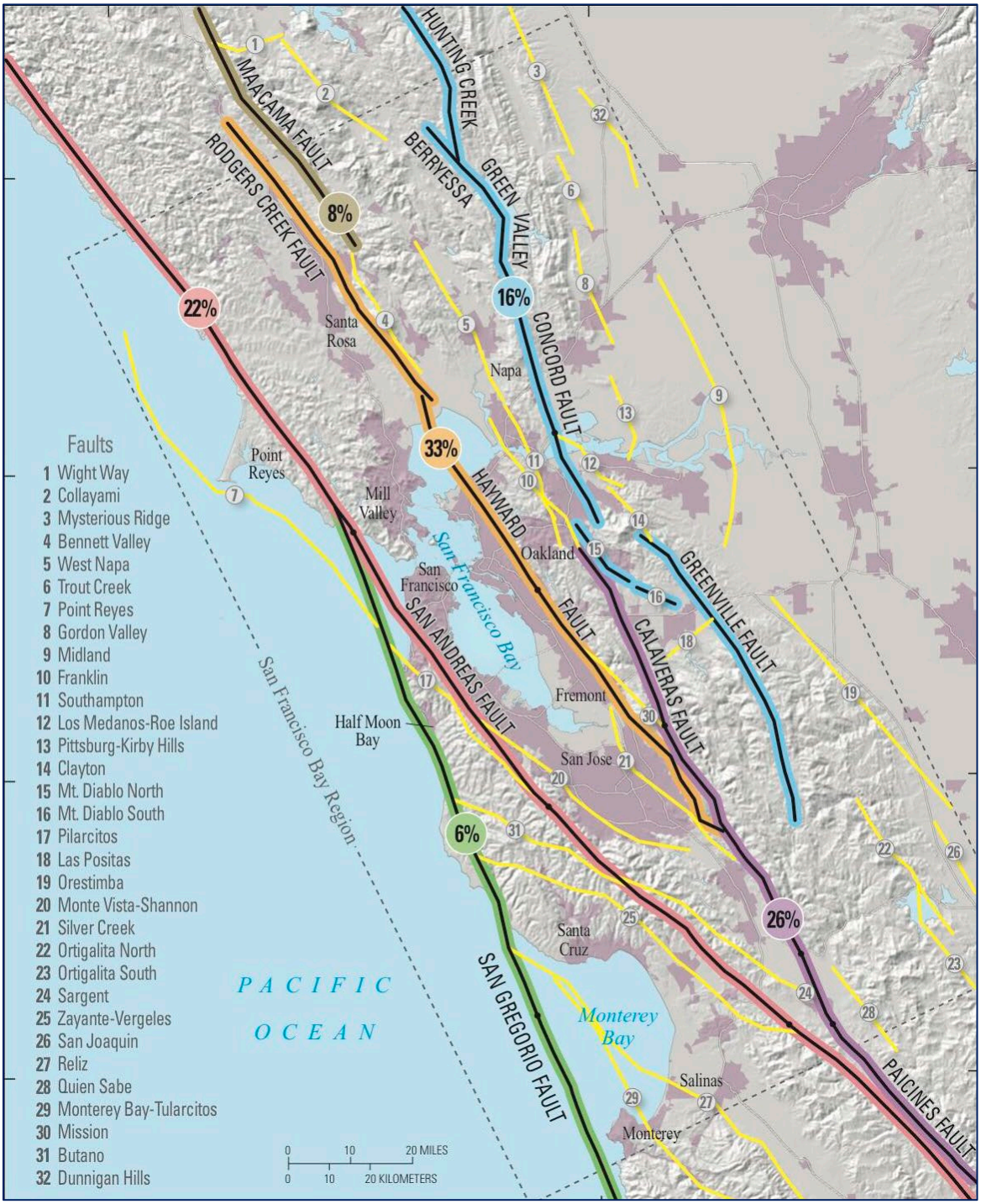
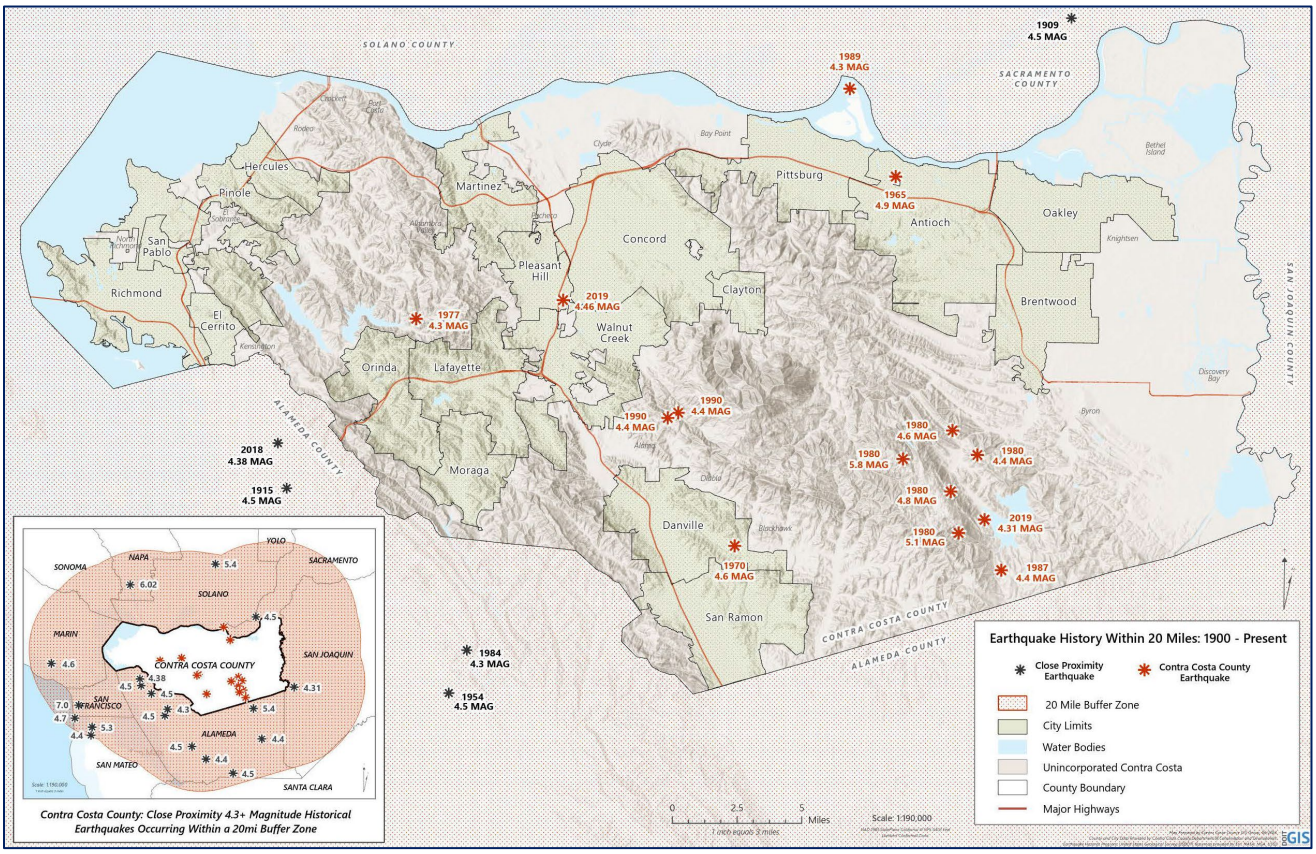


Figure 4-13 illustrates earthquake events greater than Magnitude 4.3 within 20 miles of Contra Costa County.

Figure 4-13. Earthquake History in Contra Costa County Area



4.6.4.3. Hazard Extent/Intensity

Earthquakes are measured both in terms of their inherent magnitude and in terms of their local intensity. There are several standard measures of earthquakes, including the Richter Scale and the Modified Mercalli Intensity (MMI) scale. The Richter Scale measures the magnitude or amount of energy an earthquake releases. Magnitude is measured by seismographs. The MMI scale is an observed measurement of the earthquake's intensity felt at the earth's surface and it varies depending on the observer's location at the earthquake's epicenter. The MMI Scale is comprised of 12 increasing levels, designated by Roman numerals, that range from imperceptible shaking to catastrophic destruction. Furthermore, the MMI can be used to map earthquake impacts. [136]

Table 4-67 correlates the MMI Scale with the Richter Scale and effects of ground shaking.

[136] Pacific Northwest Seismic Network. (n.d.). Magnitude/Intensity. Retrieved from https://pnsn.org/outreach/about-earthquakes/magnitude-intensity.

Table 4-67. Modified Mercalli Scale vs. Richter Scale

Intensity	Effects	Richter Scale *(approximate)*
I. Instrumental	Not felt.	1 – 2
II. Just Perceptible	Felt by only a few people, especially on upper floors of tall buildings.	3
III. Slight	Felt by people lying down, seated on a hard surface, or in the upper stories of tall buildings.	3.5
IV. Perceptible	Felt indoors by many, by few outside; dishes and windows rattle.	4
V. Rather Strong	Generally felt by everyone; sleeping people may be awakened.	4.5
VI. Strong	Trees sway, chandeliers swing, bells ring, some damage from falling object.	5
VII. Very Strong	General alarm; walls and plaster crack.	5.5
VIII. Destructive	Felt in moving vehicles; chimneys collapse; poorly constructed buildings seriously damaged.	6
IX. Ruinous	Some houses collapse; pipes break.	6.5
X. Disastrous	Obvious ground cracks; railroad tracks bent; some landslides on steep hillsides.	7
XI. Very Disastrous	Few buildings survive; bridges damaged or destroyed; all services interrupted (electrical, water, sewage, railroad; severe landslides.	7.5
XII. Catastrophic	Total destruction; objects thrown into the air; river courses and topography altered.	8

Earthquakes can trigger other types of ground failures, which could contribute to the damage. These include flow failures, landslides, and liquefaction. Liquefaction is not a type of ground failure; however, it is a physical process that occurs when shaking can mix groundwater and soil, liquefying and weakening the ground that supports buildings and severing utility lines. This is a problem in floodplains where the water table is relatively high, and the soil is more susceptible to liquefaction. [137]

4.6.4.4. Warning Time

Earthquakes occur with little to no warning. Scientists cannot predict or forecast earthquakes. An earthquake early warning system uses earthquake science and technology of monitoring systems to alert devices and people when shaking waves generated by an earthquake are expected to arrive at a location. Although it may not sound like a lot of time (compared to other natural hazards), seconds to tens of seconds of advance warning can allow people and systems to take action and protect life and property from destructive shaking. [138]

In partnership with University of California Berkeley and USGS ShakeAlert, Cal OES developed the Earthquake Warning California system. The system uses ground-motion sensors to detect earthquakes that have already started and estimate their size, location, and impact. Once it detects a significant magnitude, the MyShake App (registration is required), Wireless Emergency Alerts, or Android Alerts

[137] United States Geological Survey. (n.d.). What are the Effects of Earthquakes? Retrieved from: https://www.usgs.gov/programs/earthquake-hazards/what-are-effects-earthquakes.
[138] United States Geological Survey. (n.d.). What is the difference between earthquake early warning, earthquake forecasts, earthquake probabilities, and earthquake prediction? Retrieved from https://www.usgs.gov/faqs/what-difference-between-earthquake-early-warning-earthquake-forecasts-earthquake-probabilities.

sends a warning to mobile phone users when shaking is about to occur in the user's area. The speed of the alert varies depending on the individual's distance from the origin of the earthquake. Therefore, if the individual is closer to the earthquake's epicenter the warning will arrive faster than someone that is further away. **Table 4-68** outlines the alerting thresholds for the Earthquake Warning California system. [139]

Table 4-68. Earthquake Warning California Alerting Thresholds

Warning System	Threshold
Wireless Emergency Alerts	The Wireless Emergency Alerts is used in response to magnitude 5.0 or greater earthquakes and will alert people who will experience a shaking level of MMI IV (light) or greater.
MyShake App	The MyShake App is used in response to magnitude 4.5 or greater earthquakes and will alert people who will experience a shaking level of MMI III (weak) or greater.
Android Alerts	The Android Alerts are used in response to magnitude 4.5 or greater earthquakes and will alert people who will experience a shaking level of MMI III (weak) or greater.

4.6.4.5. Probability and Frequency

Earthquake probabilities are calculated by projecting earthquake rates based on earthquake history and fault slip rates and the result is expressed as the probability that an earthquake of a specified magnitude will occur on a fault or within an area. [140]

According to USGS, there is 72% probability of at least one (1) earthquake before 2043 with a magnitude 6.7 or greater that could cause widespread damage in the San Francisco Bay area. [141] In 2017, the Working Group on California Earthquake Probabilities (WGCEP) issued its third Uniform California Earthquake Rupture Forecast (UCERF3), which determined the likelihood of magnitude 6.7 and greater earthquakes by 2043. In the San Francisco Bay area, the probabilities are: [142]

- 98% that an earthquake measuring magnitude 6.0 or greater.
- 72% that an earthquake measuring magnitude 6.7 or greater.
- 51% that an earthquake measuring magnitude 7.0 or greater.
- 20% that an earthquake measuring magnitude 7.5 or greater.

Probability of Future Hazard Events

Table 4-69 lists the probabilities, estimated by USGS, for earthquakes on major fault lines in the San Francisco Bay area where the Rodgers Creek and Hayward faults have high potential for experiencing major to great events. [143]

[139] California Governor's Office of Emergency Services. (n.d.). Earthquake Warning California: Types of Alerts. Retrieved from https://earthquake.ca.gov/get-alerts/.
[140] California Department of Conservation. (n.d.). Earthquakes. Retrieved from https://www.conservation.ca.gov/cgs/earthquakes.
[141] United States Geological Survey. (2016). Earthquake Outlook for the San Francisco Bay Region (2014 – 2043). Retrieved from https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf.
[142] United States Geological Survey. (2015). UCERF3: A New Earthquake Forecast for California's Complex Fault System. Retrieved from https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf.
[143] United States Geological Survey. (2016). Earthquake Outlook for the San Francisco Bay Region (2014 – 2043). Retrieved from https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf.

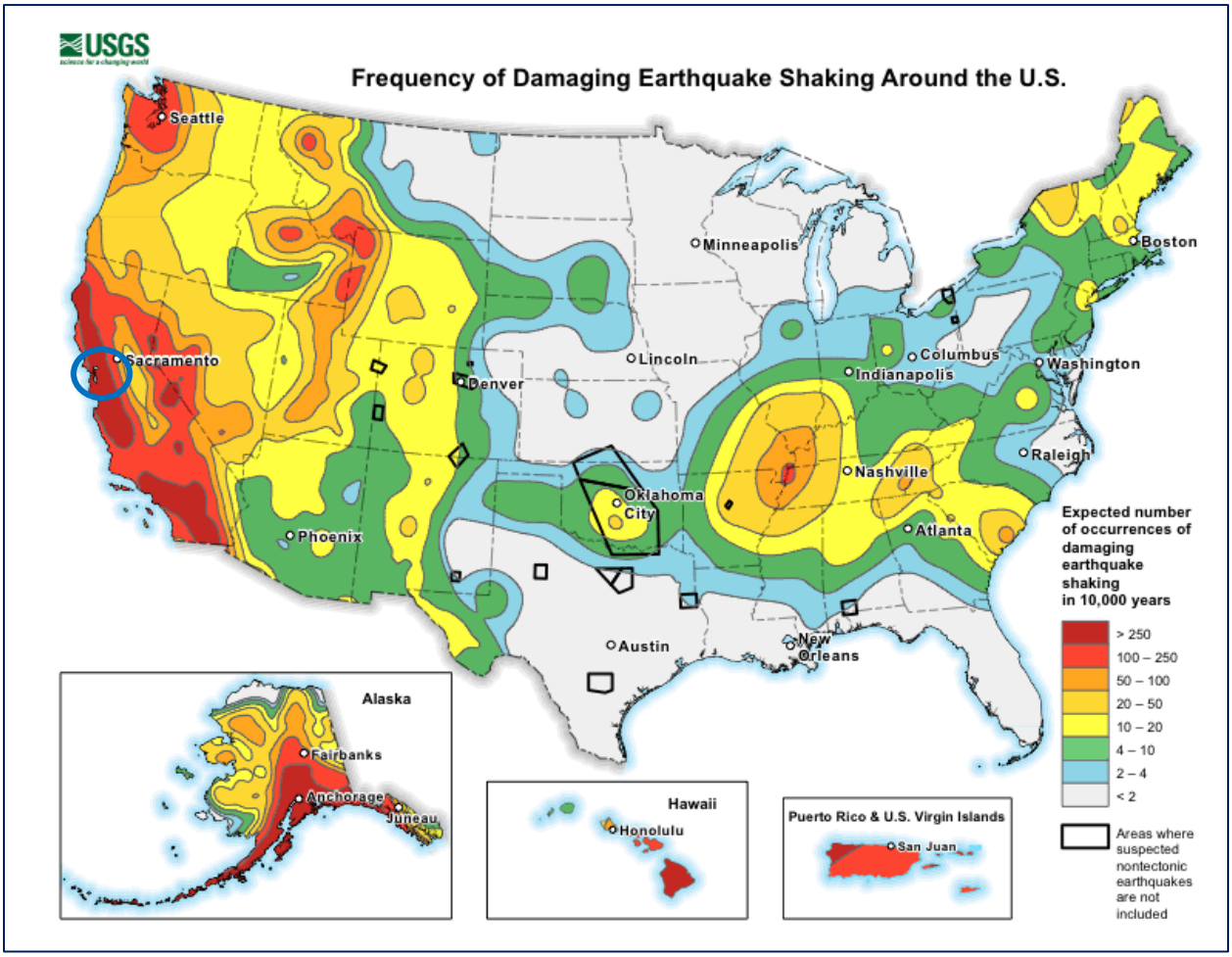
Table 4-69. Earthquake Probabilities for the San Francisco Bay Area (2014 – 2043)

Fault	Probability of One (1) or More Magnitude 6.7 or Greater Earthquake
Rodgers Creek Fault	33%
Hayward	33%
Calaveras	26%
San Andreas	22%
Hunting Creek	16%
Green Valley	16%
Concord	16%
Greenville	16%
Berryessa	16%
Maacama	8%
San Gregorio	6%

The USGS National Seismic Hazard Maps reflect the best and most current understanding of earthquake hazard in an area, the distribution of damaging earthquake shaking across the United States and compares earthquake shaking hazard areas with other areas across the United States. **Figure 4-14** illustrates the most recent USGS National Seismic Hazard Map which represents the expected number of occurrences of damaging earthquake shaking in 10,000 years. A “damaging earthquake shaking” in this map is that of MMI level VI or higher. [144]

[144] United States Geological Survey, Earthquake Hazards Program. (2022). Introduction to the National Seismic Hazard Maps. Retrieved from https://www.usgs.gov/programs/earthquake-hazards/science/introduction-national-seismic-hazard-maps.

Figure 4-14. USGS National Seismic Hazard Map



The earthquake annualized frequency value represents the modeled frequency of an earthquake hazard occurrence per year. A higher annualized frequency value results in higher EAL and Risk Index scores. **Table 4-70** outlines the annualized frequency for earthquakes, based on FEMA NRI data, for Contra Costa County.

Table 4-70. Earthquake Annualized Frequency *(FEMA National Risk Index)*

Location	Events on Record *(2021 Dataset)*	Annualized Frequency
Contra Costa County	N/A	0.970% chance per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

4.6.4.6. Past Events

The San Francisco Bay area has experienced at least 22 earthquakes of magnitude 5.0 or greater since 1850. **Table 4-71** lists the earthquakes of magnitude 5.0 or greater that have occurred in or within Contra Costa County.

Table 4-71. Earthquake Past Events Within or Near Contra Costa County (Magnitude 5.0 or Greater) [145]

Date	Magnitude	Epicenter Location
August 24, 2014 *(South Napa Earthquake)*	6.0	South Napa
October 20, 2012 *(King City Earthquake)*	5.3	17.4 miles east-northeast of King City, California
October 31, 2007 *(Alum Rock Earthquake)*	5.5	3.7 miles north-northeast of East Foothills, California
August 12, 1998 *(San Juan Bautista Earthquake)*	5.1	6.2 miles southwest of Ridgemark, California
April 18, 1990 *(Northern California)*	5.1	2.4 miles east of Interlaken, California 3.1 miles north-northwest of Aromas, California
October 18, 1989 *(Loma Prieta Earthquake)*	6.9	Loma Prieta, California
August 8, 1989 *(Santa Cruz County Earthquake)*	5.4	2.5 miles east-southeast of Lexington Hills, California
June 27, 1989	5.3	5 miles east-southeast of Lexington Hills, California
June 13, 1988	5.3	3.7 miles east of East Foothills, California
February 20, 1988	5.1	0.6 miles northeast of Tres Pinos, California
March 31, 1986	5.7	9.3 miles northeast of East Foothills, California
January 26, 1986	5.5	1.9 miles east-northeast of Tres Pinos California
January 27, 1980	5.4	5.6 miles northeast of Livermore, California

4.6.4.7. Vulnerability and Impacts

Life Safety and Health: The entire population of the planning area is potentially exposed to direct and indirect impacts from earthquakes. Whether directly impacted or indirectly impacted, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could keep people from working, road closures could isolate populations, and loss of functions of utilities could impact populations that suffered no direct damage from an event itself. A catastrophic earthquake would have significant impacts on the County since earthquake faults align with many County thoroughfares and population centers. West Contra Costa County is highly vulnerable to impacts from earthquakes along the Hayward Fault.

An earthquake impacts the life safety and health of the County by potentially causing injury or death to the population due to debris, failed infrastructure, and other hazards. The entire population of Contra Costa County falls within areas with the potential for either violent or extreme level of ground shaking. However, some populations within the planning area may be more vulnerable to an earthquake event than others. For example, those with mobility issues as well as the elderly may have challenges with evacuating or traveling to a shelter without assistance if they cannot stay in their homes.

[145] United States Geological Survey. (2023). Search Earthquake Catalog. Retrieved from https://earthquake.usgs.gov/earthquakes/search/.

Approximately, 11.4% of Contra Costa County population has a disability type (i.e., hearing, vision, cognitive, or ambulatory, self-care, and independent living difficulty). In Contra Costa County, the most prevalent type of disability is independent living difficulty (difficulty doing errands alone such as visiting a doctor's office or shopping) followed by ambulatory difficulty (serious difficulty walking or climbing stairs). As age increases, so does the percentage of each age group that has disability. For residents who are 75 years and over, 45.9% have a disability. The 65 to 74 years age group constitutes the second-highest number of disabilities with 22.9%. Disability and poverty are closely tied due to employment limitations.

Many senior-headed households have special needs due to their relatively low incomes, disabilities or limitations, and dependency needs. Specifically, many people aged 65 years and older live alone. In Contra Costa County, 201,136 residents are 65 years and older, representing 17.4% of the population and approximately 7.0% live below poverty level.[146,147]

Table 4-72 summarizes the estimates for the disabled population by disability type, age, race, and ethnicity within Contra Costa County.[148]

Table 4-72. Disability Characteristics (2022)

Disability Type	Estimate	Percent
Hearing Difficulty	35,029	3.0%
Vision Difficulty	23,653	2.1%
Cognitive Difficulty	52,048	4.8%
Ambulatory Difficulty	57,988	5.3%
Self-Care Difficulty	25,797	2.4%
Independent Living Difficulty	52,546	5.8%
Age	**Estimate**	**Percent**
Under 5 years	428	0.7%
5 to 17 years	8,463	4.5%
18 to 34 years	18,358	7.8%
35 to 64 years	39,323	8.4%
65 to 74 years	26,084	22.9%
75 years and over	38,792	45.9%

[146] United States Census Bureau. (2022). S0101: Age and Sex (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S0101?g=050XX00US06013.
[147] United States Census Bureau. (2021). S1701: Poverty Status in the Past 12 Months (2021: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2021.S1701?t=Income and Poverty:Official Poverty Measure:Poverty&g=050XX00US06013.
[148] United States Census Bureau. (2022). S1810: Disability Characteristics (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S1810?g=050XX00US06013,53037.

Race and Ethnicity	Estimate	Percent
White (not Hispanic or Latino)	60,307	13.6%
Black or African American	14,735	14.8%
American Indian and Alaska Native	14,735	10.4%
Asian	17,988	8.1%
Native Hawaiian and Other Pacific Islander	1,085	18.3%
Two (2) or More Races	16,292	9.0%
Some Other Race Alone	16,486	10.1%
Hispanic or Latino	28,798	9.3%

The median age of Contra Costa County residents is 40 years old. The population has been steadily aging since 1970, when the median age was about 28 years old. Since 2010, the fastest growing age group has been seniors 65 and older as the Baby Boomer generation ages. The second fastest growth occurred in the 55 to 64 age group, which includes younger Baby Boomers and older members of Generation X.[149]

The majority of the population in Contra Costa County is White (40.9%), with the next highest percent being Hispanic or Latino (27.0%) and Asian (19.3%). Additionally, 27.0% of the population in Contra Costa County is foreign-born. [150] Other than English, the most commonly spoken language in the County is Spanish (18.7%). The United States Census Bureau estimates that 14.5% of the County's residents speak English "less than very well."[151] **Table 4-73** summarizes the vulnerable and at-risk population for earthquakes.

Table 4-73. Vulnerability and At Risk Population

Category	Estimate	Percent
Population with Disability	131,448	11.4%
65 Years and Over	201,136	17.4%
75 to 84 Years Old	61,365	5.3%
85 Years and Over	24,486	2.1%
Language Other than English	416,505	38.0%
Spanish Spoken at Home	204,442	18.7%
Speak English "Less than very well"[152]	158,965	38.2%

[149] Contra Costa County. (2023). Contra Costa County 2045 General Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2024/02/Contra-Costa-County-General-Plan_Public-Review-Draft_Combined.pdf.
[150] United States Census Bureau. (2022). DP02: Selected Social Characteristics in the United States (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP02?g=050XX00US06013.
[151] United States Census Bureau. (2022). S1601: Language Spoken at Home (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S1601?g=050XX00US06013.
[152] Ibid.

Category	Estimate	Percent
Occupied Housing Unit: Mobile Home[153]	5,363	1.3%
Homeless Population[154]	2,372	0.2%

Table 4-78 outlines the vulnerability of the total population exposed to earthquakes. **Table 4-79** outlines the earthquake impacts to population and life safety, underserved/equity population, and essential operations, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Property Damage and Critical Infrastructure: According to Contra Costa County Assessor records, the total replacement value of buildings as of 2023 is $266.7 Billion. [155] Since all structures in the planning area are susceptible to earthquake impacts to varying degrees, this represents the property exposure to seismic events. Most of the buildings are residential. The greater potential danger is the collapse of older residential units built from reinforced masonry. Of the 415,194 occupied housing units in Contra Costa County, approximately 50.0% of the housing structures were built before the 1970s, prior to the implementation of substantial improvements to building codes and construction practices. Understanding the distribution of housing structures by age helps identify older and potentially more vulnerable buildings. **Table 4-74** outlines information on the age of the housing units, categorized by period when they were built. [156]

Table 4-74. Physical Housing Characteristics in Contra Costa County

Structure Built *(Year)*	Estimate	Percent *(of occupied housing)*
2020 or Later	5,099	1.2%
2010 to 2019	25,087	6.0%
2000 to 2009	52,348	12.6%
1980 to 1999	114,930	27.7%
1960 and 1979	120,531	29.0%
1940 and 1959	79,758	19.2%
1939 or Earlier	17,441	4.2%

All critical facilities in the planning area are exposed to earthquake hazard. Hazardous materials releases can occur during an earthquake from fixed facilities or transportation related incidents. Transportation corridors can be disrupted during an earthquake, leading to the release of materials to the surrounding environment. Facilities holding hazardous materials are of particular concern because of possible

[153] United States Census Bureau. (2022). S2504: Physical Housing Characteristics for Occupied Housing Units (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S2504?g=050XX00US06013.
[154] Contra Costa Health. (2023). Health, Housing, and Homelessness Data Reports (Point-in-Time Count). Retrieved from https://www.cchealth.org/services-and-programs/homeless-services/data.
[155] Contra Costa County. (2023). 2023-2024 County Assessment Roll. Retrieved from https://www.contracosta.ca.gov/DocumentCenter/View/79697/2023-2024-BOS-Close-of-Assessment-Roll-Letter-and-Reports-to-the-CCC-Board-of-Supervisors?bidId=.
[156] United States Census Bureau. (2022). S2504: Physical Housing Characteristics for Occupied Housing Units (2022: ACS 1-Year Estimates Subject tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S2504?g=050XX00US06013.

isolation of neighborhoods surrounding them. During an earthquake, structures storing these materials could rupture and leak into the surrounding area or an adjacent waterway, having a disastrous effect on the environment.

The following major roads in the planning area intersect moderate to very high liquefiable soils and thus are exposed to earthquakes:

- Interstate 680
- Interstate 80
- State Highway 160
- State Highway 242
- State Highway 4
- State Highway 4 Bypass
- Road 20
- Eastshore Freeway
- Grove Shafter Freeway
- John T Knox Freeway
- Byron Highway
- Pittsburg Antioch Highway
- Port Chicago Highway
- Branch Parkway
- Chilpancingo Parkway
- Garin Parkway
- John Muir Parkway
- Marina Bay Parkway
- Mountaire Parkway
- Richmond Parkway
- Rossmoor Parkway
- Village Parkway
- Vineyards Parkway
- Vintage Parkway
- Waterworld Parkway
- Windemere Parkway

There are a total of 554 critical assets (i.e., schools, nursing homes, fire stations, police stations, and hospitals) throughout the County and 100% of these assets are susceptible to earthquake impacts to varying degrees. **Table 4-75** provides a breakdown of critical assets that are located within Contra Costa County.

Table 4-75. Critical Assets Vulnerable to Earthquakes

Asset	Estimate	Percent *(of total assets)*
Schools *(public schools, private schools)*	360	100.0%
Nursing Homes	78	100.0%
Fire Stations	81	100.0%
Police Stations	24	100.0%
Hospitals	11	100.0%

Table 4-78 outlines the total property value exposed to earthquakes and how the changes in development in the past five (5) years, have affected the vulnerability of the community to earthquakes. **Table 4-79** outlines earthquake impacts on total property damage, potential future development, and the economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Building damage as a result of the magnitude 5.8 earthquake analysis was estimated using Hazus. In addition, annualized losses were calculated. *Refer to the Hazus portion at the end of this section (Section 4.6.4.7).*

Environment: Environmental problems as a result of an earthquake can be numerous and secondary hazards will likely have some of the most damaging effects on the environment. Earthquake induced landslides can significantly damage the surrounding habitat. It is also possible for streams to be rerouted after an earthquake. Rerouting can change the water quality, possibly damaging habitat and feeding areas.

Table 4-79 outlines earthquake impacts on the environment and the economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Changes in Development and Impact of Future Development: The County population has grown by 0.4% since completion of the previous Plan (in last five (5) years) which slightly results in additional people at risk from an earthquake. Growth in structures has accompanied population growth, although the number of housing units has not matched the overall increase. Much of the population growth has occurred in eastern sections of the County which are less likely to be exposed to seismic hazards. Changes in development have had minimal impact on the vulnerability (between 5% and 9%) or expected losses due to earthquake. However, the Bay Area Association of Governments (ABAG) growth forecasts predict a steady increase in households through 2050. From 2015 to 2050, ABAG projects that the County's number of households will grow by 44%.[157] This increase in development will significantly increase the impact of an earthquake in the planning area.

Table 4-78 outlines how the changes in development in the past five (5) years have affected the vulnerability of the community to earthquakes. **Table 4-79** outlines the earthquake impacts on potential future development, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Effects of Climate Change in Severity of Impacts: The exact nature and extent of this impact still needs to be studied and fully understood as it pertains to climate change. However, climate change can increase the risk of earthquake's cascading hazards (e.g., landslides, tsunamis, flooding). *The impacts of climate change for landslides, tsunamis, and flooding will be addressed separately in this Plan.*

Table 4-79 outlines the climate change impacts to earthquakes in Contra Costa County, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

[157] Bay Area Association of Government. (2020). Plan Bay Area 2050 Final Blueprint Growth Pattern. Retrieved from https://planbayarea.org/digital-library/plan-bay-area-2050-final-blueprint-growth-pattern.

Table 4-76. Probability of Occurrence

Hazard Event	Probability of Occurrence		Probability Factor	Weighted Factor
Earthquake	Medium	Significant hazard event is likely to occur within 25 years.	2	N/A

Table 4-77. Extent Factors

Hazard Event	Extent Factor	Extent		Extent Factor	Weighted Factor
Earthquake	***Extent/Intensity***	High	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a high-intensity incident.	3	9
	Catastrophic	High	Catastrophic hazard event is likely to occur at least once in 10 years.	3	9

Table 4-78. Vulnerability Factors

Hazard Event	Vulnerability Factor	Vulnerability		Vulnerability Factor	Weighted Factor
Earthquake	***Population Exposure***	High	30% or more of the population is exposed to the hazard.	3	9
	Property Exposure	High	25% or more of the total assessed property value is exposed to the hazard.	3	6
	Changes in Development	Medium	Changes in development have increased the vulnerability/exposure of the community to the hazard between 5% and 9%.	2	2

Table 4-79. Impact Factors

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
Earthquake	***Population and Life Safety***	High	Populations exposed to this hazard are likely to experience significant adverse impacts, such as fatalities and severe injuries.	3	9
	Underserved/Equity	High	Underserved populations exposed to the hazard are likely to experience significant adverse/disproportionate impacts, such as fatalities and severe injuries.	3	9
	Property Damage	High	More than $5 Million in property damages is expected from a single major hazard event, or damages are expected to occur to 15% or more of the property value within the jurisdiction.	3	6
	Economic	High	Where the total economic impact is likely to be greater than $10 Million.	3	3

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
	Environmental	High	Environmental impact from a single major hazard event is likely to be significant, requiring extensive outside resources and support; and/or repair, clean-up, restoration, and/or preservation work.	3	3
	Essential Operations	High	Impact greater than 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	3	3
	Future Development	High	Future development trends will significantly increase the impact/consequence of this hazard.	3	3
	Climate Change	No Impact	Climate change trends will not increase the risk of the hazard and its impacts.	0	0

HAZUS

Scenario: Magnitude 5.8 Event

Building damage as a result of the magnitude 5.8 earthquake analysis was estimated using Hazus. In addition, annualized losses were calculated. Hazus estimates that there are 341,000 buildings in the region which have been an aggregated total replacement of $218.5 Million. Approximately 91.0% of the buildings are associated with residential housing. **Table 4-80** provides a general distribution of the building value within Contra Costa County. In terms of building construction types found in the County, wood frame construction makes up 89.0% of the building inventory and the remaining 11.0% is distributed between the other general building types (i.e., steel, concrete, precast, reinforced masonry, unreinforced masonry, manufactured housing).

Table 4-80. Contra Costa County Population and Building Value Data

Population	Residential Building Value	Non-Residential Building Value	Total
1,165,927	$158.1 Million	$60.3 Million	$218.5 Million

The total economic loss estimated for the earthquake is $17.345 Million, which includes building and lifeline related losses based on the region's available inventory. HAZUS estimates that about 47,683 buildings will be at least moderately damaged. This is over 14% of the buildings in the region. There are an estimated 1,094 buildings that will be damaged beyond repair. **Table 4-81** summarizes the expected building damage by general occupancy within Contra Costa County.

Table 4-81. Expected Building Damage by Occupancy

Damage Level	None		Slight		Moderate		Extensive		Complete	
Occupancy	***Count***	***%***	***Count***	***%***	***Count***	***%***	***Count***	***%***	***Count***	***%***
Agriculture	353	0.20	207	0.18	140	0.34	41	0.75	8	0.74
Commercial	7,411	4.21	4,763	4.05	4,189	10.18	1,379	25.40	249	22.78
Education	317	0.18	182	0.15	118	0.29	32	0.58	4	0.38
Government	2,265	1.29	1,249	1.06	1,080	2.62	368	6.77	62	5.68
Industrial	1,815	1.03	1,204	1.02	1,197	2.91	439	8.09	93	8.51
Other Residential	13,172	7.48	9,568	8.13	4,763	11.57	1,360	25.05	261	23.86
Religion	543	0.31	333	0.28	251	0.61	84	1.54	16	1.43
Single Family	150,185	85.30	100,201	85.13	29,421	71.48	1,728	31.82	401	36.62
TOTAL	**176,060**		**117,707**		**41,159**		**5,430**		**1,094**	

Table 4-82 summarizes the expected damage by general building type.

Table 4-82. Expected Building Damage by Building Type

Building Type	None		Slight		Moderate		Extensive		Complete	
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
Wood	161,766	91.88	109,256	92.82	32,226	78.30	1,843	33.94	453	41.43
Steel	2,761	1.57	1,698	1.44	1,989	4.83	734	13.51	140	12.81
Concrete	3,133	1.78	2,090	1.78	1,612	3.92	601	11.07	101	9.20
Precast	1,840	1.04	1,223	1.04	1,415	3.44	524	9.64	83	7.63
Reinforced Masonry	5,476	3.11	2,192	1.86	2,144	5.21	772	14.21	73	6.65
Unreinforced Masonry	631	0.36	533	0.45	559	1.36	242	4.45	99	9.08
Manufactured Housing	453	0.26	714	0.61	1,213	2.95	716	13.18	144	13.20
TOTAL	**176,060**		**117,707**		**41,159**		**5,430**		**1,094**	

Hazus breaks critical facilities into two (2) groups – essential facilities (i.e., hospitals, medical clinics, schools, fire stations, police stations and emergency operations center) and high potential loss facilities (i.e., dams, levees, military installations, nuclear power plants and hazardous material sites). For essential facilities, there are 14 hospitals in the County with a total bed capacity of 1,804 beds. There are 384 schools, 78 fire stations, 35 police stations and two (2) emergency operation centers. With respect to high potential loss facilities, there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no nuclear power plants.

The Hazus model estimates the time to restore critical facilities to fully functional use. Before the flood event, Contra Costa County had 1,804 hospital beds available for use. On the day of the flood event, Hazus estimates that 893 hospital beds (50.0%) are available for use by patients already in the hospital and those injured by the earthquake. After one (1) week, 71.0% of the beds will be back in service and 91.0% will be operational after 30 days. **Table 4-83** summarizes the expected damage to essential facilities in Contra Costa County. 301 (58.7%) essential facilities are expected to have functionality greater than 50% one (1) day after the earthquake event.

Table 4-83. HAZUS Earthquake Expected Damage to Essential Facilities

Facility	Total	At Least Moderate *(Greater than 50% damage)*	Complete *(Greater than 50% damage)*	With Functionality *(Greater than 50% on day 1)*
Hospitals	14	4	0	9
Schools	384	55	0	225
Emergency Operations Center	2	1	0	1
Police Stations	35	8	0	22
Fire Stations	78	8	0	53
TOTAL	**513**	**76**	**0**	**301**

Hazus divides the lifeline inventory between transportation and utility lifeline systems. There are seven (7) transportation systems (i.e., highways, highways, railways, light rail, bus, ports, ferry and airports) and

six (6) utility systems (i.e., potable water, wastewater, natural gas, crude and refined oil, electric power and communications). Hazus estimates that the total value of the lifeline inventory (transportation and utility) is over $28.9 Million which includes 344.9 miles of highways, 613 bridges, and 9,751.2 miles of pipeline (potable water, wastewater, natural gas, and oil). **Table 4-84** summarizes the expected damage to utility systems in Contra Costa County. All utility systems are expected to have functionality greater than 50% on day seven (7) after the earthquake event.

Table 4-84. Expected Damage to Utility Systems

System	Total	Number of Locations			
		With at Least Moderate Damage	*With Complete Damage*	*With Functionality Greater than 50%*	
				After Day 1	*After Day 7*
Potable Water	6	5	0	0	6
Wastewater	14	1	0	0	14
Natural Gas	0	0	0	0	0
Oil Systems	11	1	0	0	11
Electrical Power	22	13	0	11	22
Communication	9	2	0	9	9

For the transportation systems, HAZUS calculates the direct repair cost for each component only. **Table 4-85** provides damage estimate for the transportation systems.

Table 4-85. Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations / Segments	*With at Least Moderate Damage*	*With Complete Damage*	*With Functionality Greater than 50%*	
					After Day 1	*After Day 7*
Highway	Segments	408	0	0	408	408
	Bridges	613	1	0	612	613
	Tunnels	5	0	0	5	5
Railways	Segments	97	0	0	97	97
	Bridges	123	0	0	123	123
	Tunnels	2	0	0	2	2
	Facilities	10	0	0	10	10
Light Rail	Segments	1	0	0	1	1
	Bridges	26	0	0	26	26
	Tunnels	0	0	0	0	0
	Facilities	3	0	0	3	3
Bus	Facilities	0	0	0	0	0

System	Component	Number of Locations				
		Locations / Segments	*With at Least Moderate Damage*	*With Complete Damage*	*With Functionality Greater than 50%*	
					After Day 1	*After Day 7*
Ferry	Facilities	4	0	0	4	4
Port	Facilities	77	0	0	77	77
Airport	Facilities	3	0	0	3	3
	Runways	6	0	0	6	6

Earthquakes also impact the economy, including loss of business function, damage to inventory (i.e., buildings, transportation, and utility systems), relocation costs, wage loss, and rental loss due to repair and replacement of buildings. Hazus estimates building-related economic losses, including income losses (i.e., wage, capital-related, rental, and relocation losses) and capital stock losses (i.e., structural, non-structural, content, and inventory losses).

Hazus estimates total building related losses were $14.894 Million where 14.0% of the losses were related to business interruption in Contra Costa County. The analysis concluded that the largest loss was sustained by the residential occupancies, which comprised 52% of the total loss. **Table 4-86** summarizes the building related economic loss estimates.

Table 4-86. Building Related Economic Loss Estimates *(Millions of Dollars)*

	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses	Wage	0.0	43.7	360.7	30.6	60.3	495.3
	Capital-Related	0.0	18.6	294.6	18.5	8.7	340.3
	Rental	72.6	98.4	156.5	11.8	37.1	376.5
	Relocation	263.7	67.0	258.4	48.2	177.0	814.2
	TOTAL	**336.3**	**227.7**	**1,070.1**	**109.0**	**283.0**	**2,026.2**
Capital Stock Losses	Structural	670.4	175.6	467.1	227.9	216.2	1,575.2
	Non-Structural	3,616.5	1,188.9	1,460.1	747.6	789.9	7,803.0
	Content	1,176.7	301.3	728.1	504.7	384.7	3,095.6
	Inventory	0.0	0.0	117.1	84.4	10.3	211.8
	TOTAL	**5,463.7**	**1,665.8**	**2,772.3**	**1,564.6**	**1,401.1**	**12,867.5**
SUBTOTAL		**5,800.0**	**1,893.5**	**3,842.7**	**1,673.7**	**1,684.1**	**14,893.7**

Table 4-87 provides a detailed breakdown in transportation system economic losses in Millions of dollars.

Table 4-87. HAZUS Earthquake Transportation System Economic Losses
(Millions of Dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	4,025.6	0.0	0.0
	Bridges	5,593.8	97.2	1.74
	Tunnels	92.1	2.2	2.37
	TOTAL	**9,711.5**	**99.4**	**-**
Railways	Segments	4,328.5	0.0	0.0
	Bridges	699.9	10.8	1.54
	Tunnels	1.8	0.1	3.12
	Facilities	26.6	5.4	20.40
	TOTAL	**5,056.7**	**16.3**	**-**
Light Rail	Segments	263.2	0.0	0.0
	Bridges	3.3	0.0	1.18
	Tunnels	0.0	0.0	0.0
	Facilities	17.1	3.3	18.94
	TOTAL	**283.6**	**3.3**	**-**
Bus	Facilities	0.0	0.0	0.0
	TOTAL	**0.0**	**0.0**	**-**
Ferry	Facilities	5.3	0.0	0.0
	TOTAL	**5.3**	**0.0**	**-**
Port	Facilities	293.5	56.4	19.21
	TOTAL	**293.5**	**56.4**	**-**
Airport	Facilities	24.0	5.3	22.14
	Runways	40.5	0.0	0.0
	TOTAL	**64.5**	**5.3**	**-**
	SUBTOTAL	**15,415.1**	**180.6**	**-**

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake incident and the number of displaced individuals that will require accommodations in temporary public shelters. The model estimates 5,333 households will be displaced due to the earthquake. Of these, 2,628 people (out of a total population of 1,165,927) will seek temporary shelter in public shelters.

Hazus estimates the amount of debris that will be generated by the earthquake event. Debris estimates were divided into two (2) categories – brick/wood and reinforced concrete/steel. The distinction is made because of the different types of materials handling equipment required to handle debris.

The analysis estimated that a total of 1,761 million tons of debris will be generated. Of the total amount, 37.0% is comprised of brick/wood and the remainder will be reinforced concrete/steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 70,440 truckloads (25 tons/truck) to remove the debris.

4.6.4.8. FEMA NRI Expected Annual Loss

An earthquake NRI EAL score, and rating represent a community's relative level of expected building and population loss each year due to earthquakes when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-88** outlines the earthquake EAL for Contra Costa County.

Table 4-88. Earthquake Expected Annual Loss *(FEMA National Risk Index)*

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Contra Costa County	$156.4 Million	$410.1 Million	n/a	$566.5 Million	99.8	Very High
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.4.9. FEMA Earthquake Risk Index Score

The earthquake Risk Index score and rating represent a community's relative risk for earthquakes when compared to the rest of the United States. **Table 4-89** illustrates the earthquake Risk Index rating and score for Contra Costa County.

Table 4-89. Earthquake Risk Index (FEMA National Risk Index)

Jurisdiction	Rating	Score
Contra Costa County	Very High	99.8
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

Table 4-90 represents the Earthquake Failure Total Risk Score for Contra Costa County, based on the Risk Assessment Methodology, as defined in this Plan. For further details on how the probability, extent, vulnerability, and impact factors were calculated, please refer to **Table 4-76** through **Table 4-79**. Additional details on how the Total Risk Score was calculated can be found in the Risk Assessment Methodology in Section 4.3 of this Plan.

Table 4-90. Earthquake Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Earthquake	2	18	17	36	71	68

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.5. Flood

4.6.5.1. Description

Floods are the most common and widespread of all weather-related natural disasters and result in more deaths each year than tornadoes, hurricanes, and lightning. A flood is defined as an overflowing of water onto dry land which occurs when the existing channel of a stream, river, canyon, or other watercourses cannot contain excess runoff from rainfall or snowmelt. **Table 4-91** lists and describes the different types of flood. Flooding can be damaging, and it can happen with only a few inches of water or covering a house up to the rooftop. Additionally, floods can occur within a few minutes or over a long period of time, and last days, weeks, or longer. [158]

Table 4-91. Flood Types [159]

Type	Description
River Flood	Occurs when water levels rise over the top of riverbanks due to excessive rain from tropical systems making landfall, persistent thunderstorms over the same area for extended periods of time, combined rainfall and snowmelt, or an ice jam.
Inland Flooding	Occurs when moderate precipitation accumulates over several days, intense precipitation falls over a short period, or a river overflow because of an ice or debris jam or dam or levee failure.
Flash Flood	Occurs during heavy or excessive rainfall in a short period of time, generally less than six (6) hours. Flash floods are usually characterized by raging torrents after heavy rains that rip through riverbeds, urban streets, or mountain canyons. They can occur within minutes or a few hours of excessive rainfall. They can also occur even if no rain has fallen, for instance after a levee or dam has failed, or after a sudden release of water by a debris or ice jam.
Coastal Floods	Caused by higher than average high tide and worsened by heavy rainfall and onshore winds (i.e., wind blowing landward from the ocean); the inundation of land areas along the coast.
Storm Surge	An abnormal rise in water level in coastal areas, over and above the regular astronomical tide, caused by forces generated from a severe storm's wind, waves, and low atmospheric pressure.

A floodplain is an area adjacent to a river, creek, or lake that is subject to recurring floods which can provide environmental and flood reduction benefits. [160] Floodplains may change over time from natural processes, changes in the characteristics of a watershed, or human activity (e.g., construction). River channels change as water moves downstream, acting on the channel banks and the bottom of the channel. Outside a channel curve, the banks are subject to erosion as the water scours against them. On the inside of a channel curve, the banks receive deposits of sand and sediment transferred from the eroded sites. In areas where flow contains a high-sediment load, the course of a river or stream may shift dramatically during a single flood event.

Flooding in Contra Costa County is typically caused by high-intensity, short-duration (1 to 3 hours) storms concentrated on a stream reach with already saturated soil. Two (2) types of flooding are typical – flash

[158] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Flood Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/floods/.
[159] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Floods. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/floods/types/.
[160] Contra Costa County Public Works Department. (2020). Contra Costa County Floodplain Management Program. Retrieved from https://www.contracosta.ca.gov/DocumentCenter/View/8558/Floodplain-Pamphlet-January-2020-PDF?bidId=.

floods and riverine flooding. Flash floods that occur suddenly after a brief, but intense downpour, move rapidly, end suddenly, and can occur in areas not generally associated with flooding (e.g., subdivisions not adjacent to a water body and areas serviced by underground drainage systems). Although the duration of these events is usually brief, the damage they cause can be severe. Flash floods cannot be forecast accurately. Riverine floods described in terms of their extent (including the horizontal area affected and the vertical depth of floodwater) and the related probability of occurrence (expressed as the percentage chance that a flood of a specific extent will occur in any given year).

4.6.5.2. Hazard Location

In California, 90% of the natural disasters are flood related. In Contra Costa County, flooding is predominantly confined within traditional riverine valleys. Locally, some natural or human-caused levees separate channels from floodplains and cause independent overland flow paths. Occasionally, railroad, highway, or canal embankments form barriers, resulting in ponding or diversion of the flow. Some localized flooding not associated with stream overflow can occur where there are no drainage facilities to control flows or when runoff volumes exceed the design capacity of drainage facilities. There are 87 creeks, channels, and bodies of water, listed in **Table 4-92**, that are considered principal flooding sources in the County. [161]

Table 4-92. Contra Costa County Flooding Sources

Along Giant Road from Standard Oil to Rheem Creek	Ivy Drive Tributary	Pinole Creek
Appian Creek	Jonas Hill Creek	Refugio Creek
Arroyo Del Hambre Creek	Kirker Creek	Reliez Creek
Brookside Road Tributary	Lafayette Creek	Rheem Creek Radeo Creek
Carquinez Straight	Laguna Creek	Sand Creek
Cascade Creek	Larch Creek	San Francisco Bay
Cerrito Creek	Las Trampas Creek	San Pablo Bay
Clayton Valley Drain	Lauterwasser Creek	San Pablo Creek
Corliss Drive Tributary	Lawlor Creek	San Ramon Creek
Deer Creek	Line A, DA-40	San Ramon Creek Overflow
Ditch No. 2	Los Medanos Wasteway	Sans Crainte Creek
Donner Creek	Mangini Creek	Sans Crainte Creek Tributary A
Dutch Slough	Markley Creek	Shore Acres Creek
East Antioch Creek	Marsh Creek	South Branch Moraga Creek
Each Branch Green Valley Creek	Middle Branch West Antioch Creek	South San Ramon Creek (overbank flooding)
East Branch Homestead Creek	Miranda Creek	South San Ramon Creek
East Branch Refugio Creek	Mitchell Creek	St. Marys Road Tributary
East Fork Grayson Creek	Moraga Creek	Stone Valley Creek

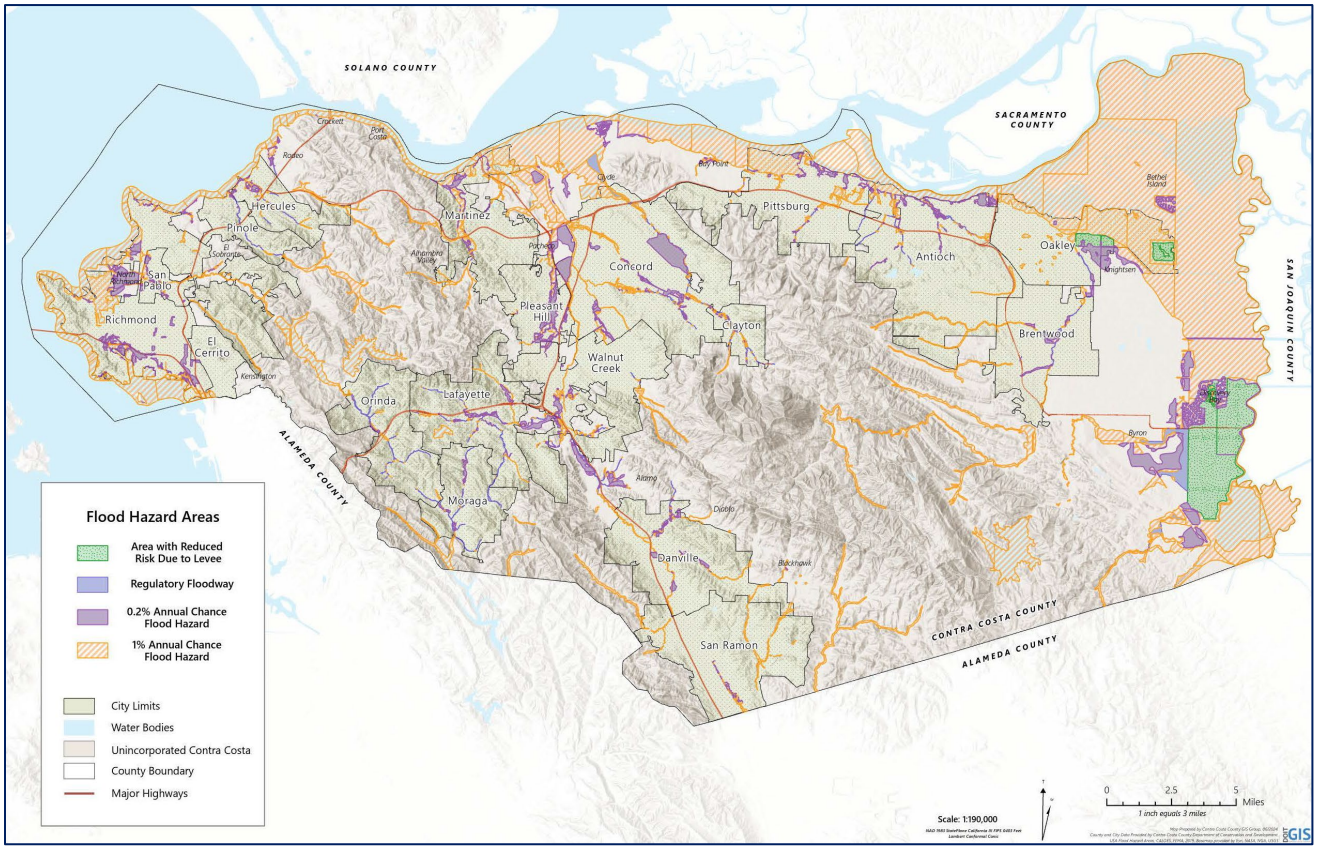
[161] Federal Emergency Management Agency. (2017). Flood Insurance Study: Contra Costa County, California and Incorporated Areas. Retrieved from https://www.contracosta.ca.gov/DocumentCenter/View/77626/Volumes-I-V?bidId=.

Eccleston Avenue Tributary	Mount Diablo Creek	Suisun Bay
Farm Bureau Road Drain	Mount Diablo Split Flow	Sycamore Creek
Galindo Creek	Murderers Creek	Tice Creek
Garrity Creek	North Branch Reliez Creek	Tice Creek Overflow
Grayson Creek	North Branch Stone Valley Creek	Walnut Creek
Green Valley Creek	Orinda Village Overflow	West Antioch Creek
Grizzly Creek	Overhill Creek	West Branch Alamo Creek
Happy Valley Creek	Overland Cross Section	West Branch East Antioch Creek
Hidden Valley Creek	Pacheco Creek	West Branch Refugio Creek
Hillcrest Branch East Antioch Creek	Payton Slough	Wildcat Creek
Homestead Creek	Pine Creek	Willow Creek

The Flood Insurance Rate Maps (FIRMs) show the flood zones, floodplain boundaries, and Base Floor Elevation (BFE) and are used for floodplain management, flood insurance ratings, and to determine flood insurance requirements. These maps show areas with a 1% chance of flooding each year, commonly known as the 100-year floodplains, and are shown as the Special Flood Hazard Areas (SFHA) in the FIRM maps.[162] The 500-year floodplains show areas with a 0.2% chance of flooding each year. **Figure 4-15** illustrates the Contra Costa County SFHA, including each Flood Zone, and the 500-year floodplain.

[162] Ibid.

Figure 4-15. Contra Costa County Floodplain



4.6.5.3. Hazard Extent/Intensity

The magnitude of flooding that is used as the standard for floodplain management in the United States is a flood with a probability of occurrence of 1% in any given year. This flood is also known as the 100-year flood or base flood. The most readily available source of information regarding the 100-year flood, as well as the 500-year flood (0.2 % probability of occurrence in any given year), is the FIRMs prepared by FEMA. These maps are used to support NFIP.

4.6.5.4. Warning Time

Flooding can be unexpected and leave a small window of time for evacuation, if it is required. The National Weather Service San Francisco Bay Area Forecast Office is responsible for issuing flood advisories in Contra Costa County. **Table 4-93** outlines the flood advisories issued by the NWS as conditions warrant.

Table 4-93. NWS Flood Advisories

Type	Definition
Flood Advisory	Issued when a flood event warrants notification but is less urgent than a warning. Advisories are issued for conditions that could cause a significant inconvenience, and if caution is not exercised, could lead to situations that may threaten life and/or property.
Flood Watch	Issued to indicate current or developing conditions that are favorable for flooding. The occurrence is neither certain nor imminent. A watch is typically issued within several hours to days ahead of the onset of possible flooding. In situations where a river or stream is expected to be the main source of the flooding, forecast confidence may allow for a Flood Watch to be issued several days in advance.
Flood Warning	Issued to inform the public of flooding that poses a serious threat to life and/or property. A Flood Warning may be issued hours to days in advance of the onset of flooding based on forecast conditions. Floods occurring along a river usually contain river stage (level) forecasts.
Flash Flood Watch	Issued to indicate current or developing conditions that are favorable for flash flooding. The occurrence is neither certain nor imminent. A watch is typically issued within several hours to days ahead of the onset of possible flash flooding.
Flash Flood Warning	Issued to inform the public, emergency management and other cooperating agencies that flash flooding is in progress, imminent, or highly likely. Flash Flood Warnings are urgent messages as dangerous flooding can develop very rapidly, with a serious threat to life and/or property. Flash Flood Warnings are usually issued minutes to hours in advance of the onset of flooding.

NWS issues Flash Flood Warnings Impact-Based Warnings for events that occur within approximately six (6) hours of heavy rainfall. The flash flood impact-based warnings fall into the three (3) categories listed in **Table 4-94**. [163]

Table 4-94. NWS Flash Flood Impact Based Warnings

Type	Definition
Base	Used most of the time when flash flood impact is possible.
Considerable	Used rarely, when there are indications flash flooding capable of unusual severity or impact is imminent or ongoing and urgent action is needed to protect lives and property. Will trigger the Wireless Emergency Alert system.
Catastrophic	Used exceedingly rarely, when a flash flood threat to life and catastrophic damage is occurring or is imminent, and floodwaters have risen or will rise to levels rarely if ever seen. Will trigger the Wireless Emergency Alert system.

When a river reaches flood stage, NWS River Forecast Centers convey the magnitude of observed forecast flooding using flood severity categories based on property damage and public threat. The three (3) flood severity categories are listed in **Table 4-95**. [164]

[163] National Weather Service. (2019). Impact-Based Flash Flood Warning. Retrieved from https://www.weather.gov/media/wrn/FFW-IBW-factsheet.pdf.
[164] National Oceanic and Atmospheric Administration, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Frequently Asked Questions About Floods. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/floods/faq/.

Table 4-95. NWS River Flood Severity Categories

Type	Definition
Minor Flooding	Minimal or no property damage, but possibly some public threat or inconvenience.
Moderate Flooding	Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
Major Flooding	Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.

4.6.5.5. Probability and Frequency

The probability of occurrence for flooding in Contra Costa County is medium because significant occurrences of this hazard are likely to occur within 25 years. However, isolated and lower-impact events occur with recurrent regularity. The number of years between floods of any given severity significantly varies due to a naturally changing climate. According to USGS, the reoccurrence interval is based on the probability that the given event will be equaled or exceeded in any given year based on past occurrences. The concept of reoccurrence intervals and probabilities is outlined in **Table 4-96**. [165]

Table 4-96. Recurrence Intervals and Probabilities of Occurrences

Recurrence Interval *(years)*	Probability of Occurrence In any Given Year	Percent Chance of Occurrence in Any Given Year
100	1 in 100	1
50	1 in 50	2
25	1 in 25	4
10	1 in 10	10
5	1 in 5	20
2	1 in 2	50

Probability of Future Hazard Events

The FEMA NRI analyses flooding data as riverine flooding – when streams and rivers exceed the capacity of their natural or constructed channels to accommodate water flow and water overflows the banks, spilling out into adjacent low-lying, dry land. [166] The riverine flooding annualized frequency value represents the average number of recorded riverine flooding hazard occurrences, in event days, per year over the period of record (24 years). **Table 4-97** outlines the annualized frequency for riverine flooding, based on FEMA NRI data, for Contra Costa County.

Table 4-97. Riverine Flooding Annualized Frequency *(FEMA National Risk Index)*

Location	Events on Record *(1996 – 2019)*	Annualized Frequency
Contra Costa County	31	1.3 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

[165] United States Geological Surve, New Jersey Water Science Center. (n.d.). Floods: Recurrence Intervals and 100-Year Floods. Retrieved from https://www.usgs.gov/centers/new-jersey-water-science-center/floods-recurrence-intervals-and-100-year-floods#data.
[166] Federal Emergency Management Agency. (n.d.). FEMA National Risk Index: Riverine Flooding. Retrieved from https://hazards.fema.gov/nri/riverine-flooding.

Repetitive Loss and Severe Repetitive Loss Properties

FEMA defines a Repetitive Loss property as an NFIP-insured property meeting at least one (1) of the following paid loss criteria since 1978, regardless of any changes in ownership:

- Four (4) or more separate claims payments greater than $5,000 each (including building and contents payment).
- Two (2) or more separate flood insurance claims payments (building payments only), where the total of the payments is greater than the property's current value.

Additionally, to receive a designation, at least two (2) of the claim payments must occur within 10 years of one another. [167]

A Severe Repetitive Loss property is defined by FEMA as any NFIP-insured single-family or multi-family residential building meeting at least one (1) of the following paid loss criteria since 1978 or from building constructed after 1978, regardless of any changes in ownership:

- That has incurred flood-related damage for which four (4) or more separate claims payments have been made, with the amount of each claim (including building and contents payments) exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000.
- For which at least two (2) separate claims payments (building payments only) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the building. [168]

Additionally, to receive designation, at least (2) of the claims must be within 10 years of each other. Claims within 10 days of each other will be counted as one (1) claim.

Refer to Section 3.11 of this Plan for a list of Contra Costa County jurisdiction participating in the NFIP and CRS.

Table 4-98 summarizes FEMA Repetitive Loss and Severe Repetitive Loss properties for each of the participating jurisdictions in Contra Costa County. [169]

[167] Federal Emergency Management Agency, National Flood Insurance Program. (2023). A Policyholder's Guide to Severe Repetitive Loss. Retrieved from https://agents.floodsmart.gov/sites/default/files/fema_nfip-policyholders-guide-severe-repetitive-loss_brochure_07-2023.pdf.
[168] Federal Emergency Management Agency, National Flood Insurance Program. (2021). National Flood Insurance Program: Flood Insurance Manual. Retrieved from https://www.fema.gov/sites/default/files/documents/fema_nfip-all-flood-insurance-manual-apr-2021.pdf.
[169] Federal Emergency Management Agency. (2024). OpenFEMA Dataset: NFIP Multiple Loss Properties - v1. Retrieved from https://www.fema.gov/openfema-data-page/nfip-multiple-loss-properties-v1.

Table 4-98. Contra Costa County Repetitive Loss and Severe Repetitive Loss Properties

Jurisdiction	Total Repetitive Loss Properties	Total Severe Repetitive Loss Properties	Mitigated Repetitive Loss and Severe Repetitive Loss Properties
Contra Costa County	22 *(**13** Single Family; **2** Two (2)-Four (4) Unit Residential Building; **1** More than Four (4) Units Residential Building; **3** Single-Family Residential Building; **1** Residential Condo; **2** Non-Residential Building)*	2 *(**1** Single Family; **1** More than Four (4) Units Residential Building)*	1 *(**1** Single Family)*
City of Brentwood	0	0	0
City of Clayton	0	0	0
Town of Danville	0	0	0
City of El Cerrito	3 *(**2** Single Family; **1** Residential (2, 3, or 4 units) Non-Condo Building)*	0	0
City of Hercules	0	0	0
City of Lafayette	2 *(**1** Single Family; **1** More than Four (4) Units Residential Building)*	0	0
City of Martinez	11 *(**4** Single Family; **3** Non-Residential Building; **2** Two (2)-Four (4) Unit Residential Building; **1** Single Family Residential Building; **1** Residential Non-Condo Building)*	1 *(**1** Single Family)*	0
Town of Moraga	0	0	0
City of Oakley	0	0	0
City of Orinda	2 *(**1** Single Family Residential Building; **1** Non-Residential Building)*	0	0
City of Pinole	0	0	0
City of Pleasant Hill	3 *(**3** Single Family)*	0	1 *(**1** Single Family)*
City of Richmond	5 *(**4** Single Family; **1** Non-Residential Building)*	1 *(**1** Single Family)*	1 *(**1** Single Family)*
City of San Pablo	7 *(**7** Single Family)*	0	0

Jurisdiction	Total Repetitive Loss Properties	Total Severe Repetitive Loss Properties	Mitigated Repetitive Loss and Severe Repetitive Loss Properties
City of San Ramon	1 *(**1** Single Family)*	0	0
City of Walnut Creek	3 *(**3** Single Family)*	1 *(**1** Single Family)*	3 *(**1** Single Family; **2** Two (2)-Four (4) Unit Residential Building)*

Occupancy Type: *Single Family = Single family residence • Two (2)-Four (4) Unit Residential Building = Two (2)-four (4) unit residential building • More Than Four (4) Units Residential Building = Residential building with more than four (4) units • Non-Residential Building = Non-residential building • Non-Residential Business = Non-residential business • Single Family Residential Building = Single-family residential building with the exception of a mobile home or a single residential unit within a multi-unit building • Residential (2, 3, or 4 units) Non-Condo Building = Residential non-condo building with two (2), three (3), or four (4) units seeking insurance on all units • Residential (5 or more units) Non-Condo Building = Residential non-condo building with 5 or more units seeking insurance on all units • Residential Mobile/Manufactured Home = Residential mobile/manufactured home • Residential Condo Association = Residential condo association seeking coverage on a building with one (1) or more units • Single Residential Unit = Single residential unit within a multi-unit building • Non-Residential Mobile/manufactured Home = Non-residential mobile/manufactured home • Non-Residential Building = Non-residential building • Non-Residential Unit = Non-residential unit within a multi-unit building*

4.6.5.6. Past Events

The National Center of Environmental Information (NCEI) has reported 58 flood events between 1950 and 2023 in Contra Costa County. Additionally, there have been eight (8) flood disasters declared in Contra Costa County between 1950 and 2023. A notable event occurred between December 26, 2022, through January 17, 2023, a series of six (6) storm systems moved through the San Francisco Bay area resulting in widespread flooding, including river flooding. In Contra Costa County, the event resulted in a series of Flood Warnings and rainfall amounts ranged from 6.2 inches to 20.07 inches. [170] On January 9, 2023, a Major Disaster Declaration (DR-3591) was issued for this event.

Table 4-99 lists flood events that have occurred in the Contra Costa County between 1950 and 2023 according to NCEI.

Table 4-99. Flood Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
CAMEO ACRES	Contra Costa County	CA	12/27/2022	06:00	Flood	0	0	0.01K	0.00K
SAN FRANCISCO BAY SHORELINE	San Francisco Bay Shoreline	CA	1/12/2021	11:00	Coastal Flood	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE	San Francisco Bay Shoreline	CA	1/11/2021	10:30	Coastal Flood	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE	San Francisco Bay Shoreline	CA	12/14/2020	10:48	Coastal Flood	0	0	0.00K	0.00K
SAN RAMON	Contra Costa County	CA	1/16/2020	11:09	Flood	0	0	0.00K	0.00K
MARTINEZ	Contra Costa County	CA	1/16/2020	09:31	Flood	0	0	0.00K	0.00K
PACHECO	Contra Costa County	CA	12/7/2019	14:28	Flood	0	0	0.00K	0.00K
WALNUT CREEK	Contra Costa County	CA	11/26/2019	20:15	Flood	0	0	0.00K	0.00K
ORINDA	Contra Costa County	CA	3/6/2019	05:13	Flood	0	0	0.00K	0.00K

[170] National Weather Service, San Francisco Bay Area, California Weather Forecast Office. (2023). A Parade of Storms Impact Bay Area. Retrieved from https://www.weather.gov/mtr/AtmosphericRivers_12_2022-01_2023.

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
LAS JUNTAS	Contra Costa County	CA	3/6/2019	02:17	Flood	0	0	0.00K	0.00K
HOOKSTON	Contra Costa County	CA	2/26/2019	04:35	Flood	0	0	0.00K	0.00K
OLEUM	Contra Costa County	CA	2/14/2019	07:28	Flood	0	0	0.00K	0.00K
RICHMOND	Contra Costa County	CA	2/14/2019	06:45	Flood	0	0	100.00K	0.00K
SAN PABLO	Contra Costa County	CA	2/13/2019	10:35	Flood	0	0	0.00K	0.00K
VINEHILL	Contra Costa County	CA	2/13/2019	08:00	Flood	0	0	0.00K	0.00K
MONSATO	Contra Costa County	CA	2/9/2019	23:26	Flood	0	0	0.00K	0.00K
ORINDA	Contra Costa County	CA	1/6/2019	16:05	Flood	0	0	0.00K	0.00K
WALNUT CREEK	Contra Costa County	CA	11/23/2018	15:29	Flood	0	0	0.00K	0.00K
SELBY	Contra Costa County	CA	4/7/2018	00:24	Flood	0	0	0.00K	0.00K
VINEHILL	Contra Costa County	CA	3/1/2018	10:38	Flood	0	0	0.00K	0.00K
SELBY	Contra Costa County	CA	3/1/2018	09:55	Flood	0	0	0.00K	0.00K
EAST RICHMOND	Contra Costa County	CA	1/9/2018	01:30	Flood	0	0	0.00K	0.00K
WALNUT CREEK	Contra Costa County	CA	1/9/2018	00:03	Flood	0	0	250.00K	0.00K
ALAMO	Contra Costa County	CA	1/8/2018	14:33	Flood	0	0	0.50K	0.00K
WALNUT CREEK	Contra Costa County	CA	1/8/2018	09:13	Flood	0	0	0.00K	0.00K
ORINDA	Contra Costa County	CA	4/7/2017	22:02	Flood	0	0	0.00K	0.00K
NEROLY	Contra Costa County	CA	1/8/2018	20:29	Flood	0	0	0.00K	0.00K
CLYDE	Contra Costa County	CA	2/20/2017	20:29	Flood	0	0	0.00K	0.00K
BYRON	Contra Costa County	CA	2/20/2017	20:29	Flood	0	0	0.00K	0.00K
ANTIOCH ARPT	Contra Costa County	CA	2/20/2017	18:54	Flood	0	0	0.00K	0.00K
PACHECO	Contra Costa County	CA	2/20/2017	17:49	Flood	0	0	0.00K	0.00K
TASSAJARA	Contra Costa County	CA	2/20/2017	16:00	Flood	0	0	0.00K	0.00K
CLAYTON	Contra Costa County	CA	2/20/2017	15:20	Flood	0	0	0.00K	0.00K
EAST RICHMOND	Contra Costa County	CA	2/20/2017	07:47	Flood	0	0	0.00K	0.00K
PLEASANT HILL	Contra Costa County	CA	2/20/2017	01:40	Flood	0	0	0.00K	0.00K
CLAYTON	Contra Costa County	CA	1/10/2017	19:42	Flood	0	0	0.00K	0.00K
GREENBROOK	Contra Costa County	CA	12/2/2012	08:56	Flood	0	0	0.50k	0.00K
ORINDA	Contra Costa County	CA	12/2/2012	00:00	Flood	0	0	250.00K	0.00K
ORINDA VLG	Contra Costa County	CA	1/19/2010	07:00	Flood	0	0	0.00K	0.00K
PITTSBURG	Contra Costa County	CA	1/19/2010	06:00	Flood	0	0	0.00K	0.00K
LOS MEDANOS	Contra Costa County	CA	1/19/2010	06:00	Flood	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
LOS MEDANOS	Contra Costa County	CA	10/13/2009	07:00	Flood	0	0	75.00K	0.00K
COUNTYWIDE	Contra Costa County	CA	1/1/2006	00:00	Flood	0	0	22.00M	0.00K
COUNTYWIDE	Contra Costa County	CA	12/31/2005	21:00	Flood	0	0	22.00M	0.00K
WALNUT CREEK	Contra Costa County	CA	12/14/2002	09:00	Flood	0	0	0.00K	0.00K
ORINDA	Contra Costa County	CA	2/13/2000	21:00	Flash Flood	0	0	100.00K	0.00K
WALNUT CREEK	Contra Costa County	CA	2/7/1998	13:00	Flash Flood	0	0	0.00K	0.00K
PITTSBURG	Contra Costa County	CA	2/3/1998	00:00	Flash Flood	0	0	0.00K	0.00K
WALNUT CREEK	Contra Costa County	CA	2/3/1998	00:00	Flash Flood	0	0	0.00K	0.00K
COUNTYWIDE	Contra Costa County	CA	1/25/1997	05:35	Flash Flood	0	0	0.00K	0.00K
COUNTYWIDE	Contra Costa County	CA	1/22/1997	14:15	Flash Flood	0	0	0.00K	0.00K
COUNTYWIDE	Contra Costa County	CA	1/2/1997	16:00	Flash Flood	0	0	0.00K	0.00K
COUNTYWIDE	Contra Costa County	CA	1/2/1997	11:45	Flash Flood	0	0	0.00K	0.00K
COUNTYWIDE	Contra Costa County	CA	1/2/1997	05:52	Flash Flood	0	0	0.00K	0.00K
COUNTYWIDE	Contra Costa County	CA	1/1/1997	10:40	Flash Flood	0	0	0.00K	0.00K
COUNTYWIDE	Contra Costa County	CA	1/1/1997	09:00	Flash Flood	0	0	0.00K	0.00K
COUNTYWIDE	Contra Costa County	CA	1/1/1997	07:18	Flash Flood	0	0	0.00K	0.00K
ORINDA	Contra Costa County	CA	12/22/1996	00:00	Flood	0	0	0.00K	0.00K
					TOTAL	**0**	**0**	**44.43M**	**0.00K**

4.6.5.7. Vulnerability and Impacts

Life Safety and Health: Most deaths during a flood occur when vehicles are driven into hazardous floodwater. Vehicles trying to drive through flooded areas or standing water can be swept away and potentially drown. Additionally, a number of hazards can be hidden below floodwaters which is why it is imperative to avoid floodwaters. Floodwater and standing water can make you vulnerable to infectious diseases, chemical hazards, and injuries.[171] Floods and their aftermath present numerous threats to public health and safety:

- **Unsafe food:** Floodwaters contain disease-causing bacteria, dirt, oil, human and animal waste, and farm and industrial chemicals. Their contact with food items, including food crops in agricultural lands, can make that food unsafe to eat. Refrigerated and frozen foods are affected during power outages caused by flooding. Foods in cardboard, plastic bags, jars, bottles, and paper packaging may be unhygienic with mold contamination.
- **Contaminated drinking and washing water, and poor sanitation:** Flooding impairs clean water sources with pollutants. The pollutants also saturate into the groundwater. Flooded wastewater treatment plants can be overloaded, resulting in backflows of raw sewage. Private wells can be

[171] Centers for Disease Control and Prevention. (2022). Flood Waters or Standing Waters. Retrieved from https://www.cdc.gov/healthywater/emergency/extreme-weather/floods-standingwater.html.

contaminated by floodwater. Additionally, private sewage disposal systems can become a cause of infection if they overflow.

- **Mosquitoes and animals:** Floods provide new breeding grounds for mosquitoes in wet areas and stagnant pools. The public should dispose of dead animals that can carry viruses and diseases only in accordance with guidelines issued by local animal control authorities. Leptospirosis—a bacterial disease associated predominantly with rats—often accompanies floods in developing countries, although the risk is low in industrialized regions unless cuts or wounds have direct contact with disease contaminated floodwaters or animals.
- **Mold and mildew:** Excessive exposure to mold and mildew can cause flood victims, especially those with allergies and asthma, to contract upper respiratory diseases, triggering cold-like symptoms. Molds grow in as short a period as 24 to 48 hours in wet and damp areas of buildings and homes that have not been properly cleaned after flooding (e.g., water-infiltrated walls, floors, carpets, toilets and bathrooms). Very small mold spores can be easily inhaled by human bodies and, in large enough quantities, cause allergic reactions, asthma episodes, and other respiratory problems. Infants, children, seniors, and pregnant women are considered most vulnerable to mold-induced health problems.
- **Carbon monoxide poisoning:** In the event of power outages following floods, some people use alternative fuels for heating or cooking in enclosed or partly enclosed spaces, such as small gasoline engines, stoves, generators, lanterns, gas ranges, charcoal or wood. Built-up carbon monoxide from these sources can poison people and animals.
- **Hazards when reentering and cleaning flooded homes and buildings:** Flooded buildings can pose significant health hazards to people entering them. Electrical power systems can become hazardous, and gas leaks can trigger fire and explosions. Flood debris (e.g., broken bottles, wood, stones and walls) may cause injuries to those cleaning damaged buildings. Additionally, containers of hazardous chemicals may be buried under flood debris. Hazardous dust and mold can circulate through a building and be inhaled by those engaged in cleanup and restoration.
- **Mental stress and fatigue:** People who live through a devastating flood can experience long term psychological impact. The expense and effort required to repair flood-damaged homes places severe financial and psychological burdens on the people affected. Post-flood recovery can cause anxiety, anger, depression, lethargy, hyperactivity, and sleeplessness. There is also a long-term concern among the affected that their homes could be flooded again in the future.

Everyone in Contra Costa County is vulnerable to flooding, but those within the SFHA (i.e., 100-year floodplain) are at a higher risk, followed by those within the 500-year floodplain. However, the underserved and at risk population face unique vulnerabilities and impacts as a result of flooding. These groups include, but are not limited to, households in poverty, low income households, population living in single access roads, people with limited English proficiency, individuals without access to lifelines, the elderly population (including those with access and functional needs), and undocumented individuals.[172]

- **Households in Poverty and Low Income Households:** Households in poverty include those with an income at or below $24,300 for a household of four (4). In Contra Costa County, most households considered to live in poverty are located within the 100-year flood zone and households affected by coastal flooding are primarily located within North Richmond, Bay Point,

[172] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.

and the tracts and islands in the Delta. The low income population includes households with an income of 80% or less of the median income ($104,400) in Contra Costa County. This population tends to be less likely to evacuate in response to emergency incidents. Furthermore, households in poverty and low income households may have fewer financial resources to complete preparedness and recovery activities (i.e., fix flood damage) and the structures are not waterproofed or built above the current 100-year flood elevation. High concentration of this population is located within or near a flood zone or dam inundation area, mostly in the north and east portion of the County.

- **Individuals Living on Single Access Roads:** Includes the population living in areas with a single route in and out (i.e., accessible via one (1) roadway) of the neighborhood or area. This population is uniquely vulnerable to flooding if these roadways are blocked, damaged, and destroyed these individuals can become isolated from the community and emergency services. In Contra Costa County, several neighborhoods and communities in the Delta and in the hillside areas in the central and western side of the County are only accessible via one (1) roadway.
- **People with Limited English Proficiency:** This group includes those that speak English “less than very well”, per the United States Census Bureau definition. In Conta Costa County, 158,965 people (38.2%) have limited English proficiency (i.e., speak English “less than very well”). This population are more likely to live in low income areas which are also most likely to be located within low lying areas. Flooding can cause significant damage to homes resulting in uninhabitable and unhealthy conditions to live in. Additionally, individuals with limited English proficiency may have limited access to information and resources designed to prevent or mitigate flooding risk due to language or cultural differences.
- **Individuals Without Access to Lifelines:** Includes individuals who do not have access to basic technology or services (e.g., transportation, modern communication). This population is vulnerable because not having access to these can create barriers to prepare and respond to emergency events (e.g., flooding), may be unable to evacuate in a timely manner, and may become isolated if transit services are not operating. For example, this population may be unaware of an approaching weather event and may be unable to evacuate in a timely manner in the event an evacuation order is issued.
- **Senior (65 years old and over):** The elderly population (i.e., seniors), especially those with access and functional needs, may have physical limitations that make it harder to evacuate in the event of an emergency, such as flooding. Furthermore, the elderly population may lack access to social connections and community support that can assist in preparing for and responding to emergency events, evacuating, improving home resiliency, managing medical needs, and locating support services. A high concentration of the elderly population lives in central Contra Costa County, Bethel Island, eastern part of Richmond, and several parts of Walnut Creek.
- **Undocumented Individuals:** Includes people who do not have formal permission to live in the United States (i.e., do not have citizenship, permanent residency, visas, or other similar status). This population is most likely to fall in the households in poverty and low income categories, which are considered to be at risk populations during a flooding event and are more likely to live in low lying areas in structures that are not waterproofed or build above the 100-year flood elevations.

Table 4-100 summarizes the vulnerable and at-risk population for flooding in Contra Costa County.

Table 4-100. Vulnerability and At Risk Population

Category	Estimate	Percent
Households in Poverty[173]	7,600	12.0%
Low Income Households[174]	25,340	41.0%
Spanish Spoken at Home[175]	204,442	18.7%
Speak English "Less than very well"[176]	158,965	38.2%
Language Other than English[177]	416,505	38.0%
Foreign Born[178]	312,050	27.0%
Households Without Vehicle[179]	8,872	1.6%
65 Years and Over[180]	201,136	17.4%
Seniors (65 years and over) Living Alone[181]	45,672	22.7%
Undocumented Individuals[182]	There are no official counts of how many undocumented individuals live in Contra Costa County, but in 2019 there was an estimate of 63,000.	

Table 4-106 outlines the vulnerability of the total population exposed to floods, and **Table 4-107** outlines the flood impacts to population and life safety, underserved/equity population, and essential operations, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Property Damage and Critical Infrastructure: In Contra Costa County, there is a range from the large, state-owned bridges that carry interstate freeways, to locally owned bridges that carry rural roads and pedestrians over small creeks. Countywide, there are over 400 bridges where approximately 80 are owned by the County and 160 are owned by Caltrans. There are 26 bridges that are within the 100-year flood zone and dam inundation areas. Some of these bridges are located in low lying areas that could become flooded during a heavy rainfall event. Additionally, flood control infrastructure (i.e., levees, dikes,

[173] Ibid.
[174] Ibid.
[175] United States Census Bureau. (2022). S1601: Language Spoken at Home (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S1601?g=050XX00US06013.
[176] Ibid.
[177] Ibid.
[178] United States Census Bureau. (2022). DP02: Selected Social Characteristics in the United States (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP02?g=050XX00US06013.
[179] United States Census Bureau. (2022). S0801: Commuting Characteristics by Sex. Retrieved from https://data.census.gov/table/ACSST1Y2022.S0801?g=050XX00US06013.
[180] United States Census Bureau. (2022). DP05: Demographics and Housing Estimates (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP05?g=050XX00US06013.
[181] United States Census Bureau. (2022). DP02: Selected Social Characteristics in the United States (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP02?g=050XX00US06013.
[182] Migration Policy Institute. (2019). Profile of the Unauthorized Population: Contra Costa County, CA. Retrieved from https://www.migrationpolicy.org/data/unauthorized-immigrant-population/county/6013.

and drainage channels), meant to prevent the creeks, Delta, and other bodies of water from overflowing and causing floods can fail and cause flooding in these areas. Although the Contra Costa County Flood Control District is responsible for local flood control projects, many of these levees and drainage facilities in the Delta region of the County are privately owned and operated. Interstate 680 and 80, and State Route 4, along with many regional roadways, are within flooding zones. Flooding to these roadways and other local roadways can cause major disruptions to local and regional transportation, transit, and commuters.

There are three (3) standard rail lines that run through Contra Costa County which are operated by Union Pacific, Burlington Northern Santa Fe, and Richmond Pacific Railroad Corporation. These run along the western, northern, and eastern boundaries of the County, along Interstate 80, State Route 4, and Byron Highway. The aforementioned rail lines are used for freight trains; however, the Capitol Corridor commuter train runs along the Union Pacific railway. Additionally, the Bay Area Rapid Transit District (BART) operates its own separate rail lines used exclusively for public transit. Two (2) BART rail lines are located in the County – one beginning in Richmond and heading south toward Berkeley and another one in the central part of the County extending from the City of Orinda to the City of Antioch. The BART, Amtrak, and the freight lines are located within the flood areas in coastal and northern Contra Costa County. Flooding can cause damage to the tracks and result in the system to completely shutting down.

There are 10 wastewater treatment plants in the County which treat wastewater for residents within cities and unincorporated County. Two (2) of these wastewater treatment plants are within the 100-year and 500-year floodplain. Furthermore, one (1) is located within a dam inundation area, including the West Contra Costa and Pinole-Hercules plants. Additionally, if the Delta levee fails the Mokelumne Aqueduct could be exposed to coastal flooding. The Contra Costa Canal and the Clifton Court Forebay are also within the coastal flooding area. In the event that these levees fail during a coastal flooding event, these water and wastewater infrastructure would also fail resulting in the contamination of freshwater, reducing the availability of drinking and agricultural water.

In Contra Costa County, there are approximately 61 industrial buildings within the coastal flooding areas, 68 are within the 500-year floodplain. Industrial buildings located outside the 100-year floodplain are unlikely to be waterproofed or flood resistant. If any of these structures are damaged due to flooding, it can increase the potential of a hazardous materials release.[183]

There are a total of 554 critical assets (i.e., schools, nursing homes, fire stations, police stations, and hospitals) throughout the County, and 14 (2.5%) are located within the 100-year floodplain (i.e., SFHA) and 24 (4.3%) are located within the 500-year floodplain. **Table 4-101** provides a breakdown of critical assets that are located within the floodplains in Contra Costa County.

Table 4-101. Critical Assets in the 100-Year and 500-Year Floodplains

Asset	Estimate	Percent *(of total asset)*
100-Year Floodplain		
Schools *(public schools, private schools)*	5	1.4%
Nursing Homes	1	1.3%
Fire Stations	7	8.6%

[183] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.

Asset	Estimate	Percent *(of total asset)*
Police Stations	1	4.2%
Hospitals	0	0.0%
500-Year Floodplain		
Schools *(public schools, private schools)*	12	3.3%
Nursing Homes	4	5.1%
Fire Stations	7	8.6%
Police Stations	0	0.0%
Hospitals	1	9.1%

Locations that are directly flooded experience the greatest economic impact. In these areas, renovations of commercial buildings may be necessary, disrupting associated services. Significant damage may occur in agricultural areas, with destruction of crops and other agricultural products. The tourism industry may be affected by major flood events, as popular vacation areas tend to overlap flood hazard zones. Also, flooding in major roadways can disrupt local and regional transportation and transit and if commuters in the Bay Area are unable to reach their jobs, large sections of the economy can be affected. Additionally, flooding can cause damage to the rail and BART lines resulting in a shutdown which can disrupt regional transit networks that are essential to the economic activity of the County and region. Loss of power and communications may occur; and drinking water and wastewater treatment facilities may be temporarily out of operation.

Table 4-106 outlines the total property value exposed to floods and how the changes in development in the past five (5) years have affected the vulnerability of the community to floods. **Table 4-107** outlines the flood impacts on total property damage, potential future development, and the economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Building damage as a result of a 100-year flood analysis was estimated using Hazus. In addition, annualized losses were calculated. *Refer to the Hazus portion at the end of this section (Section 4.6.5.7).*

Environment: The environment vulnerable to flood hazard is the same as the environment exposed to the hazard. Loss estimation platforms such as Hazus are not currently equipped to measure environmental impacts of flood hazards. The best gauge of vulnerability of the environment would be a review of damage from past flood events. Loss data that segregates damage to the environment was not available at the time of this Plan. Capturing this data from future events could be beneficial in measuring the vulnerability of the environment for future updates. While the vulnerability assessment focuses on human vulnerability to flood events, the impact of human activities on flooding is also worth noting. Due to negative impacts of floods, many structural and other measures have been devised to limit how far a floodplain can extend. However, floodplains have many natural and beneficial functions, and disruption of natural systems can have long-term consequences for entire regions.

In Contra Costa County, the wetland ecosystems, located adjacent to the San Francisco Bay and Delta, include permanent wetland, seasonal wetland, fresh emergent wetland, alkali wetland, and marshes. Wildlife in these ecosystems includes great blue heron, great egret, wood duck, green-winged teal, mallard, California red-legged frog, western pond turtle, garter snakes, western spadefoot toad, western toad, California tiger salamander, tri-colored blackbird, and vernal pool fairy shrimp. It is forecast that coastal flooding will inundate most of the wetland and tidal marshes in Contra Costa County by 2070.

The wildlife habitat, recreation, and flood protection that these ecosystems provide may not be able to be sustained.

Additionally, flooding can disrupt water and wastewater services, and failure of these treatment plants can result in sewer systems to backup which can potentially contaminate creeks, streams, and water systems with raw sewage. Contra Costa County currently has 10 wastewater treatment plants, some of which are located within the 100-year and 500-year floodplain. Furthermore, industrial buildings that sustain flood damage can result in a hazardous materials event which can contaminate soil, water, and aid. Contra Costa County has approximately 270 industrial buildings, many of which are within flooding areas.[184]

Table 4-107 outlines flood impacts on the environment, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Changes in Development and Impact of Future Development: There have been no significant changes in development that have affected the risks associated with flooding. Future increases in population within the SHFA may expose more of the population to floods. Growth over the past decade has considerably increased. Between 2010 and 2022, as outlined in **Table 3-3**, the population in Contra Costa County grew 10.6%, from 1,046,025 to 1,156,966 residents. The Bay Area Association of Governments (ABAG) growth forecasts predict a steady increase in households through 2050. From 2015 to 2050, ABAG projects that the County's number of households will grow by 44%.[185] This increase in population can add an additional strain to first responders in the event of an evacuation due to flooding.

Table 4-106 outlines how the changes in development in the past five (5) years have affected the vulnerability of the community to floods. **Table 4-107** outlines the flood impacts on potential future development, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Effects of Climate Change in Severity of Impacts: As global average temperatures increase, evaporation increases adding moisture into the atmosphere which results in more precipitation.[186] In California and western United states, observations of climate change have shown sea level rise is expected to continue to increase flooding on coastal areas. Additionally, scientists project that the frequency and intensity of heavy rainfall (e.g., atmospheric rivers), and associated floods in the County will increase. Although heavy precipitation does not necessarily result in flooding, the potential increases and in some location moderate amounts of precipitation can lead to serious damage.[187]

Table 4-102 indicates the 25-year precipitation projections in Contra Costa County.[188] **Table 4-103** outlines the flood associated climate indicators for Contra Costa County projected through the end of the century.[189]

[184] Ibid.
[185] Bay Area Association of Government. (2020). Plan Bay Area 2050 Final Blueprint Growth Pattern. Retrieved from https://planbayarea.org/digital-library/plan-bay-area-2050-final-blueprint-growth-pattern.
[186] Environmental Protection Agency. (n.d.). Climate Change Indicators: U.S. and Global Precipitation. Retrieved from https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-precipitation.
[187] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.
[188] Northeast Regional Climate Center. (n.d.). Neighborhoods at Risk: Climate Projections. Retrieved from https://nar.headwaterseconomics.org/.
[189] Climate Mapping for Resilience and Adaptation. (n.d.). Climate Mapping for Resilience and Adaptation Assessment Tool. Retrieved from https://livingatlas.arcgis.com/assessment-tool/explore/details.

Table 4-102. 25-Year Precipitation Projections for Contra Costa County

Higher Emissions (RCP8.5)
By 2048, Contra Costa County is expected to have a 0.4 inches increase (from 19.6 inches to 20.1 inches) in average annual precipitation.
Lower Emissions (RCP4.5)
By 2048, Contra Costa County is expected to have a 0.15 inches increase (from 19.11 inches to 19.26 inches) in average annual precipitation.

Table 4-103. Future Climate Indicators for Contra Costa County

Indicators	Modeled History (1976 – 2005)	Early Century (2015 – 2044)		Mid Century (2035 – 2064)		Late Century (2070 – 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min – Max	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*
Precipitation							
Average annual total precipitation	**19 inches**	**19 inches**	**20 inches**	**20 inches**	**20 inches**	**20 inches**	**21 inches**
	17 – 21	16 – 25	17 – 24	17 – 26	16 – 25	16 – 25	14 – 27
Days per year with precipitation *(Wet Days)*	**84 days**	**82 days**	**82 days**	**80 days**	**80 days**	**80 days**	**77 days**
	80 – 88	74 – 91	74 – 91	68 – 91	69 – 98	70 – 90	58 – 94
Maximum period of consecutive wet days	**11 days**	**11 days**	**12 days**	**11 days**	**11 days**	**11 days**	**11 days**
	10 – 12	10 – 14	10 – 14	9 – 14	9 – 15	10 – 15	8 – 17
Temperature Thresholds							
Annual days with total precipitation greater than 1 inch	**2 days**	**3 days**	**3 days**	**3 days**	**3 days**	**3 days**	**4 days**
	2 – 3	2 – 4	2 – 4	2 – 5	2 – 5	2 – 5	2 – 7
Annual days with total precipitation greater than 2 inches	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**
	0 – 0	0 – 1	0 – 1	0 – 1	0 – 1	0 – 1	0 – 1
Annual days with total precipitation greater than 3 inches	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**
	0 – 0	0 – 0	0 – 0	0 – 0	0 – 0	0 – 0	0 – 0
Annual days that exceed 99th percentile precipitation	**4 days**	**5 days**	**5 days**	**5 days**	**5 days**	**5 days**	**6 days**
	3 – 7	3 – 8	3 – 8	3 – 8	3 – 9	3 – 9	4 – 11
Days with maximum temperature below 32°F	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**	**0 days**
	0 – 0	0 – 0	0 – 0	0 – 0	0 – 0	0 – 0	0 – 0

Table 4-107 outlines the climate change impacts to floods in Contra Costa County, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Table 4-104. Probability of Occurrence

Hazard Event	Probability of Occurrence		Probability Factor	Weighted Factor
Urban/Flash Flooding	Medium	Significant hazard event is likely to occur within 25 years.	2	N/A
Riverine/Creek Flooding	Medium	Significant hazard event is likely to occur within 25 years.	2	N/A

Table 4-105. Extent Factors

Hazard Event	Extent Factor	Extent		Extent Factor	Weighted Factor
Urban/Flash Flooding	***Extent/Intensity***	High	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a high-intensity incident.	3	9
	Catastrophic	Medium	Catastrophic hazard event is likely to occur at least once between 11 and 50 years.	2	6
Riverine/Creek Flooding	***Extent/Intensity***	Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2	6
	Catastrophic	Medium	Catastrophic hazard event is likely to occur at least once between 11 and 50 years.	2	6

Table 4-106. Vulnerability Factors

Hazard Event	Vulnerability Factor	Vulnerability		Vulnerability Factor	Weighted Factor
Urban/Flash Flooding	***Population Exposure***	Medium	15% to 29% of the population (including underserved population) is exposed to the hazard.	2	6
	Property Exposure	Medium	10% to 24% of the total assessed property value is exposed to the hazard.	2	4
	Changes in Development	Medium	The changes in development have increased the vulnerability of the community to the hazard between 5% and 9%.	2	2
Riverine/Creek Flooding	***Population Exposure***	Low	14% or less of the population is exposed to the hazard.	1	3
	Property Exposure	Low	9% or less of the total assessed property value is exposed to a hazard.	1	2
	Changes in Development	Medium	The changes in development have increased the vulnerability of the community to the hazard between 5% and 9%.	2	2

Table 4-107. Impact Factors

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
Urban/Flash Flooding	***Population and Life Safety***	Medium	Populations exposed to this hazard are likely to experience some adverse impacts, such as injuries requiring acute medical care.	2	6
	Underserved/Equity	Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2	6
	Property Damage	High	More than $5 Million in property damages is expected from a single major hazard event, or damages are expected to occur to 15% or more of the property value within the jurisdiction.	3	6
	Economic	Medium	Total economic impact is likely to be greater than $500,000, but less than or equal to $10 Million.	2	2
	Environmental	Medium	Environmental impact from a single major hazard event is likely to be localized, requiring some outside resources and support; and/or repair, clean-up, restoration, or preservation work.	2	2
	Essential Operations	Medium	Impact between 24 and 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	2	2
	Future Development	Medium	Future development trends will increase the impact/consequence of this hazard, but not significantly.	2	2
	Climate Change	High	Climate Change trends will significantly increase the risk of this hazard and its impacts.	3	3
Riverine/Creek Flooding	***Population and Life Safety***	Medium	Populations exposed to this hazard are likely to experience some adverse impacts, such as injuries requiring acute medical care.	2	6
	Underserved/Equity	Low	Underserved populations exposed to the hazard are likely to experience minimal adverse/disproportionate impacts, such as ambulatory injuries.	1	3
	Property Damage	High	More than $5 Million in property damages is expected from a single major hazard event, or damages are expected to occur to 15% or more of the property value within the jurisdiction.	3	6
	Economic	Medium	Total economic impact is likely to be greater than $500,000, but less than or equal to $10 Million.	2	2
	Environmental	Medium	Environmental impact from a single major hazard event is likely to be localized, requiring some outside resources and support; and/or repair, clean-up, restoration, or preservation work.	2	2

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
	Essential Operations	Medium	Impact between 24 and 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	2	2
	Future Development	Medium	Future development trends will increase the impact/consequence of this hazard, but not significantly.	2	2
	Climate Change	High	Climate Change trends will significantly increase the risk of this hazard and its impacts.	3	3

HAZUS

Scenario: 100-Year Flood

Building damage as a result of a 100-year flood analysis was estimated using Hazus. In addition, annualized losses were calculated. Hazus estimates that there are 341,451 buildings in the region which have been an aggregated total replacement of $218.5 Million. Approximately 91.1% of the buildings are associated with residential housing. **Table 4-108** provides a general distribution of the building value within Contra Costa County. In terms of building construction types found in the County, wood frame construction makes up 89.0% of the building inventory and the remaining 11.0% is distributed between the other general building types (i.e., steel, concrete, precast, reinforced masonry, unreinforced masonry, manufactured housing).

Table 4-108. Contra Costa County Population and Building Value Data

Population	Residential Building Value	Non-Residential Building Value	Total
1,165, 466	$158.1 Million	$60.3 Million	$218.5 Million

The total economic loss estimated for the flood is $9.952 Million, representing 24.1% of the total replacement value of the scenario buildings. HAZUS estimates that about 8,489 buildings will be at least moderately damaged. This is over 62% of the total number of buildings in the scenario. There is an estimated 559 building that will be completely destroyed. **Table 4-109** summarizes the expected damage by general occupancy for the buildings in Contra Costa County.

Table 4-109. 100-Year Flood Expected Building Damage by Occupancy

Damage Level	1 – 10		11 – 20		21 – 30		31 – 40		41 – 50		>50	
Occupancy	***Count***	***%***	***Count***	***%***	***Count***	***%***	***Count***	***%***	***Count***	***%***	***Count***	***%***
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	223	36	370	59	27	4	6	1	0	0	0	0
Education	4	100	0	0	0	0	0	0	0	0	0	0
Government	45	55	37	44	0	0	1	1	0	0	0	0
Industrial	23	28	40	49	8	10	9	11	1	1	0	0
Religion	3	50	3	50	0	0	0	0	0	0	0	0
Residential	2,333	23	3,786	37	1,854	18	1,154	11	634	6	559	5
TOTAL	**2,633**		**4,236**		**1,889**		**1,170**		**635**		**559**	

Table 4-110 summarizes the expected damage by general building type.

Table 4-110. Expected Building Damage by Building Type

Building Type	1 – 10		11 – 20		21 – 30		31 – 40		41 – 50		>50	
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
Concrete	113	36	167	53	30	9	5	2	3	1	0	0
Manufactured Housing	26	9	24	8	22	7	0	0	21	7	204	69
Masonry	83	31	141	53	35	13	5	2	3	1	0	0
Steel	49	33	81	54	14	9	3	2	2	1	0	0
Wood	2,312	23	3,774	38	1,756	18	1,143	11	603	6	355	4

For essential facilities, there are 14 hospitals in the County with a total bed capacity of 1,804 beds. There are 384 schools, 78 fire stations, 35 police stations and two (2) emergency operation centers. With respect to high potential loss facilities, there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no nuclear power plants.

The Hazus model estimates the time to restore critical facilities to fully functional use. Before the flood event, Contra Costa County had 1,804 hospital beds available for use. On the day of the flood event, Hazus estimates that 1,804 hospital beds (100%) are available. **Table 4-111** summarizes the expected damage to essential facilities in Contra Costa County. None of the essential facilities listed are expected to be damaged due to the flood event.

Table 4-111. 100-Year Flood Expected Damage to Essential Facilities

Facility	Total	At Least Moderate	At Least Substantial	Loss of Use
Hospitals	14	0	0	0
Schools	384	0	0	0
Emergency Operations Center	2	0	0	0
Police Stations	35	0	0	0
Fire Stations	78	0	0	0
TOTAL	**384**	**0**	**0**	**0**

Flood events also impact the economy, including loss of business function, damage to inventory (i.e., buildings, transportation, and utility systems), relocation costs, wage loss, and rental loss due to repair and replacement of buildings. Hazus estimates building-related economic losses, including income losses (i.e., wage, capital-related, rental, and relocation losses) and capital stock losses (i.e., structural, non-structural, content, and inventory losses).

Hazus estimates total building related losses were $5.001 Million where 50.0% of the losses were related to business interruption in Contra Costa County. The analysis concluded that the largest loss was sustained by the residential occupancies, which comprised 52% of the total loss.

The total building related losses were $5.001 Million. 50% of the estimated losses were related to the business interruption of Contra Costa County. The residential occupancies made up 30.6% of the total

loss. **Table 4-112** provides a summary of the losses associated with the building damage in Millions of dollars.

Table 4-112. 100-Year Flood Building Related Economic Loss Estimates *(Millions of Dollars)*

	Area	Residential	Commercial	Industrial	Others	Total
Building Loss	Building	1,481.3	352.1	101.3	96.3	2,030.9
	Content	867.8	1,099.4	218.6	544.0	2,729.7
	Inventory	0.0	195.2	31.4	14.0	240.7
	TOTAL	**2,349.1**	**1,646.7**	**351.3**	**654.3**	**5,001.3**
Business Interruptions	Income	39.6	778.0	7.4	193.4	1,018.6
	Relocation	343.0	261.8	8.4	132.6	745.7
	Rental Income	221.8	169.8	2.1	27.4	421.0
	Wage	93.2	880.7	12.8	1,778.7	2,765.4
	TOTAL	**697.5**	**2,090.3**	**30.6**	**2,132.3**	**4,950.6**
SUBTOTAL		**3,046.5**	**3,737.0**	**381.9**	**2,786.6**	**9,952.0**

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood incident and associated potential evacuation, and the number of displaced individuals that will require accommodations in temporary public shelters. The model estimates 23,642 households (70,926 people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 4,961 people (out of a total population of 1,165,466) will seek temporary shelter in public shelters.

Hazus estimates the amount of debris that will be generated by the flood event. Debris estimates were divided into three (3) categories – finishes (e.g., dry wall, insulation), structural (e.g., wood, brick), and foundations (e.g., concrete slab, concrete block, and rebar). The distinction is made because of the different types of materials handling equipment required to handle debris.

The analysis estimated that a total of 78,790 tons of debris will be generated. Of the total amount, 78.0% is comprised of finishes, 11.0% is structural, and 12.0% is foundation. If the debris tonnage is converted to an estimated number of truckloads, it will require 3,152 truckloads (25 tons/truck) to remove the debris.

4.6.5.8. FEMA NRI Expected Annual Loss Estimates

A riverine flooding NRI EAL score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to riverine flooding when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-113** outlines the riverine flooding EAL for Contra Costa County.

Table 4-113. Riverine Flooding Expected Annual Loss *(FEMA National Risk Index)*

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Contra Costa County	$4.0 Million	$4.1 Million	$291,636	$8.4 Million	96.3	Very High
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.5.9. FEMA Flooding Risk Index Scores

The riverine flooding Risk Index score and rating represent a community's relative risk for riverine flooding when compared to the rest of the United States. **Table 4-114** illustrates the riverine flooding Risk Index rating and score for Contra Costa County.

Table 4-114. Riverine Flooding Risk Index *(FEMA National Risk Index)*

Jurisdiction	Rating	Score
Contra Costa County	Very High	96.2
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

Table 4-115 represents the Flooding Total Risk Score for Contra Costa County, based on the Risk Assessment Methodology, as defined in this Plan. For further details on how the probability, extent, vulnerability, and impact factors were calculated, please refer to **Table 4-104** through **Table 4-107**. Additional details on how the Total Risk Score was calculated can be found in the Risk Assessment Methodology in Section 4.3 of this Plan.

Table 4-115. Flooding Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Urban/Flash Flooding	2	15	12	29	56	55
Riverine/Creek Flooding	2	12	7	29	48	48

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.6. Landslide

4.6.6.1. Description

A landslide is the movement of a mass of rock, debris, or earth down a slope. Landslides are a type of "mass wasting," which denotes any downslope movement of soil and rock under the direct influence of gravity. The landslide term is comprised of five (5) types of slope movement – falls, topples, slides, spreads, and flows – which are further subdivided by the type of geologic material (i.e., bedrock, debris, or earth). [190] Slope movement occurs when forces acting downslope exceed the strength of the earth's material that compose the slope. The modes of slope movement are listed in **Table 4-116**. [191]

Table 4-116. Types of Slope Movement

Type	Description
Falls	Masses of soil or rock that dislodge from steep slopes and free fall, bounce, or roll downslope.
Topples	Move by the forward pivoting of a mass around an axis below the displaced mass.
Slides	Displaced masses of material along one (1) or more discrete planes. There are two (2) types of sliding – rational and translational. • Rotational sliding the slide plane is curved and the mass rotates backwards around an axis parallel to the slope. • Translational sliding the failure surface is more or less planar and the mass moves parallel to the ground surface.
Lateral Spreads	Move by horizontal extension and shear or tensile fractures and are commonly induced by liquefaction of material in an earthquake.
Flows	Mobilize as a deforming, viscous mass without a discrete failure plane.
Complex	Occurs when more than one (1) type of movement occurs sequentially during a failure.
Composite	Occurs when more than one (1) type of movement does not occur sequentially during a failure.

Landslides are an important natural process because they shape the Earth's landscape and contribute to the overall environmental quality of a region. However, when landslides impact people, property, or infrastructure it is considered a natural hazard. Landslides can occur in slopes already on the verge of movement by rainfall, snowmelt, changes in water level, stream erosion, changes in ground water, earthquake, volcanic activity, disturbance by human activities, or any combination of these factors. [192] The California Department of Conservation (CDC) classifies landslides into the six (6) categories listed in **Table 4-117**.

[190] United States Geological Survey. (n.d.). What is a Landslide and What Causes One? Retrieved from https://www.usgs.gov/faqs/what-landslide-and-what-causes-one.
[191] California Department of Conservation. (n.d.). Landslides. Retrieved from https://www.conservation.ca.gov/cgs/landslides.
[192] United States Geological Survey. (n.d.). What is a Landslide and What Causes One? Retrieved from https://www.usgs.gov/faqs/what-landslide-and-what-causes-one.

Table 4-117. Types of Common Landslide [193]

Type	Description
Earth Flows	The majority of the soil materials are fine-grained, cohesive silt and clay and occur in moderately steep slopes (10% to 30% grade). Earth flows are slow moving (centimeters or millimeters over a period of days or weeks) and are often triggered by periods of prolonged rainfall and sometimes do not occur until well after a rainfall event or the rainy season.
Debris Flows	The majority of the soil is coarse-grained (e.g., fine sand to boulder size particles) and non-cohesive and commonly begin as a slide of a shallow mass of soil and weathered rock. Debris flows tend to be small in areal extent and their deposits are relatively thin.
Debris Slide	The majority of the soil is coarse-grained, most common in unconsolidated sandy or gravelly units, but also are common in residual soils that form in-place weathering of relatively hard rock. Debris slides tend to occur on very steep slopes (60% to 70% grade) where the base of the slope is undercut with erosion. These move at rates between meters per day to meters per minute and are often triggered after a single heavy rainstorm or series to storms that deliver enough rain to trigger a debris slide.
Rockslides	Involves bedrock in which the rock that moves remains largely intact for at least a portion of the movement. Rockslides occur in a variety of sizes on a variety of gradients (35% to 70% grade) and have a range of triggering mechanism.
Rock Falls	Occurs when a mass of rock detaches from a steep slope by sliding, spreading, or toppling and descends mainly through the air by falling, bouncing, or rolling. Rock falls can be triggered by intense rain, earthquakes, and freeze-thaw wedging.

Additionally, earthquake shaking can induce underwater landslides (i.e., submarine landslides) which can cause tsunamis potentially resulting in damage to coastal areas.

4.6.6.2. Hazard Location

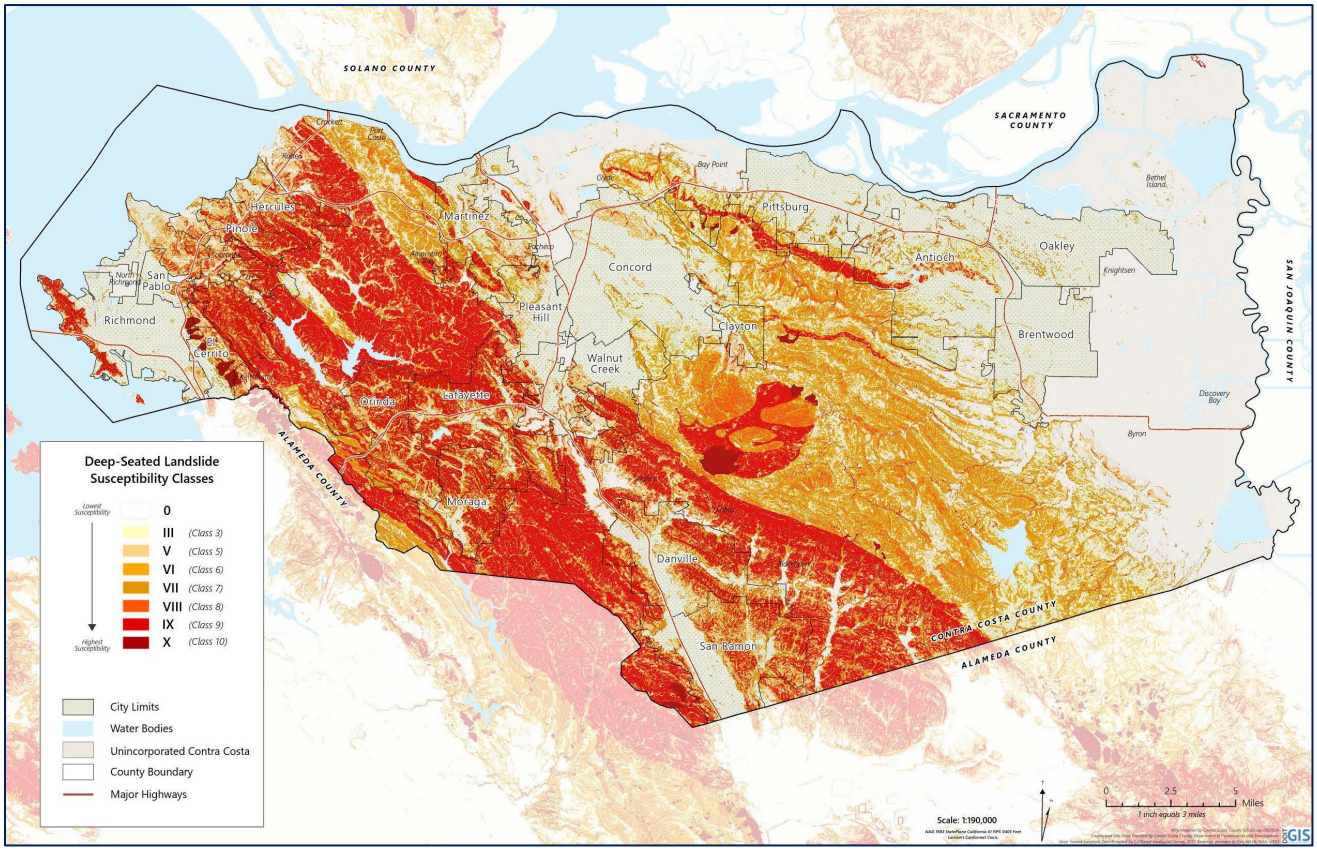
The best available predictor of where movement of slides and earth flows might occur is the location of past movements. Past landslides can be recognized by their distinctive topographic shapes, which can remain in place for thousands of years. Most landslides recognizable in this fashion range from a few acres to several square miles and many show no evidence of recent movement and are not currently active. A small proportion of them may become active in any given year, with movements concentrated within all or part of the landslide masses or around their edges.

The recognition of ancient dormant mass movement sites is important in the identification of areas susceptible to flows and slides because they can be reactivated by earthquakes or by exceptionally wet weather. Also, because they consist of broken materials and frequently involve disruption of groundwater flow, these dormant sites are vulnerable to construction-triggered sliding.

Landslide susceptibility maps describe the relative likelihood of future land sliding based solely on the intrinsic properties of a location or site. There are three (3) site factors that most determine susceptibility – prior failure, rock or soil strength, and steepness of slope.[194] **Figure 4-16** illustrates landslide susceptibility in Contra Costa County. Western Contra Costa County has a very high susceptibility to landslides. Meanwhile, central Contra Costa County susceptibility to landslide is medium and the eastern part of the County susceptibility is low.

[193] California Department of Conservation. (n.d.). Landslides. Retrieved from https://www.conservation.ca.gov/cgs/landslides.
[194] California Department of Conservation. (n.d.). Landslides. Retrieved from https://www.conservation.ca.gov/cgs/landslides.

Figure 4-16. Landslide Susceptibility in Contra Costa County



4.6.6.3. Hazard Extent/Intensity

In the United States, landslides cause billions of dollars in damages and kill between 25 and 50 people annually. Casualties are primarily caused by rockfalls, rockslides, and debris flows. Worldwide, landslides cause thousands of casualties and billions of dollars in damages. [195]

Although there are no scales for the intensity or severity of landslides, understanding the likelihood of deep land sliding based on regional estimates of rock strength and steepness of slopes can help understand the extent and intensity of potential landslides. A statewide analysis of landslide susceptibility was conducted by the California Geological Survey using a combination of regional rock strength and slope data to create classes of susceptibility. The methodology used for the analysis assumed, in general, that landslide susceptibility is low on very low slopes in all rock materials, and that susceptibility increases with slope and in weak rocks. The analysis also factored in locations of past landslides. [196]

4.6.6.4. Warning Time

Landslides can occur suddenly or slowly. The velocity of mass movement depends on slope angle, material, and water content. Some methods used to monitor mass movements can provide an idea of the type of movement and the amount of time prior to failure. It is also possible to determine what areas are at risk during general time periods. Assessing the geology, vegetation, and amount of predicted

[195] United States Geological Survey. (2004). Landslide Types and Processes. Retrieved from https://pubs.usgs.gov/fs/2004/3072/pdf/fs2004-3072.pdf.
[196] California Geological Survey. (2011). Susceptibility to Deep-Seated Landslides in California. Retrieved from https://www.conservation.ca.gov/cgs/documents/publications/map-sheets/MS_058.pdf.

precipitation for an area can help in these predictions. However, there is no practical warning system for individual landslides.

USGS provides a system of notification for potential landslides, listed in **Table 4-118**. Watches and warnings may be issued for discrete areas and include advice about contacting the area's local emergency management. Additionally, rainfall induced debris flows watches and warning are weather dependent and will closely track NWS advisories for flash flooding. [197]

Table 4-118. USGS Landslide Advisories

Type	Description
Landslide Advisory	A general statement about the potential of landslide activity in a given region relative to developing rainfall predictions. An advisory may include general statements about rainfall conditions that can lead to debris flow activity, and list precautions to be taken in the event of heavy rainfall.
Landslide Watch	Means that landslide activity will be possible but is not imminent. People in, or planning to travel through, a watch area should know landslide preparedness and stay informed about developing weather patterns.
Landslide Warning	Indicate that landslide activity is presently occurring, and extreme caution should be taken.

4.6.6.5. Probability and Frequency

The probability of occurrence for landslides in Contra Costa County is high because significant occurrences of this hazard are likely to occur annually. Additionally, according to the 2023 California State Hazard Mitigation Plan, landslide probability of occurrence is notably high in the coastal regions of California where much of the State's population, industry, and infrastructure is located. [198]

Probability of Future Hazard Events

The landslide annualized frequency value represents the average number of recorded landslide hazard occurrences in event days, per year over the period of record (11.8 years). **Table 4-119** outlines the annualized frequency for landslides, based on FEMA NRI data, for Contra Costa County. While the FEMA NRI has an annual frequency of zero (0) landslide events in the County, studies and landslide data suggest that at least one (1) landslide event will occur every year.

Table 4-119. Landslide Annualized Frequency *(FEMA National Risk Index)*

Location	Events on Record *(2010 – 2021)*	Annualized Frequency
Contra Costa County	12	0.0 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

4.6.6.6. Past Events

In Contra Costa County, landslides have occurred in conjunction with heavy rainfall events. **Table 4-120** lists landslide events that affected Contra Costa County between 1980 and 2023. There are no records

[197] United States Geological Survey. (n.d.). What is the Difference Between a Landslide Advisory, a Landslide Watch, and a Landslide Warning? Retrieved from https://www.usgs.gov/faqs/what-difference-between-landslide-advisory-landslide-watch-and-landslide-warning.
[198] California Governor's Office of Emergency Services. (2023). California State Hazard Mitigation Plan. Retrieved from https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-1_11.10.2023.pdf.

in the County of fatalities attributed to landslides. However, deaths have occurred across the west coast as a result of slides and slope collapses.

Table 4-120. Significant Landslide Events

Date	Event Type	Location	Description
December 27, 2022 – January 31, 2023	Severe storms, flooding, landslides, and mudslides	Contra Costa County *(43 other counties in the State)*	An atmospheric river impacted the State of California beginning on December 27, 2022, producing torrential rainfall which resulted in catastrophic landslides and mudslides throughout Contra Costa County.
February 27, 2017 – March 4, 2017	Mudslide	Near the City of Concord and City of Brentwood	A slow moving mudslide closed the 3100 block of Morgan Territory Road from Concord to Brentwood and Livermore. It caused Contra Costa Water District's waterline to break, which affected about 90 customers.
January 3, 2017 – January 12, 2017	Severe storms, flooding, and mudslides	Contra Costa County *(33 other counties in the State)*	Trees and landslides covered roadways throughout the Bay Area. *(DR-4301)*
March 13, 2016	Landslide	Town of Moraga	A landslide forced two (2) homeowners to evacuate their homes in the Town of Moraga. A lower portion of the hill slid into San Pablo Creek in January.
2011	Winter Storm	Local	Central Contra Costa Sanitary District reported landslides and damage to sewer pipes.
December 17, 2005 – January 3, 2006	Severe storms, flooding, mudslides, and landslides	Contra Costa County *(29 other counties in the State)*	A series of rainfall events caused significant runoff with localized evacuations, some slope failures, and road closures throughout the declared counties. Urban flooding initiated landslides that contributed to the damage. In Contra Costa County, much of the damage was in the following cities – Walnut Creek, Richmond, San Pablo, Martinez, and Orinda. Damaged facilities included schools, park areas, and several government agency structures. *(DR-1628)*
February 13, 2000 – February 14, 2000	Flash Flood	Countywide	Widespread rainfall occurred over 24 hours with accumulations exceeding five (5) inches. Several homes in Daly City had to be evacuated due to mudslides and consecutive years of above average rainfall.
February 2, 1998 – April 30, 1998	Severe winter storms and El Niño rainstorm	San Francisco Bay Area	Widespread flooding occurred that caused landslides in Contra Costa County. *(DR-1203)*
December 2, 1996 – April 1, 1997	Severe storms, flooding, mudslides, and landslides	Contra Costa County *(46 other counties in the State)*	Minor landslide damage in Contra Costa County was attributed to heavy rainfall and saturated soils. *(DR-1155)*
February 13, 1995 – April 19, 1995	Severe winter storms, flooding, landslides, and mud flows	San Francisco Bay Area	Minor landslide damage in Contra Costa County was attributed to heavy rainfall and saturated soils. *(DR-1046)*

Date	Event Type	Location	Description
January 3, 1995 – February 10, 1995	Severe winter storms, flooding, landslides, and mud flows	San Francisco Bay Area	Minor landslide damage in Contra Costa County was attributed to heavy rainfall and saturated soils. *(DR-1044)*
January 5, 1993 – March 20, 1993	Severe winter storm, mudslides, landslides, and flooding	Contra Costa County *(26 other counties in the State)*	Minor landslide damage in Contra Costa County was attributed to heavy rainfall and saturated soils. *(DR-979)*
January 21, 1983 – March 30, 1983	Coastal storms, floods, slides, and tornadoes	Contra Costa County *(35 other counties in the State)*	Heavy rainfall throughout coastal areas of California caused landslides. *(DR-677)*
December 19, 1981 – January 8, 1982	Severe storms, flood, mudslides, and high tide	San Francisco Bay Area	Prolonged heavy rainfall and saturated soils caused numerous slope failures and mud flows on steep and unstable slopes throughout the San Francisco Bay area. In Contra Costa County, 335 homes were damaged by landslides. *(DR-651)*

Sources: FEMA 2017; Hazard Mitigation Plan Annual Progress Report, California Geology 1982; USGS 1984, 1987, 1989 and 1998; and NOAA, 2017.

4.6.6.7. Vulnerability and Impacts

Life Safety and Health: In general, all of the population within landslide susceptibility areas are considered to be vulnerable, especially those within a high landslide susceptibility area (Class VIII – X). As illustrated in **Figure 4-16**, the majority of the population in the western portion of Contra Costa County is within a high (Class VIII – X) landslide susceptibility area. Increasing population and the fact that many homes are built on property atop or below bluffs and on steep slopes subject to mass movement, increases the number of lives endangered by this hazard.

The underserved and at risk population face unique vulnerabilities and impacts as a result of landslides. These groups include, but are not limited to, households in poverty, the elderly population, undocumented individuals, and population living in single access roads.[199]

- **Household in Poverty:** Includes those with an income at or below $24,300 for a household of four (4). This population may live in homes that are less structurally sound. In the event of a landslide, the foundation of these homes can be damaged or completely destroyed resulting in financial strain for these households. In Contra Costa County, a high concentration of households in poverty within high landslide susceptibility areas can be found in Rodeo, Crockett, Bay Point, and Port Costa.
- **Senior (65 years old and over):** The elderly population (i.e., seniors), especially those with access and functional needs, may have physical limitations that make it harder to evacuate in the event of an emergency, such as flooding. Furthermore, the elderly population may lack access to social connections and community support that can assist in preparing for and responding to emergency events, evacuating, improving home resiliency, managing medical needs, and

[199] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.

locating support services. Communities with high concentrations of seniors are primarily located on the hillsides in Contra Costa County, which are within high landslide susceptibility areas.

- **Undocumented Individuals:** Includes people who do not have formal permission to live in the United States (i.e., do not have citizenship, permanent residency, visas, or other similar status). This population is most likely to fall in the households in poverty and low income categories, which are considered to be at risk populations during a landslide event.
- **Individuals Living on Single Access Roads:** Includes the population living in areas with a single route in and out (i.e., accessible via one (1) roadway) of the neighborhood or area. This population is uniquely vulnerable to landslides because if these roadways are blocked, damaged, and destroyed these individuals can become isolated from the community and emergency services. In Contra Costa County, several neighborhoods and communities in the Delta and in the hillside areas of central and western Contra Costa County are only accessible via one roadway.

Table 4-121 summarizes the vulnerable and at-risk population for landslides in Contra Costa County.

Table 4-121. Vulnerability and At Risk Population

Category	Estimate	Percent
Households in Poverty[200]	7,600	12.0%
65 Years and Over[201]	201,136	17.4%
Seniors (65 years and over) Living Alone[202]	45,672	22.7%
Undocumented Individuals[203]	There are no official counts of how many undocumented individuals live in Contra Costa County, but in 2019 there was an estimate of 63,000.	

Table 4-126 outlines the vulnerability of the total population exposed to landslides, and **Table 4-127** outlines the landslide impacts to population and life safety, underserved/equity population, and essential operations, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Property Damage and Critical Infrastructure: Although only a partial list of historical landslides in Contra Costa County is available, the available records suggest a significant vulnerability to this hazard. The millions of dollars in damage Countywide attributable to mass movement during those events affected private property and public infrastructure and facilities. Loss estimations for the landslide hazard are not based on modeling utilizing damage functions, because no such damage functions have been generated. Instead, loss estimates were developed representing 10%, 30%, and 50% of the replacement value of exposed structures. This allows emergency managers to select a range of economic impact based on an estimate of the percentage of damage to the general building stock. Damage in excess of 50% is considered to be substantial by most building codes and typically requires total reconstruction of the structure.

[200] Ibid.
[201] United States Census Bureau. (2022). DP05: Demographics and Housing Estimates (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP05?g=050XX00US06013.
[202] United States Census Bureau. (2022). DP02: Selected Social Characteristics in the United States (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP02?g=050XX00US06013.
[203] Migration Policy Institute. (2019). Profile of the Unauthorized Population: Contra Costa County, CA. Retrieved from https://www.migrationpolicy.org/data/unauthorized-immigrant-population/county/6013.

In Contra Costa County, there is a range from the large, state-owned bridges that carry interstate freeways, to locally owned bridges that carry rural roads and pedestrians over small creeks. Countywide, there are over 400 bridges where approximately 80 are owned by the County and 160 are owned by Caltrans. Landslides can cause severe damage to bridges which can cause them to become unstable and fail. State Route 4 and 24, Interstate 80 and 680, and 40 bridges are located within moderate to very high landslide susceptibility areas in Contra Costa County. Disruption to the fourth bore of the Caldecott Tunnel can substantially disrupt regional transportation and connections between the County and the rest of the Bay Area. Also, the following transportation assets are within moderate and high landslide susceptibility zones – North Concord/Martinez BART station, Martinez Amtrak station, Pittsburg/Bay Point BART station, and Lafayette BART station. A landslide disruption (e.g., damage to tracks or station) could limit transit opportunities within east and west County.

Electrical transmission and distribution lines are power lines that carry high voltage electricity between power plants and customers. There are a number of transmission lines throughout the County and a number pass over hills and mountains within high landslide susceptibility areas in the eastern and western portion of the County. The electric infrastructure is extremely vulnerable to landslides as they can be damaged or destroyed. Also, these power lines are used to distribute electricity to other regions in the Bay Area, so, if multiple lines are disrupted due to a landslide it can cause widespread power outages. Additionally, there are approximately 34 industrial structures within landslide prone areas within the County. In the event a landslide impacts these structures, holding tanks can be disturbed resulting in a chemical release and contamination of surrounding areas.[204]

There are a total of 554 critical assets (i.e., schools, nursing homes, fire stations, police stations, and hospitals) throughout the County and 306 (55.2%) are located within a landslide susceptibility area. **Table 4-43** provides a breakdown of critical assets that are located within a landslide susceptibility area in Contra Costa County.

Table 4-122. Critical Assets Vulnerable to Landslides

Asset	Estimate	Percent *(of total asset)*
Schools *(public schools, private schools)*	173	48.1%
Nursing Homes	51	65.4%
Fire Stations	57	70.4%
Police Stations	17	70.8%
Hospitals	8	72.7%

Table 4-126 outlines the total property value exposed to landslides and how the changes in development in the past five (5) years have affected the vulnerability of the community to landslides. **Table 4-127** outlines the landslide impacts on total property damage, potential future development, and the economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Environment: A landslide alters the landscape of an area. In addition to changes in topography, vegetation and wildlife habitats may be damaged or destroyed. Soil and sediment runoff will accumulate downslope, potentially blocking waterways and roadways and impairing the quality of streams and other

[204] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.

water bodies. Furthermore, landslides that fall into streams may impact fish and wildlife habitat, as well as affect water quality. Hillsides that provide wildlife habitat can be lost for prolonged periods. In central and western Contra Costa County, some aquatic habitats (i.e., streams, reservoirs, ponds, and sloughs or channels) are located within landslide prone areas. Streams can be blocked by a landslide which significantly affects fish and wildlife habitat because of additional debris that is being added into the habitat. Aquatic ecosystems in the County include the Delta and shoreline areas that are submerged by water, and the three (3) large reservoirs – San Pablo Reservoir, Briones Reservoir, and Los Vaqueros Reservoir. Aquatic wildlife species include various duck species, California red-legged frog, western pond turtle, and juvenile and spawning adult Chinook salmon.[205]

Table 4-127 outlines landslide impacts on the environment and economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Changes in Development and Impact of Future Development: Changes in development have not significantly affected the risk from landslides and future development should have minimal impact on risk associated with landslides. Contra Costa County has implemented stricter zoning and building codes and policies for areas that are prone to landslides. For example, projects in areas of known landslide susceptibility require submittal of a geotechnical report and the County ensures effective mitigation measures are incorporated into the project's design. The implementation of these policies will ensure that future development trends minimally increase impact/consequence of landslides within Contra Costa County.

Table 4-126 outlines how the changes in development in the past five (5) years have affected the vulnerability of the community to landslides. **Table 4-127** outlines the landslide impacts on potential future development, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Effects of Climate Change in Severity of Impacts: Climate change does not directly cause more frequent or intense landslides. However, it is expected to increase the conditions that can lead to landslides, such as an increase in heavy storms that saturate the ground and make a landslide more likely. As global average temperatures increase; evaporation increases adding moisture into the atmosphere which results in more precipitation.[206] The frequency and intensity of heavy precipitation events are projected to increase over the 21st century.[207] Although heavy precipitation does not necessarily result in landslides, landslides are predominantly a result of saturated soils, it is possible that increased intensity of rain events will result in a greater number of landslides annually and an increase in the severity of impacts. Increasing temperatures are expected to increase the occurrence and duration of droughts and the probability of wildfire, reducing the vegetation that helps to support slopes and slows down water. Overall, the impacts of climate change on drought, heavy rainfall, and wildfire will result in an increased probability for landslide occurrences. **Table 4-123** indicates the 25-year climate projections in Contra Costa County.

[205] Ibid.
[206] Environmental Protection Agency. (n.d.). Climate Change Indicators: U.S. and Global Precipitation. Retrieved from https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-precipitation.
[207] U.S. Global Change Research Program. (2017). Climate Science Special Report: Fourth National Climate Assessment, Volume I (Chapter 7: Precipitation Change in the United States). Retrieved from https://science2017.globalchange.gov/chapter/7/.

Table 4-123. 25-Year Climate Projections for Contra Costa County [208]

Higher Emissions (RCP8.5)
Contra Costa County is expected to experience a 43% increase in extremely hot days and a 7% increase in days with heavy precipitation within 25 years.
By 2048, Contra Costa County is expected to have a 0.4 inches increase (from 19.6 inches to 20.1 inches) in average annual precipitation.
By 2049, Contra Costa County is expected to experience 11 more days that reach above 95°F (from 23 days to 33 days per year).
Lower Emissions (RCP4.5)
Contra Costa County is expected to experience a 29% increase in extremely hot days and an 8% increase in days with heavy precipitation within 25 years.
By 2048, Contra Costa County is expected to have a 0.15 inches increase (from 19.11 inches to 19.26 inches) in average annual precipitation.
By 2049, Contra Costa County is expected to experience seven (7) more days that reach above 95°F (from 22 days to 29 days per year).

Table 4-127 outlines the climate change impacts to landslides in Contra Costa County, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

[208] Northeast Regional Climate Center. (n.d.). Neighborhoods at Risk: Climate Projections. Retrieved from https://nar.headwaterseconomics.org/.

Table 4-124. Probability of Occurrence

Hazard Event	Probability of Occurrence		Probability Factor	Weighted Factor
Landslide	High	Significant hazard event is likely to occur annually.	3	N/A

Table 4-125. Extent Factors

Hazard Event	Extent Factor	Extent		Extent Factor	Weighted Factor
Landslide	***Extent/Intensity***	Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2	6
	Catastrophic	Low	Catastrophic hazard event is likely to occur at least once in 51 or more years.	1	3

Table 4-126. Vulnerability Factors

Hazard Event	Vulnerability Factor	Vulnerability		Vulnerability Factor	Weighted Factor
Landslide	***Population Exposure***	Low	14% or less of the population is exposed to the hazard.	1	3
	Property Exposure	Low	9% or less of the total assessed property value is exposed to a hazard.	1	2
	Changes in Development	Low	Changes in development have increased the vulnerability/exposure of the community to the hazard by 4% or less.	1	1

Table 4-127. Impact Factors

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
Landslide	***Population and Life Safety***	Medium	Populations exposed to this hazard are likely to experience some adverse impacts, such as injuries requiring acute medical care.	2	6
	Underserved/Equity	Low	Underserved populations exposed to the hazard are likely to experience minimal adverse/disproportionate impacts, such as ambulatory injuries.	1	3
	Property Damage	High	More than $5 Million in property damages is expected from a single major hazard event, or damages are expected to occur to 15% or more of the property value within the jurisdiction.	3	6
	Economic	Low	Total economic impact is not likely to be greater than $100,000.	1	1

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
	Environmental	Low	Environmental impact from a single major hazard event is likely to be minimal, requiring little to no outside resources and support, and/or minimal repair, clean-up, restoration, or preservation work.	1	1
	Essential Operations	Medium	Impact between 24 and 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	2	2
	Future Development	Low	Future development trends will minimally increase impact/consequence of this hazard.	1	1
	Climate Change	Medium	Climate Change trends will increase the risk of this hazard and its impacts, but not significantly.	2	2

4.6.6.8. FEMA NRI Expected Annual Loss Estimates

A landslide NRI EAL score, and rating represent a community's relative level of expected building and population loss each year due to landslides when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-128** outlines the landslide EAL for Contra Costa County.

Table 4-128. Landslide Expected Annual Loss *(FEMA National Risk Index)*

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Contra Costa County	$25,121	$207,224	n/a	$232,345	94.6	Very High
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.6.9. FEMA Landslide Risk Index Scores

The landslide Risk Index score and rating represent a community's relative risk for landslide when compared to the rest of the United States. **Table 4-129** illustrates the landslide Risk Index rating and score for Contra Costa County.

Table 4-129. Landslide Risk Index *(FEMA National Risk Index)*

Jurisdiction	Rating	Score
Contra Costa County	Very High	93.7
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

Table 4-130 represents the Landslide Total Risk Score for Contra Costa County, based on the Risk Assessment Methodology, as defined in this Plan. For further details on how the probability, extent, vulnerability, and impact factors were calculated, please refer to **Table 4-124** through **Table 4-127**. Additional details on how the Total Risk Score was calculated can be found in the Risk Assessment Methodology in Section 4.3 of this Plan.

Table 4-130. Landslide Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Landslide	3	9	6	22	37	55

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.7. Sea Level Rise

4.6.7.1. Description

Sea level rise is the increase in the global mean sea level to the effects of climate change, a trend that is expected to continue.[209] Sea level has a significant role in flooding, coastal erosion, and storm hazards (e.g., coastal flooding).

Increasing global surface temperatures, melting glaciers and ice sheets, and thermal expansion are climate conditions causing sea level to rise globally. However, there are additional factors affecting global sea level change – subsidence and uplift. Vertical land motion (VLM) includes both subsidence and uplift and changes can add up over time. Subsidence may cause a relative rise in local sea levels, but this is highly dependent on localized factors. Likewise, uplift (the opposite of subsidence) may reduce sea level rise. Both instances of land fluctuation occur, on average, to the degree of a few millimeters per year.[210] Regardless of the cause of sea level rise, a higher average sea level means that hazards such as coastal flooding, flooding, and coastal erosion will have more severe impacts to the population, property, and infrastructure.[211]

Sea level rise varies regionally along the United States coasts because of land and ocean height variations. In the next three (3) decades sea level rise is anticipated to be, on average, four (4) to eight (8) inches in western United States. Additionally, sea level rise is expected to create a profound shift in coastal flooding in the next 30 years by causing tide and storm surge heights to increase and move further inland. By 2050, damaging flooding is expected to occur, on average, 10 times more often than it does currently, and it can be intensified by other local factors.[212] Currently, the rate of sea level rise in the San Francisco Bay area roughly matches the global average and expected to be higher than the global average based on half of NOAA's average sea level rise scenarios.[213] Other sea level rise consequences include:[214]

- Contra Costa County's extensive coastal infrastructure (e.g., critical facilities, transportation networks, residential areas) vulnerability to inundation, erosion, and flooding will increase.
- High water levels will become more frequent, increasing in extent, depth, and duration of temporary flooding, and expanding the area that is permanently inundated. Impacts will go beyond the coastal area.

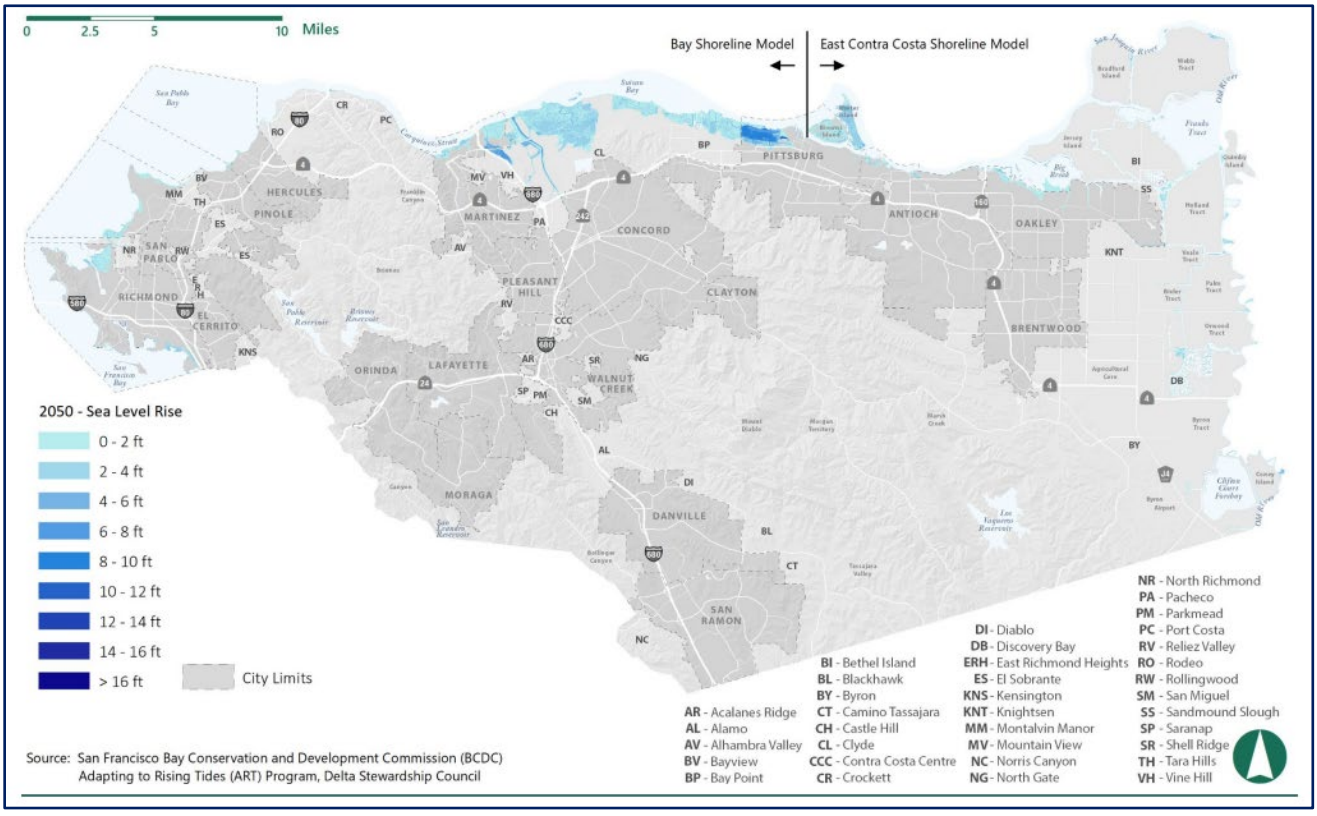
[209] National Geographic. (n.d.). Sea Level Rise. Retrieved from https://education.nationalgeographic.org/resource/sea-level-rise/.
[210] National Aeronautics and Space Administration, Sea Level Change. (n.d.). Understanding Sea Level. Retrieved from https://sealevel.nasa.gov/understanding-sea-level/regional-sea-level/subsidence.
[211] National Oceanic and Atmospheric Administration, Climate.gov. (2022). Climate Change: Global Sea Level. Retrieved from https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level.
[212] National Oceanic and Atmospheric Administration, National Ocean Service. (2022). 2022 Sea Level Rise Technical Report. Retrieved from https://oceanservice.noaa.gov/hazards/sealevelrise/sealevelrise-tech-report.html.
[213] San Francisco Baykeeper. (n.d.). Sea Level Rise Long California: Questions and Answers. Retrieved from https://baykeeper.org/shoreview/california-slr.html.
[214] Contra Costa County Adapting to Rising Tides Project. (2017). Adapting to Rising Tides: Contra Costa County Assessment and Adaptation Project. Retrieved from https://www.adaptingtorisingtides.org/wp-content/uploads/2017/03/Contra-Costa-ART-Project-Report_Final.pdf.

- The hazard poses substantial economic risks, as it threatens businesses, port facilities, and industries reliant on the San Francisco Bay area waterways, potentially resulting in loss of revenue, jobs, and decreased property values.
- Sea level rise can lead to the loss of critical coastal habitats, increased salinity in estuaries, and harm to native species, impacting the region's ecological balance.

4.6.7.2. Hazard Location

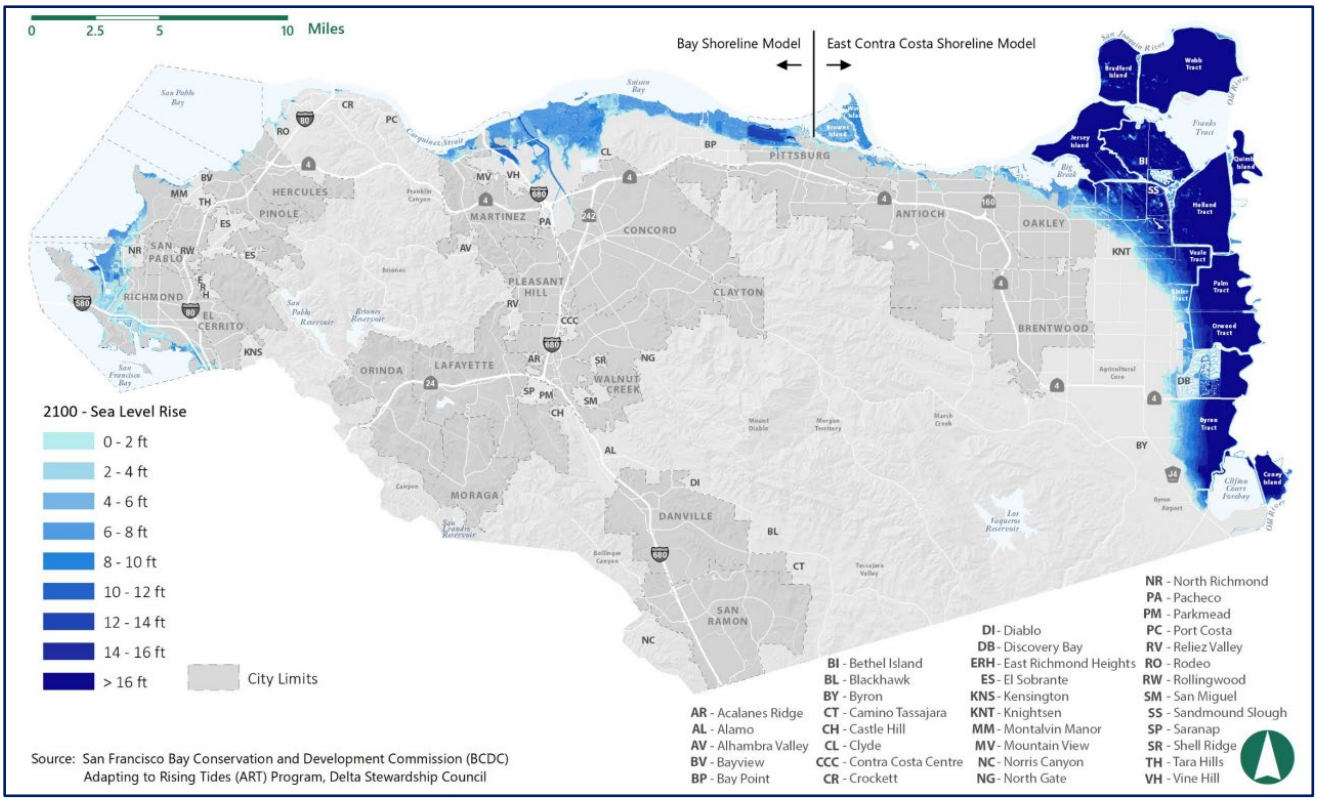
All coastal communities in the County are vulnerable to sea level rise. Areas with low lying shorelines such as the City of Richmond and the City of Concord are particularly at risk. Additionally, the extensive coastline along San Pablo and Suisun Bays, including unincorporated County and coastal cities – El Cerrito, San Pablo, Pinole, Hercules, Rodeo, Pittsburg, Antioch, and Martinez. **Figures 4-17** and **4-18** depicts the Contra Costa County 2050 and 2100 sea level rise projections, respectively. [215]

Figure 4-17. Expected Sea Level Rise 2050 Projection



[215] Contra Costa County. (2023). Public Review Draft Contra Costa County 2045 General Plan – Health and Safety Element. Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2024/02/Chapter_9_Health-and-Safety-Element.pdf.

Figure 4-18. Expected Sea Level Rise 2100 Projection



4.6.7.3. Hazard Extent/Intensity

There are no intensity scales for measuring sea level rise. In 2018, the State of California updated the sea level rise projections for San Francisco, based on greenhouse gasses emissions scenarios used by the IPCC in the Fifth Assessment Report, called the Representative Concentration Pathways (RCP). The high emissions represent the RCP 8.5 scenario, and the low emissions represent the RCP 2.6 scenario. **Table 4-131** illustrate the recommended probabilistic projections for the height of sea level rise in the San Francisco area, as see in the Rising Seas Report. [216]

Table 4-131. Projected Sea Level Rise for San Francisco

Emissions Scenario	Year	Likely Range *(feet)* *66% probability sea level rise is between…*	1 in 200 Chance *(feet)* *0.5% probability sea level rise meets or exceeds…*
High Emissions	2030	0.3 – 0.5	0.8
High Emissions	2040	0.5 – 0.8	1.3
High Emissions	2050	0.6 – 1.1	1.9
Low Emissions	2060	0.6 – 1.3	2.4
High Emissions		0.8 – 1.5	2.6

[216] California Natural Resources Agency. (2018). State of California Sea level Rise Guidance (2018 Update). Retrieved from https://www.opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf.

Emissions Scenario	Year	Likely Range *(feet)* *66% probability sea level rise is between…*	1 in 200 Chance *(feet)* *0.5% probability sea level rise meets or exceeds…*
Low Emissions	2070	0.8 – 1.5	3.1
High Emissions		1.0 – 1.9	3.5
Low Emissions	2080	0.9 – 1.8	3.9
High Emissions		1.2 – 2.4	4.5
Low Emissions	2090	1.0 – 2.1	4.7
High Emissions		1.4 – 2.9	5.6
Low Emissions	2100	1.0 – 2.4	5.7
High Emissions		1.6 – 3.4	6.9
Low Emissions	2110*	1.2 – 2.5	6.3
High Emissions		1.9 – 3.5	7.3
Low Emissions	2120	1.2 – 2.8	7.4
High Emissions		2.2 – 4.1	8.6
Low Emissions	2130	1.3 – 3.1	8.5
High Emissions		2.4 – 4.6	10.0
Low Emissions	2140	1.3 – 3.4	9.7
High Emissions		2.6 – 5.2	11.4
Low Emissions	2150	1.3 – 3.8	11.0
High Emissions		2.8 – 5.8	13.0

Most of the available climate model experiments do not extend beyond 2100. The resulting reduction in model availability causes a small dip in projections between 2100 and 2110, as well as a shift in uncertainty estimates (see Kopp et al. 2014). Use of 2110 projections should be done with caution and with acknowledgement of increased uncertainty around these projections.

4.6.7.4. Warning Time

There is no warning time mechanism for sea level rise. However, probabilistic projections for sea level rise over various timescales have been developed. These projections are meant to help decision makers to better understand future sea level rise and when a particular level is expected to occur.

4.6.7.5. Probability and Frequency

The probability of occurrence for sea level rise in Contra Costa County is medium because along the Contra Costa County shoreline, sea levels are projected to rise up to about 2 feet (24 inches) by 2050 and 7 feet (84 inches) by 2100. However, it is possible that sea levels could rise faster than these projections, which has happened historically.

Probability of Future Hazard Events

The State of California Sea Level Rise Guidance 2018 update provides the probability of sea level rise meeting or exceeding a particular height for each decade between 2030 and 2150. The probability that sea level rise will meet or exceed a particular height in San Francisco for high emissions (RCP 8.5) is

listed on **Table 4-132** and low emissions (RCP 2.6) is listed on **Table 4-133**. The areas shaded in gray have less than a 0.1% probability of occurrence. [217]

Table 4-132. Probability that Sea level Rise Will Meet or Exceed a Particular Height in San Francisco (High Emissions – RCP 8.5)

	1 Feet	2 Feet	3 Feet	4 Feet	5 Feet	6 Feet	7 Feet	8 Feet	9 Feet	10 Feet
2030	0.1%									
2040	3.3%									
2050	31%	0.4%								
2060	65%	3%	0.2%	0.1%						
2070	84%	13%	1.2%	0.2%	0.1%					
2080	93%	34%	5%	0.9%	0.3%	0.1%	0.1%			
2090	96%	55%	14%	3%	0.9%	0.3%	0.2%	0.1%	0.1%	
2100	96%	70%	28%	8%	3%	1%	0.5%	0.3%	0.2%	0.1%
2150	100%	96%	79%	52%	28%	15%	8%	4%	3%	2%

Table 4-133. Probability that Sea level Rise Will Meet or Exceed a Particular Height in San Francisco (Low Emissions – RCP 2.6)

	1 Feet	2 Feet	3 Feet	4 Feet	5 Feet	6 Feet	7 Feet	8 Feet	9 Feet	10 Feet
2060	43%	1.4%	0.2%							
2070	62%	4%	0.6%	0.2%	0%					
2080	74%	11%	2%	0.4%	0.2%	0.1%				
2090	80%	20%	3%	1.0%	0.4%	0.2%	0.1%	0.1%		
2100	84%	31%	7%	2%	0.8%	0.4%	0.2%	0.1%	0.1%	
2150	93%	62%	31%	14%	7%	4%	2%	2%	1%	1%

The FEMA NRI analyses coastal flooding – when water inundates or covers normally dry coastal land as a result of high or rising tides or storm surges. [218] The coastal flooding annualized frequency value represents the modeled frequency of coastal flooding occurrences, in events per year. **Table 4-134** outlines the annualized frequency for coastal flooding, based on FEMA NRI data, for Contra Costa County.

Table 4-134. Coastal Flooding Annualized Frequency *(FEMA National Risk Index)*

Location	Events on Record	Annualized Frequency
Contra Costa County	n/a	1.5 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

[217] Ibid.
[218] Federal Emergency Management Agency. (n.d.). FEMA National Risk Index: Coastal Flooding. Retrieved from https://hazards.fema.gov/nri/coastal-flooding.

4.6.7.6. Past Events

Changes in sea level have been occurring for at least the last 100 years and are projected to continue. The rate of sea level rise is increasing, and this trend is projected to continue.

4.6.7.7. Vulnerability and Impacts

Life Safety and Health: The population in areas with low lying shorelines (e.g., City of Richmond, City of Concord) are particularly at risk. Additionally, the extensive coastline along San Pablo and Suisun Bays, including unincorporated County and coastal cities – El Cerrito, San Pablo, Pinole, Hercules, Rodeo, Pittsburg, Antioch, and Martinez.

The underserved and at risk population face unique vulnerabilities and impacts as a result of sea level rise. These groups include, but are not limited to, households in poverty, individuals experiencing homelessness, and the population living on single access roads.

- **Household in Poverty:** Includes those with an income at or below $24,300 for a household of four (4). This population is most likely to live in low lying areas and the structures may not be waterproofed or built above the 100-year flood elevation. In Contra Costa County, the households in poverty within Vine Hill, Bay Point, and North Richmond are vulnerable to sea level rise.
- **Individuals Experiencing Homelessness:** Includes those who do not have a permanent home, including those who live in their vehicles or temporary shelters. This population is uniquely vulnerable to sea level rise because most of the homeless encampments are located along the coastal cities near and within coastal flood areas in the County. Therefore, sea level rise can damage or destroy these encampments and other homeless facilities located within the coastline resulting in additional hardship for this population. In 2024, there are 2,843 people experiencing homelessness in Contra Costa County, an 18.5% increase from 2023.[219]
- **Individuals Living on Single Access Roads:** Includes those living in areas with a single route in and out (i.e., accessible via one (1) roadway) of the neighborhood or area (e.g., Rodeo, Crockett, and Port Costa). This includes several communities in the Delta and in the hillside areas of central and western Contra Costa County. This population is uniquely vulnerable to sea level rise because as sea level continues to rise, these roadways may become permanently impassible. These communities can become isolated from the community and emergency services in the long term. As illustrated in **Figure 4-18**, sea level rise is projected to significantly impact the Delta islands located in the eastern section of the County by 2100.[220]

Table 4-135 summarizes the vulnerable and at-risk population for sea level rise in Contra Costa County.

Table 4-135. Vulnerability and At Risk Population

Category	Estimate	Percent
Households in Poverty[221]	7,600	12.0%

[219] Contra Costa Health. (2024). Health, Housing, and Homelessness Data Reports (Point-in-Time Count). Retrieved from https://www.cchealth.org/services-and-programs/homeless-services/data.
[220] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.
[221] Ibid.

Category	Estimate	Percent
Low Income Households[222]	25,340	41.0%
Homeless Population[223]	2,372	0.2%

Table 4-139 outlines the vulnerability of the total population exposed to sea level rise, and **Table 4-140** outlines the sea level rise impacts to population and life safety, underserved/equity population, and essential operations, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Property Damage and Critical Infrastructure: As sea level continues to rise, repeated disruptions by coastal flooding will aggravate existing impacts on infrastructure, initiate cascading impacts on the larger economy, and burden people. Saltwater intrusion into drinking water sources can result in the need for water utilities to increase treatment, relocate water intakes, or develop alternate sources of fresh water. Saltwater intrusion, through surface water or groundwater sources, may diminish the availability or quality of source waters for drinking water utilities.

In Contra Costa County, the levees near North Richmond, Vine Hill, and the Delta can be damaged or overtopped due to an increase in coastal storm events and sea level rise is exacerbating the effects of these events. Interstate 80 and 680, and State Route 160 are within sea level rise inundation areas. Flooding to these roadways and other local roadways can cause major disruptions to local and regional transportation, transit, and commuters.

The BART, Amtrak, and the freight lines are located within the flood areas in coastal and northern Contra Costa County. There are three (3) standard rail lines that run through the County which are operated by Union Pacific, Burlington Northern Santa Fe, and Richmond Pacific Railroad Corporation. These run along the western, northern, and eastern boundaries of the County, along Interstate 80, State Route 4, and Byron Highway. The aforementioned rail lines are used for freight trains; however, the Capitol Corridor commuter train runs along the Union Pacific railway. Additionally, the BART operates its own separate rail lines used exclusively for public transit. Two (2) BART rail lines are located in the County – one beginning in Richmond and heading south toward Berkeley and another one in the central part of the County extending from the City of Orinda to the City of Antioch. Furthermore, some of these rail lines serve as the first line of defense against coastal flooding for communities; these rail lines include Martinez and Antioch Amtrak stations, rail lines along Bay Point, Montalvin Manor, Rodeo, and Port Costa.

The Rodeo sewage treatment plant, West Contra Costa Wastewater, and the Mt. View Sanitary District are within low lying areas along the coastline. Wet weather flows into the treatment plants can be exacerbated with rising sea levels, preventing the system from functioning properly. Treatment plants can also fail if pumps and control panels are not waterproofed or are not salt-resistant. The Contra Costa Canal and Clifton Court Forebay are also within the coastal flooding area. These water and wastewater infrastructure systems are vulnerable to flooding and shoreline flooding which can be exacerbated by sea level rise. Also, there are approximately 44 industrial buildings in Contra Costa County that are located within sea level rise inundation areas. Most industrial and manufacturing centers, important economic drivers to the County, are located within sea level rise inundation areas along the bayfront and Delta in the western and northern portions of Contra Costa County. These center can be damaged by floods

[222] Ibid.
[223] Contra Costa Health. (2023). Health, Housing, and Homelessness Data Reports (Point-in-Time Count). Retrieved from https://www.cchealth.org/services-and-programs/homeless-services/data.

which could be exacerbated by sea level rise. These centers are located in the neighborhoods of North Richmond, Rodeo, Crockett, Bay Point, Pacheco, Clyde, and the City of Martinez.[224]

There are a total of 554 critical assets (i.e., schools, nursing homes, fire stations, police stations, and hospitals) throughout the County and none are located within inundation areas for one (1) foot of sea level rise. **Table 4-43** provides a breakdown of critical assets that are located within sea level rise inundation areas for one (1) foot in Contra Costa County.

Table 4-136. Critical Assets in Vulnerable to 1 Foot of Sea Level Rise

Asset	Estimate	Percent *(of total asset)*
Schools *(public schools, private schools)*	0	0.0%
Nursing Homes	0	0.0%
Fire Stations	0	0.0%
Police Stations	0	0.0%
Hospitals	0	0.0%

Table 4-139 outlines the vulnerability of the total property value exposed to a flood event, and the impact on total property damage in the event of a flood, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Environmental: Rising seas increase the risk of flooding, storm surge inundation, erosion and shoreline retreat, and wetland loss. Rising sea levels also threaten a significant portion of prime agricultural land in the County, as low lying areas could be subject to more frequent shoreline flooding and saltwater intrusion into groundwater basins could disrupt agricultural water supplies. Meanwhile, rising tides may increase groundwater levels, inundating contaminated soil and pushing toxins toward the surface. Given that some contaminated sites in Contra Costa County are located near the shoreline, rising groundwater may cause contaminated soil to leach into previously unaffected areas. Natural ecosystems in the Bay and Delta regions will be disrupted by the higher tide levels and intrusion of saltwater into freshwater systems. Historically, marshes have adapted to changes in sea level by building up sediment, increasing the height of the marsh to keep pace with the tide levels of San Francisco Bay, and by moving inland. However, sea level rise is expected to outpace the rate of marsh-level rise and development near wetlands will likely prevent marsh migration. Without substantial intervention, most tidal marshes in Contra Costa County are expected to convert to another habitat type, a process called “downshifting,” which will lead to the establishment of different plant and animal species. Additionally, sea level rise may push saltwater into the Delta’s aquatic system which will decrease the water quality and harm aquatic species and organisms.

Some of the environmental assets that are vulnerable and can be impacted by sea level rise within the County are considered major economic drivers. Significant impacts to these assets can result in economic challenges to Contra Costa County and disruptions to these resources can impact the economy of populations that rely on these activities. [225]

[224] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.
[225] Ibid.

- **Agriculture:** Agriculture land in the eastern and Delta portions of the County are within sea level rise inundation areas and can face significant economic challenges if agriculture is not viable. Sea level rise can inundate farmland increasing the salinity in the water and soil damaging crops that do not grow in high salt conditions. Furthermore, sea level rise can cause saltwater intrusion which can decrease the water supplies for crop irrigation.
- **Regional Parks:** Regional shorelines and parks on the Bay and Delta could be permanently inundated due to sea level rise resulting in unusable parks which may not meet the demands of the public.
- **The Delta:** The Sacramento-San Joaquin River Delta spans from the City of Pittsburg in the west, Locke in the east, Sacramento to the North, and Tracy to the south. The Delta primarily encompasses the northern and easternmost borders of Contra Costa County and provides opportunities for boating, fishing, transportation, and a water source for the County. Sea level rise can continually or permanently inundate marinas, harbors, farmland, and other recreational facilities within the Delta. Furthermore, saltwater intrusion can disrupt water quality and fish/wildlife population.

Table 4-140 outlines sea level rise impacts on the environment and economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Changes in Development and Impact of Future Development: There have been no significant changes in development that have affected the risks associated with sea level rise. Future increases in population within the sea level inundation area and coastal communities will increase vulnerability and impacts to sea level rise. Growth over the past decade has considerably increased. Between 2010 and 2022, as outlined in **Table 3-3**, the population in Contra Costa County grew 10.6%, from 1,046,025 to 1,156,966 residents. The Bay Area Association of Governments (ABAG) growth forecasts predict a steady increase in households through 2050. From 2015 to 2050, ABAG projects that the County's number of households will grow by 44%.[226] As sea level continues to rise, floodplain boundaries may expand further inland exposing areas that are not currently vulnerable to sea level rise. Additionally, the communities in Contra Costa County that are protected by levees may become more vulnerable because the levee will become increasingly vulnerable to overtopping due to increasing sea level.

Table 4-139 outlines how the changes in development in the past five (5) years have affected the vulnerability of the community to sea level rise. **Table 4-140** outlines the sea level rise impacts on potential future development, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Effects of Climate Change in Severity of Impacts: The primary reasons for sea level rise are the added water from ice sheets and glaciers and the ocean water's thermal expansion, both of which are a result of increasing global average temperatures.[227] Since 1880, the global average sea level has risen between eight (8) to nine (9) inches and in 2022 the average sea level was four (4) inches above 1993 levels, a record high. Due to land processes (e.g., erosion, oil and groundwater pumping, subsidence), the rate of local sea level rise along the United States coastline is greater than the global average. Furthermore, high tide flooding between 300% and 900% more frequent than 50 years ago.[228]

[226] Bay Area Association of Government. (2020). Plan Bay Area 2050 Final Blueprint Growth Pattern. Retrieved from https://planbayarea.org/digital-library/plan-bay-area-2050-final-blueprint-growth-pattern.
[227] National Aeronautics and Space Administration. (2023). Sea Level. Retrieved from https://climate.nasa.gov/vital-signs/sea-level/.
[228] Lindsey, R. (2022). Climate Change: Global Sea Level. Retrieved from https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level.

In California, observations of climate have shown that sea level rise is expected to continue to increase flooding and erosion of beaches, bluffs, and cliffs. Relative to the average sea levels between 1991 and 2009, sea levels in California may increase in most places by six (6) to 10 inches by 2030, 13 to 23 inches by 2050, and 41 to 83 inches by 2100. However, it is possible that sea level may increase faster than these projections. Studies show that eventually, sea levels may increase enough to permanently inundate low lying areas near the Bay shoreline and the Delta areas.[229]

Table 4-140 outlines the climate change impacts to sea level rise in Contra Costa County, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

[229] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.

Table 4-137. Probability of Occurrence

Hazard Event	Probability of Occurrence		Probability Factor	Weighted Factor
Sea Level Rise	Medium	Significant hazard event is likely to occur within 25 years.	2	N/A

Table 4-138. Extent Factors

Hazard Event	Extent Factor	Extent		Extent Factor	Weighted Factor
Sea Level Rise	***Extent/Intensity***	Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2	6
	Catastrophic	Medium	Catastrophic hazard event is likely to occur at least once between 11 and 50 years.	2	6

Table 4-139. Vulnerability Factors

Hazard Event	Vulnerability Factor	Vulnerability		Vulnerability Factor	Weighted Factor
Sea Level Rise	***Population Exposure***	Low	14% or less of the population is exposed to the hazard.	1	3
	Property Exposure	Low	9% or less of the total assessed property value is exposed to a hazard.	1	2
	Changes in Development	Low	Changes in development have increased the vulnerability/exposure of the community to the hazard by 4% or less.	1	1

Table 4-140. Impact Factors

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
Sea Level Rise	***Population and Life Safety***	No Impact	Populations exposed to this hazard are not likely to experience significant adverse impacts.	0	0
	Underserved/Equity	Low	Underserved populations exposed to the hazard are likely to experience minimal adverse/disproportionate impacts, such as ambulatory injuries.	1	3
	Property Damage	Medium	More than $500,000 but less than $5 Million in property damages is expected from a single major hazard event, or damages are expected to occur to more than 5% but less than 15% of the property value within the jurisdiction.	2	4
	Economic	Medium	Total economic impact is likely to be greater than $500,000, but less than or equal to $10 Million.	2	2

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
	Environmental	Medium	Environmental impact from a single major hazard event is likely to be localized, requiring some outside resources and support; and/or repair, clean-up, restoration, or preservation work.	2	2
	Essential Operations	Low	Impact less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	1	1
	Future Development	Medium	Future development trends will increase the impact/consequence of this hazard, but not significantly.	2	2
	Climate Change	High	Climate Change trends will significantly increase the risk of this hazard and its impacts.	3	3

4.6.7.8. FEMA NRI Expected Annual Loss Estimates

A coastal flooding NRI EAL score, and rating represent a community's relative level of expected building and population loss each year due to coastal flooding when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-141** outlines the coastal flooding EAL for Contra Costa County.

Table 4-141. Coastal Flooding Expected Annual Loss *(FEMA National Risk Index)*

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Contra Costa County	$79.2 Billion	$2.1 Billion	N/A	$81.3 Billion	56.8	Relatively Moderate
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.7.9. FEMA Coastal Flooding Risk Index Scores

The coastal flooding Risk Index score and rating represent a community's relative risk for coastal flooding when compared to the rest of the United States. **Table 4-142** illustrates the coastal flooding Risk Index rating and score for Contra Costa County.

Table 4-142. Coastal Flooding Risk Index *(FEMA National Risk Index)*

Jurisdiction	Rating	Score
Contra Costa County	Relatively Moderate	57.5
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

Table 4-143 represents the Sea Level Rise Total Risk Score for Contra Costa County, based on the Risk Assessment Methodology, as defined in this Plan. For further details on how the probability, extent, vulnerability, and impact factors were calculated, please refer to **Table 4-137** through **Table 4-140**. Additional details on how the Total Risk Score was calculated can be found in the Risk Assessment Methodology in Section 4.3 of this Plan.

Table 4-143. Sea Level Rise Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Sea Level Rise	2	12	6	17	35	37

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.8. Severe Weather

4.6.8.1. Description

For the purposes of this Plan, severe weather includes those hazards that are typically produced during severe thunderstorms (i.e., hail, strong winds, and tornado), heavy rainfall, and heat wave.

Severe Thunderstorms

A thunderstorm is a rain shower during which you hear thunder and since thunder includes lightning, then all thunderstorms include lightning. However, a thunderstorm is classified as severe when it contains one (1) or more of the following – hail one (1) inch or greater, winds gusting in excess of 58 mph, and/or a tornado. [230]

Included below are the hazards that comprise a severe thunderstorm – hail, strong winds, tornado. Each hazard is examined independently, but it is recognized that these could occur simultaneously.

Hail

Hail is a form of precipitation that consists of solid ice that forms inside thunderstorm updrafts. During a thunderstorm, hail forms when raindrops are carried upward by the thunderstorm's updrafts into extremely cold air and freeze. As the hailstones continue to be carried upward, they continue to collide with liquid water drops that freeze into the surface of the hailstone. Once the thunderstorm's updraft can no longer hold the weight of the hailstone, which occurs when the updraft weakens or the hailstone is too heavy, then the hail falls. When a hailstone encounters different liquid water content conditions and temperatures within the thunderstorms, it causes hailstone to have layers of clear and cloudy ice. The speed at which hail falls primarily depends on four (4) characteristics – hail size, friction between the hailstone and surrounding air, local wind conditions (horizontal and vertical), and degree of melting of the hailstone. There is much uncertainty in the average speed hail falls; however, NOAA developed the estimates shown on **Table 4-144**. [231]

Table 4-144. Hail Speed Estimates

Hail Size (inches)	Fall Speed (mph)
Less than 1	9 – 25
1 – 1.75	20 – 40
2 – 4	44 – 72
4 or greater	Over 100

[230] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Thunderstorm Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/thunderstorms/.
[231] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Hail Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/hail/.

Strong Winds

Strong winds, also known as damaging winds, are classified as exceeding 58 mph and often originate from thunderstorms.[232] Most severe thunderstorm winds that cause damage at the ground are a result of outflow generated by the downdraft of a thunderstorm. **Table 4-145** outlines the different types of strong winds.[233]

In coastal regions a strong wind is called a gale. Gale winds are sustained surface winds between 34 and 47 knots (39 to 54 mph).

Table 4-145. Types of Strong Winds

Type	Description
Straight-line Wind	Term used to define any thunderstorm wind that is not associated with a rotation and is used mainly to differentiate from tornadic winds.
Downdraft	A small-scale column of air that rapidly winds towards the ground.
Macroburst	An outward burst of strong winds at or near the surface with horizontal dimensions larger than 2.5 miles and occurs when a strong downdraft reaches the surface. Macroburst winds may begin over a smaller area and then spread out over a wider area, sometimes producing damage similar to a tornado. Although usually associated with thunderstorms, macrobursts can occur with showers too weak to produce thunder.
Microburst	A small, concentrated downburst that produces an outward burst of strong winds at or near the surface. Microbursts are small (less than 2.5 miles across) and short-lived (five (5) to 10 minutes) with maximum windspeeds sometimes exceeding 100 mph. There are two (2) kinds of microbursts – wet and dry. A wet microburst is accompanied by heavy precipitation at the surface. Dry microbursts, common in places like the high plains and the intermountain west, occur with little or no precipitation reaching the ground.
Gust Front	The leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Sometimes the winds push up air above them, forming a shelf cloud or detached roll cloud.
Derecho	A widespread, long-lived windstorm that is associated with a band of rapidly moving showers or thunderstorms. A typical derecho consists of numerous downbursts and downburst clusters. By definition, if the wind damage swath extends more than 240 miles and includes wind gusts of at least 58 mph or greater along most of its length, then the event may be classified as a derecho.
Haboob	A wall of dust that is pushed out along the ground from a thunderstorm downdraft at high speeds.
A **downburst is the general term used to broadly describe macro and microbursts.*	

Tornado

A tornado is a narrow, violently rotating column of air that extends from a thunderstorm to the ground. A tornado is hard to see unless it forms a condensation funnel made up of water droplets, dust, and debris. Tornadoes are among the most violent phenomena of all atmospheric storms and atmospheric scientists continue to conduct research to better understand how tornadoes form. Tornadoes come from mainly

[232] Federal Emergency Management Agency. (n.d.). Strong Wind. Retrieved from https://hazards.fema.gov/nri/strong-wind.
[233] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Types of Damaging Winds. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/wind/types/.

two (2) types of thunderstorms – supercell and non-supercell.[234] **Table 4-146** outlines the types of tornadoes.[235]

Table 4-146. Types of Tornadoes

Type	Description
Supercell	The most common and destructive tornadoes occur from supercells. A supercell is a rotating thunderstorm with a well-defined radar circulation called a mesocyclone. *Supercells can also produce damaging hail, severe non-tornadic winds, frequent lightning, and flash floods.* The rotating updraft from a supercell is the key development for a tornado. One way a column of air can begin to rotate is from wind shear when winds at two (2) different levels above the ground blow at different speeds or in different directions. Once the updraft is rotating and fed with warm moist air flowing in the ground level, a tornado can form.
Non-Supercell	Nearly 20% of all tornadoes are associated with lines of strong thunderstorms called quasi-linear convective systems (QLCS). QLCS tornadoes frequently occur during the late night and early morning hours. These tornadoes, however, tend to be weaker and shorter-lived on average than those associated with supercell thunderstorms. NOAA's National Severe Storms Laboratory (NSSL) researchers are looking for ways to detect QLCS tornadoes more effectively.
Another type of non-supercell tornado is a landspout. A landspout is a tornado with a narrow, rope-like condensation funnel that forms while the thunderstorm cloud is still growing and there is no rotating updraft - the spinning motion originates near the ground.	

Heavy Rainfall

There is no single definition for heavy (or extreme) rainfall. However, meteorologists consider instances where the amount of precipitation (rain or snow) experienced in a location substantially exceeds normal amounts. The amount of precipitation needed to qualify as heavy rain varies with location and season. Rainfall events share characteristics such as high moisture and an atmospheric disturbance (e.g., winter storm, atmospheric river) and when these conditions persist over an area the more rainfall an area will receive.[236] Heavy rainfall is most frequently measured by tracking the frequency of events, analyzing the mean return period, and measuring the amount of precipitation in a certain period (most typically inches of rain within a 24-hour period)[237].

Atmospheric River

A relatively common weather pattern that brings heavy rainfall and mountain snow to California is often referred to as an atmospheric river. About 30% to 50% of the annual precipitation in the west coast states occurs during a few atmospheric river events and approximately 80% of the levee breaches in the California's Central Valley are associated with atmospheric rivers.[238] Atmospheric rivers are long, concentrated regions in the atmosphere that transport moist air from the tropics to higher latitudes. The combination of moist air and high wind speeds produce heavy precipitation upon landfall, especially over mountainous terrain. As atmospheric rivers move over land, conditions can be similar to a tropical cyclone

[234] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Tornado Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/tornadoes/.
[235] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Types of Tornadoes. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/tornadoes/types/.
[236] National Oceanic and Atmospheric Administration. (2018). Ask the Scientist: Extreme Rainfall, Why it Happens and How We Predict It. Retrieved from https://www.noaa.gov/stories/ask-scientist-extreme-rainfall-why-it-happens-and-how-we-predict-it.
[237] United States Environmental Protection Agency. (2023). Climate Change Indicators: Heavy Precipitation. Retrieved from https://www.epa.gov/climate-indicators/climate-change-indicators-heavy-precipitation.
[238] Monroe, R. (2019). New Scale To Characterize Strength And Impacts Of Atmospheric River Storms. Retrieved from https://scripps.ucsd.edu/news/new-scale-characterize-strength-and-impacts-atmospheric-river-storms.

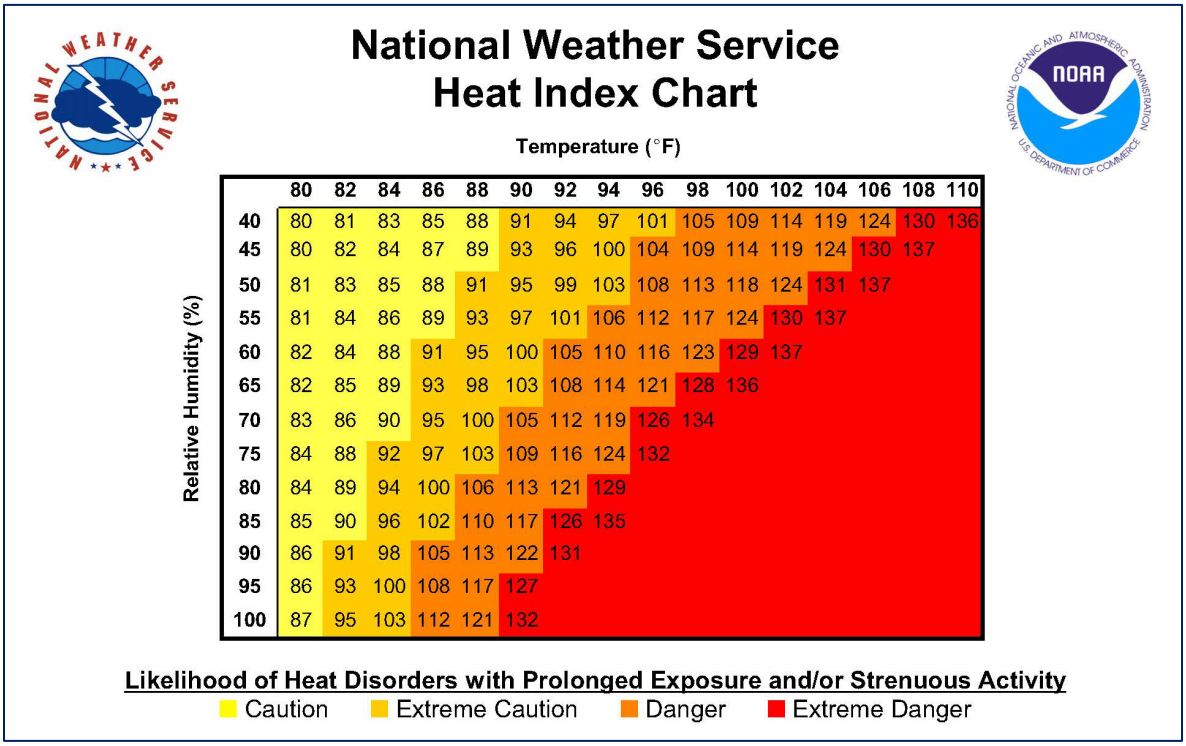
leading to flash flooding, mudslides, cyclone force winds, increased wave heights, and catastrophic damage to life and property. [239]

Heat Wave / Extreme Heat

The definition of a heat wave varies based on different factors, such as location, weather conditions (e.g., temperature, humidity, cloud cover) and the time of year. [240] However, excessive/extreme heat can be defined as a prolonged period of excessively hot weather, with temperatures above the average high. [241] Heat alone does not make high temperatures a threat; both humidity and heat combined is what makes high temperatures a dangerous. [242] The Heat Index is a measure of how hot it really feels when relative humidity is factored in with the actual air temperature (i.e., ambient temperature).

Figure 4-19 illustrates NWS' Heat Index Chart. The NWS primarily uses Heat Index values to determine excessive heat events and issue the appropriate advisories. [243]

Figure 4-19. National Weather Service Heat Index Chart



[239] National Oceanic and Atmospheric Administration. (2023). Atmospheric Rivers: What are They and How Does NOAA Study Them? Retrieved from https://research.noaa.gov/2023/01/11/atmospheric-rivers-what-are-they-and-how-does-noaa-study-them/.
[240] U.S. Environmental Protection Agency and the Centers for Disease Control and Prevention. (2016). Climate Change and Extreme Heat: What You Can Do to Prepared. Retrieved from https://www.epa.gov/sites/default/files/2016-10/documents/extreme-heat-guidebook.pdf.
[241] Federal Emergency Management Agency. (n.d.). Extreme Heat | What. Retrieved from https://community.fema.gov/ProtectiveActions/s/article/Extreme-Heat-What.
[242] National Oceanic and Atmospheric Administration. (2022). Heat Index. Retrieve from https://www.noaa.gov/jetstream/global/heat-index#.
[243] National Weather Service. (n.d.). Heat Forecast Tools. Retrieved from https://www.weather.gov/safety/heat-index.

4.6.8.2. Hazard Location

Severe Thunderstorms (i.e., hail, strong winds, and tornado), heavy rainfall, atmospheric river, and heat wave can occur anywhere in Contra Costa County. **Figure 4-20** illustrates hail events within five (5) miles of Contra Costa County that occurred between 1950 and 2023.

Figure 4-20. Contra Costa County Hail History (1950 – 2023)

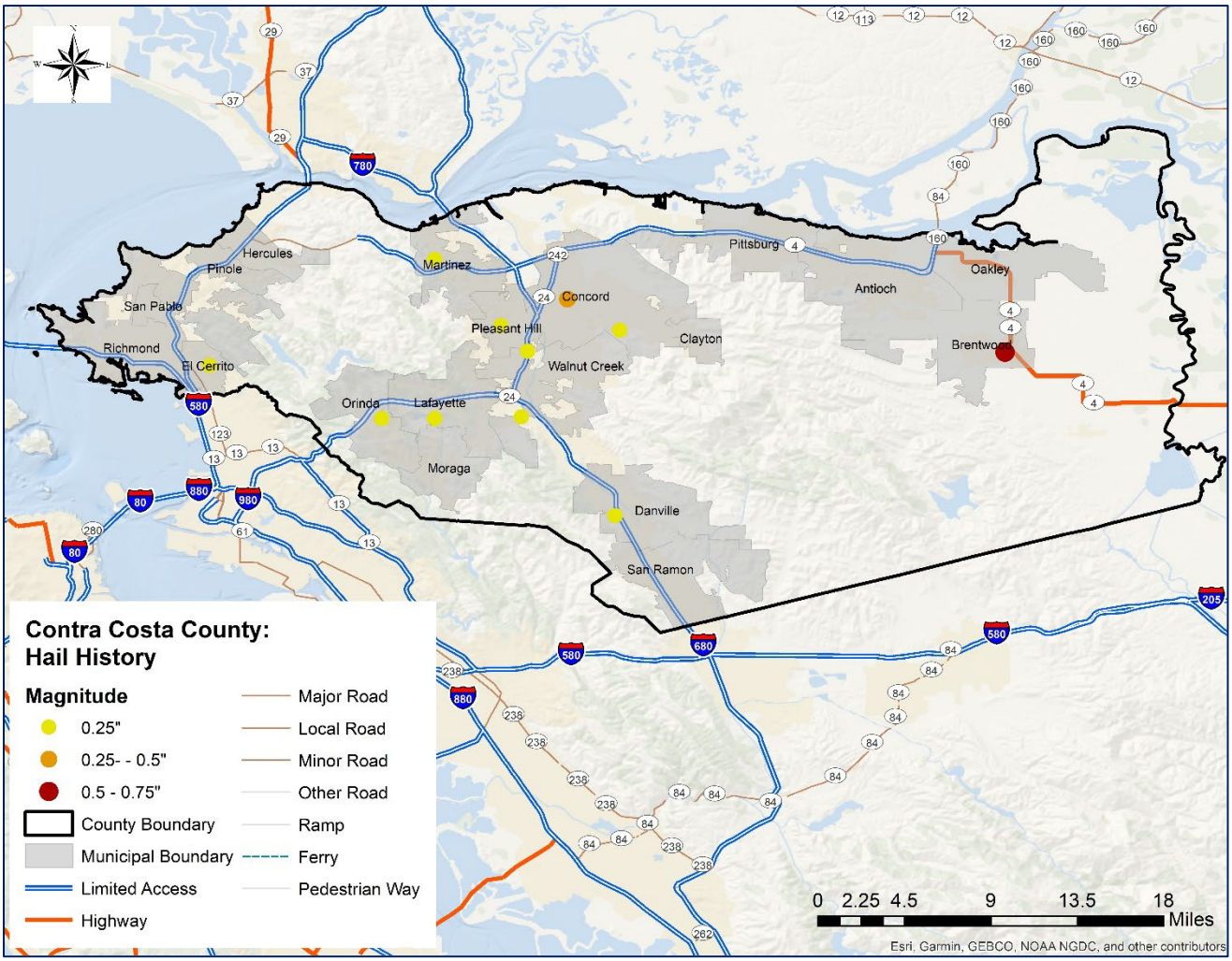


Figure 4-21 illustrates strong wind events within five (5) miles of Contra Costa County that occurred between 1950 and 2023.

Figure 4-21. Contra Costa County Strong Wind History (1950 – 2023)

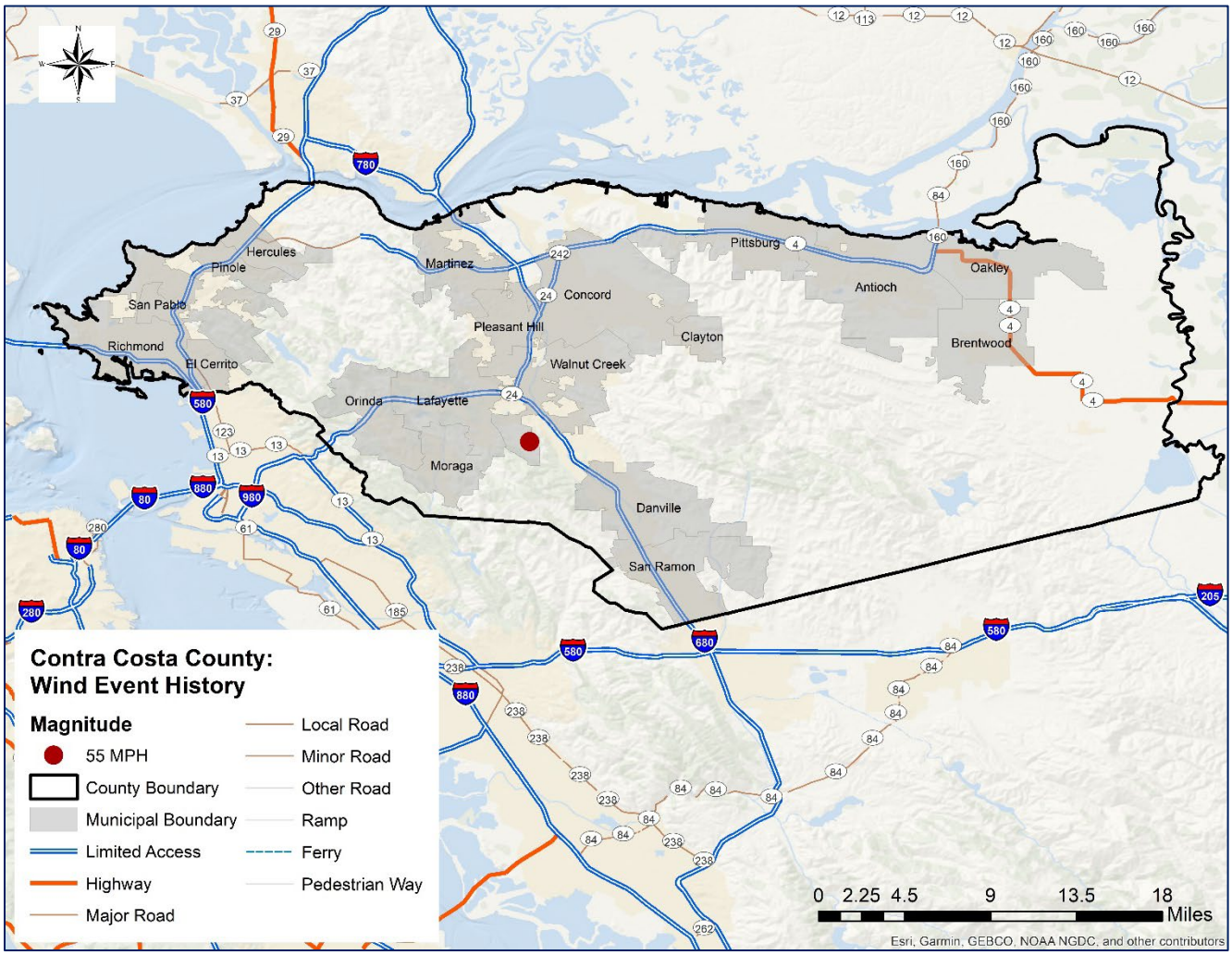
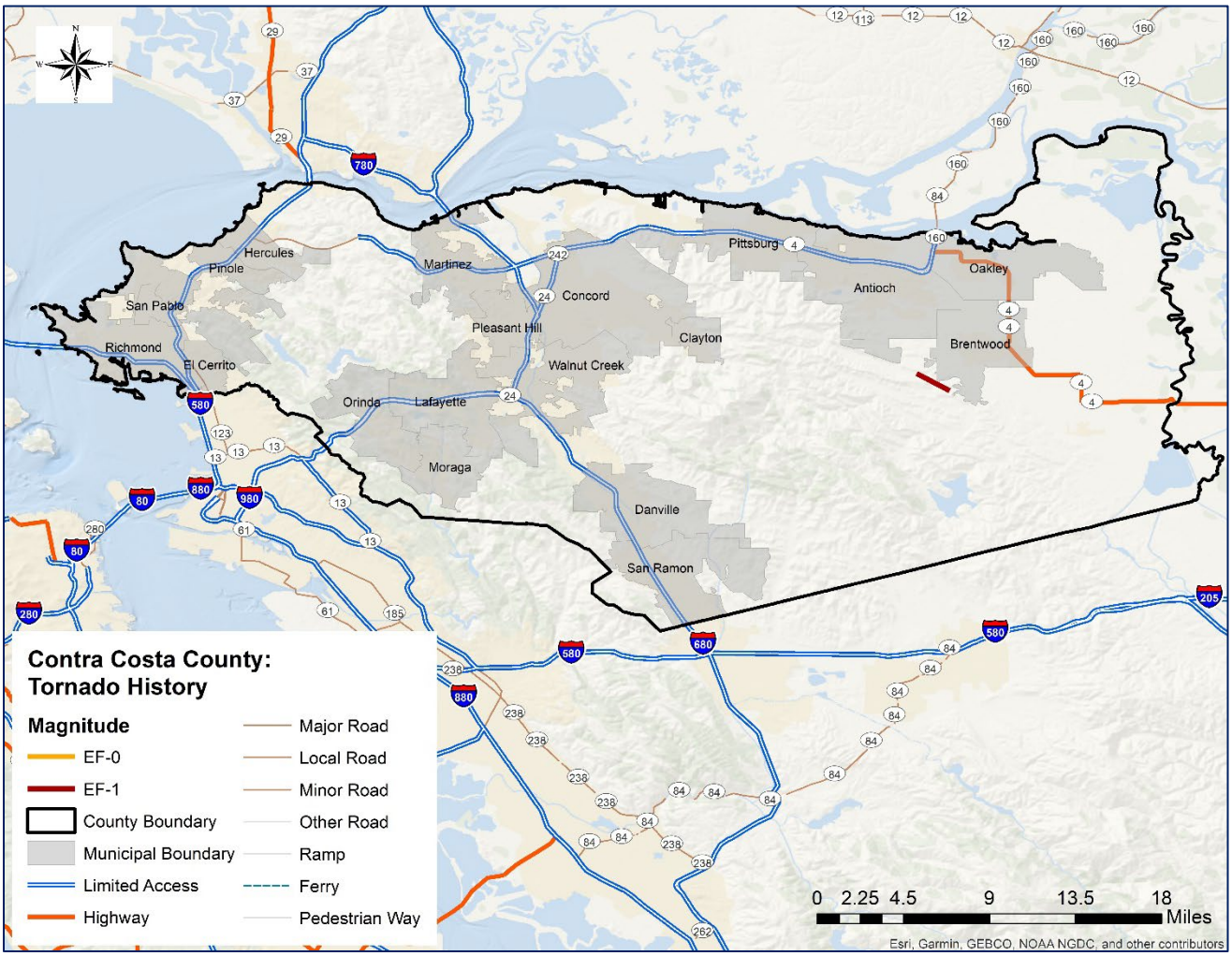


Figure 4-22 illustrates tornado events within five (5) miles of Contra Costa County that occurred between 1950 and 2023.

Figure 4-22. Contra Costa County Tornado History (1950 – 2023)

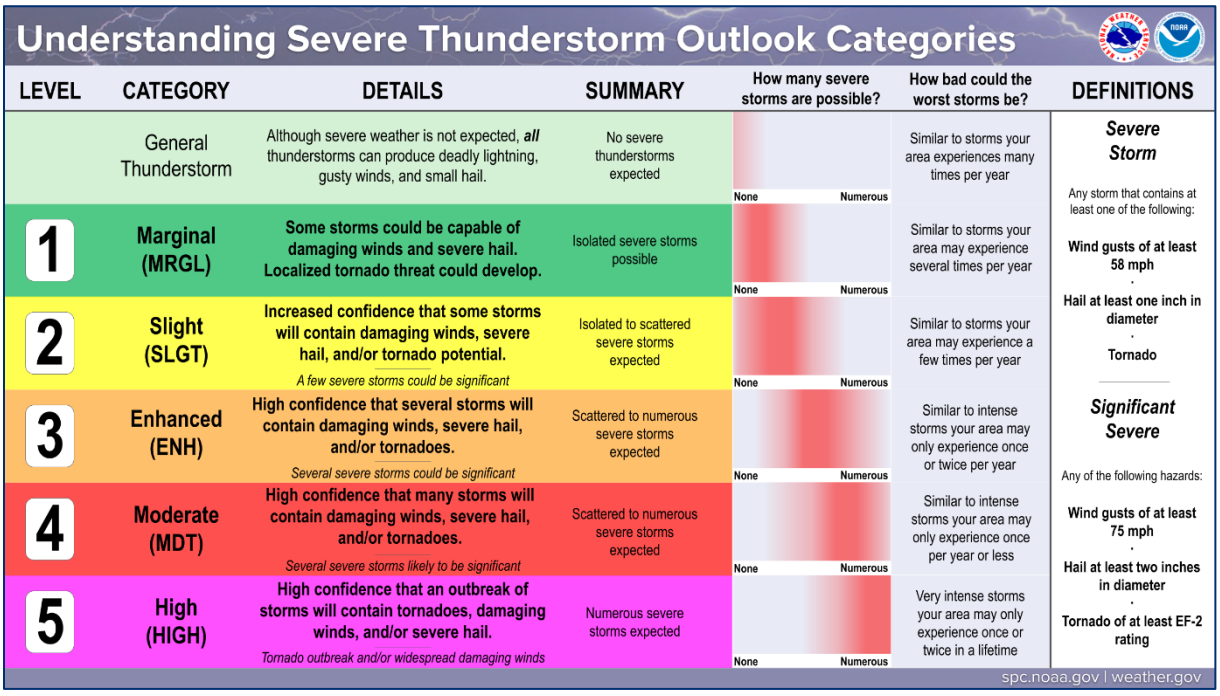


4.6.8.3. Hazard Extent/Intensity

Severe weather can be life threatening and can cause substantial damage to infrastructure and property. The extent of damage caused by severe weather depends on the type of severe weather, strength, and location.

Figure 4-23 illustrates the severe thunderstorm outlook categories used by the NWS Storm Prediction Center (SPC) when issuing Severe Thunderstorm Outlooks.

Figure 4-23. SPC Severe Thunderstorm Outlook Categories



Hail can vary in shapes and sizes, and only the very large hailstones pose a serious risk to life safety. NWS reports hail size by comparing the hailstone with traditional object to size conversion for assessment and translation of severe hail reports. **Table 4-147** lists the traditional conversion of hail size descriptions. [244]

Table 4-147. Converting Traditional Hail Size Descriptions

Hail Size *(inches)*	Object Analog Reported
0.25	Pea
0.50	Mothball
0.75	Penny
0.88	Nickel
1.00	Quarter
1.50	Walnut, ping pong

[244] NOAA, National Severe Storms Laboratory. (n.d.). Severe Weather 101: Hail Basics. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/hail/.

Hail Size *(inches)*	Object Analog Reported
1.75	Golf ball
2.50	Tennis ball
2.75	Baseball
3.00	Teacup
4.00	Softball
4.50	Grapefruit

The Beaufort Wind Scale was developed to estimate and report wind speeds when a measuring apparatus is not available (e.g, open sea). It was invented in the 1805 by Sir Francis Beaufort of the British Navy as a way to interpret wind conditions at sea. Since then, the scale has been modified to include the effects on land. **Table 4-148** outlines the 13 force classification that comprise the Beaufort Wind Scale. [245]

Table 4-148. Beaufort Wind Scale

Force	Wind *(knots)*	Classification	Appearance of Wind Effects	
			On the Water	On Land
0	< 1	Calm	Sea surface smooth and mirror-like.	Calm, smoke rises vertically.
1	1 – 3	Light Air	Scaly ripples and no foam crests.	Smoke drift indicates wind direction and still wind vanes.
2	4 – 6	Light Breeze	Small wavelets, crests glassy, and no breaking.	Wind felt on face, leaves rustle, and vanes begin to move.
3	7 – 10	Gentle Breeze	Large wavelets, crests begin to break, and scattered whitecaps.	Leaves and small twigs constantly moving, and light flags extended.
4	11 – 16	Moderate Breeze	Small waves of one (1) to four (4) feet becoming longer with numerous whitecaps.	Dust, leaves, and loose paper lifted, and small tree branches move.
5	17 – 21	Fresh Breeze	Moderate waves of four (4) to eight (8) feet taking longer form, many whitecaps, and some spray.	Small trees and leaves begin to sway.
6	22 – 27	Strong Breeze	Larger waves of eight (8) to 13 feet, whitecaps are common, and more spray.	Larger tree branches moving and whistling in wires.
7	28 – 33	Near Gale	Sea heaps up, waves are 13 to 19 feet, white foam streaks off breakers.	Whole trees moving and resistance felt walking against wind.
8	34 – 40	Gale	Moderately high waves (18 to 25 feet) of greater length, edges of crests begin to break into spindrift, and foam blown in streaks.	Twigs breaking off trees and generally impedes progress.
9	41 – 47	Strong Gale	High waves (23 to 32 feet), sea begins to roll, dense streaks of foam, and spray may reduce visibility.	Slight structural damage occurs, and slate blows off roofs.

[245] National Weather Service. (n.d.). Beaufort Wind Scale. Retrieved from https://www.spc.noaa.gov/faq/tornado/beaufort.html.

Force	Wind (knots)	Classification	Appearance of Wind Effects	
			On the Water	On Land
10	48 – 55	Storm	Very high waves (29 to 41 feet) with overhanging crests, sea white with densely blown foam, heavy rolling, and lowered visibility.	Seldom experienced on land, trees broken or uprooted, and considerable structural damage.
11	56 – 63	Violent Storm	Exceptionally high waves (37 to 52 feet), foam patches cover sea, and visibility more reduced.	--
12	> 63	Hurricane	Air filled with foam, waves over 45 feet, sea completely white with driving spray, and visibility greatly reduced.	See Saffir-Simpson Hurricane Wind Scale.

Tornado rating, based on the Enhance Fujita Scale (EF Scale), is assigned after tornado-related damage is surveyed. The EF Scale is based on the estimated wind speeds and related damage. **Table 4-149** outlines the EF Scale. When tornado damages are surveyed, they are compared to a list of Damage Indicators and Degrees of Damage which help to better estimate the range of wind speeds the tornado likely produced. The EF Scale was revised from the original Fujita Scale and became operational in February 2007. [246]

Table 4-149. Enhanced Fujita Scale

EF Rating	3 Second Gust (mph)
0	65 – 85
1	86 – 110
2	111 – 135
3	136 – 165
4	166 – 200
5	Over 200

The NWS HeatRisk Tool Prototype is a color numeric-based index that provides a forecast of the potential level of risk for heat-related impacts to occur in a 24-hour period. This serves as a supplementary tool for official NWS heat products and is meant to provide risk guidance for decision-makers and heat-vulnerable populations who require certain actions at levels that may be below the NWS heat product thresholds. **Table 4-150** outlines the NWS HeatRisk categories and risk of heat-related impacts. [247]

Table 4-150. NWS HeatRisk Categories

Category		Risk of Heat-Related Impacts
0	Green	Little to no risk from expected heat.
1	Yellow	**Minor:** This level of heat affects primarily those individuals extremely sensitive to heat, especially when outdoors without effective cooling and/or adequate hydration.

[246] National Weather Service. (n.d.). The Enhance Fujita Scale (EF Scale). Retrieved from https://www.weather.gov/oun/efscale.
[247] National Weather Service. (n.d.). NWS HeatRisk Prototype. Retrieved from https://www.wrh.noaa.gov/wrh/heatrisk/.

Category		Risk of Heat-Related Impacts
2	Orange	**Moderate**: This level of heat affects most individuals sensitive to heat, especially those without effective cooling and/or adequate hydration. Impacts possible in some health systems and in heat-sensitive industries.
3	Red	**Major**: This level of heat affects anyone without effective cooling and/or adequate hydration. Impacts likely in some health systems, heat-sensitive industries, and infrastructure.
4	Magenta	**Extreme**: This level of rare and/or long-duration extreme heat with little to no overnight relief affects anyone without effective cooling and/or adequate hydration. Impacts likely in most health systems, heat-sensitive industries, and infrastructure.
The HeatRisk takes into consideration the following – how unusual the heat is for the time of the year, the duration of the heat including both daytime and nighttime temperatures, and those temperatures that pose an elevated risk of heat-related impacts based on data from the CDC.		

The Atmospheric River Scale was developed in collaboration with the Center for Western Water and Weather Extremes at Scripps Institution of Oceanography at University of California San Diego and National Weather Service. The scale uses the amount of water vapor within the atmospheric river as its basis and a period of 24 to 48 hours as its standard measurement of duration. For example, if an atmospheric river remains over an area for over 48 hours the category is increased one and if it is less than 24 hours it is decreased by a category. The Atmospheric River Scale has five (5) categories outlined in **Table 4-151**. [248]

Table 4-151. Atmospheric River Scale

Category		Description
1	Weak	Primarily beneficial.
2	Moderate	Mostly beneficial, but also hazardous.
3	Strong	Balance of beneficial and hazardous.
4	Extreme	Mostly hazardous, but also beneficial.
5	Exceptional	Primarily hazardous.

4.6.8.4. Warning Time

The NWS SPC is responsible for issuing severe thunderstorms and tornado advisories, as conditions warrant. **Table 4-152** outlines the severe thunderstorms and tornado advisories. [249]

Table 4-152. NWS Severe Weather Advisories

Type	Description
Severe Thunderstorm Watch	Issued by the NOAA SPC when conditions are favorable for the development of severe thunderstorms in and close to the watch area. The size of the watch can vary depending on the weather situation. Severe thunderstorm watches are usually issued for a duration of four (4) to eight (8) hours. They are normally issued well in advance of the actual occurrence of severe weather.

[248] Monroe, R. (2019). New Scale To Characterize Strength And Impacts Of Atmospheric River Storms. Retrieved from https://scripps.ucsd.edu/news/new-scale-characterize-strength-and-impacts-atmospheric-river-storms.
[249] National Weather Service. (n.d.). National Weather Service Glossary. Retrieved from https://w1.weather.gov/glossary/.

Type	Description
Severe Thunderstorm Warning	Issued by the local NWS Forecast Office when either a severe thunderstorm is indicated by radar, or a spotter reports a thunderstorm producing hail one (1) inch or larger in diameter and/or winds equal or exceed 58 mph. Severe thunderstorm warnings are usually issued for a duration of one (1) hour. They can be issued without a Severe Thunderstorm Watch being already in effect. Severe thunderstorms can produce tornadoes with little or no advance warning.
Tornado Watch	Issued by the SPC when conditions are favorable for the development of tornadoes in and close to the watch area. The size of the watch can vary depending on the weather situation. Tornado watches are usually issued for a duration of four (4) to eight (8) hours. They are normally issued well in advance of the actual occurrence of tornadoes.
Tornado Warning	Issued by the local NWS Forecast Office when either a tornado is indicated by radar, or sighted by spotters. Tornado warnings are usually issued for a duration of around 30 minutes. They can be issued without a Tornado Watch being already in effect
Gale Watch	Issued by the local NWS Forecast Office for locations along the water when one (1) or both of the following conditions is possible to begin within 36 hours and is not directly associated with a tropical cyclone – sustained winds of 34 to 47 knots (39 to 55 mph) **or** frequent gusts (duration of two (2) or more hours) between 34 to 47 knots (39 to 55 mph).
Gale Warning	Issued by the local NWS Forecast Office for locations along the water when one (1) or both of the following conditions is expected to begin within 36 hours and is not directly associated with a tropical cyclone – sustained winds of 34 to 47 knots (39 to 55 mph) **or** frequent gusts (duration of two (2) or more hours) between 34 to 47 knots (39 to 55 mph). At this point, vessel need to be secure at port.

Heavy rainfall can lead to flooding, which can be unexpected and leave a small window of time for evacuation if it is required. The NWS San Francisco Bay Area Forecast Office is responsible for issuing flood advisories and Flash Flood Warnings Impact-Based Warnings for events that occur within approximately six (6) hours of heavy rainfall in Contra Costa County. *Refer to the Flood section of this Plan for more information on the warning time during a heavy rainfall event.*

During an excessive heat event, the NWS San Francisco Bay Area Forecast Office issues excessive heat advisories, watches, and warnings. **Table 4-153** outlines the heat-related products issued by the local NWS Forecast Office. NWS' local offices collaborate with local agencies (e.g., emergency managers, public health professionals) to determine when an alert should be issued for the local area by establishing heat index thresholds for each advisory.

Table 4-153. NWS Excessive Heat Advisories

Type	Definition
Excessive Heat Outlook	Issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to those who need considerable lead time to prepare for the event.
Heat Advisory	Issued within 12 hours of the onset of extremely dangerous heat conditions. Generally, an advisory is issued when the heat index values are expected to reach 100°F or higher for at least two (2) days, and nighttime air temperatures will not drop below 75°F.
Excessive Heat Watch	Issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. Generally, a watch is issued when the risk of a heat wave has increased, but its occurrence and timing is still uncertain

Type	Definition
Excessive Heat Warning	Issued within 12 hours of the onset of extremely dangerous heat conditions. Generally, a warning is issued when the heat index values are expected to reach 105°F or higher for at least two (2) days and nighttime air temperatures will not drop below 75°F.

4.6.8.5. Probability and Frequency

The probability of occurrence for severe weather in Contra Costa County is high because significant severe weather events are likely to occur annually.

Probability of Future Hazard Events

The hail annualized frequency value represents the average number of recorded hail hazard occurrences, in event days, per year over the period of record (34 years). **Table 4-154** outlines the annualized frequency for hail, based on FEMA NRI data, for Contra Costa County.

Table 4-154. Hail Annualized Frequency *(FEMA National Risk Index)*

Location	Events on Record *(1986 – 2021)*	Annualized Frequency
Contra Costa County	2	0.0 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

The strong wind annualized frequency value represents the average number of recorded strong wind hazard occurrences, in event days, per year over the period of record (34 years). **Table 4-155** outlines the annualized frequency for strong winds, based on FEMA NRI data, for Contra Costa County.

Table 4-155. Strong Wind Annualized Frequency *(FEMA National Risk Index)*

Location	Events on Record *(1986 – 2021)*	Annualized Frequency
Contra Costa County	2	0.0 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

The tornado annualized frequency value represents the average number of recorded tornado hazard occurrences, in event days, per year over the period of record (72 years). **Table 4-156** outlines the annualized frequency for tornadoes, based on FEMA NRI data, for Contra Costa County.

Table 4-156. Tornado Annualized Frequency *(FEMA National Risk Index)*

Location	Events on Record *(1950 – 2021)*	Annualized Frequency
Contra Costa County	5	0.1 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

The heat wave annualized frequency value represents the average number of recorded heat wave hazard occurrences in event days, per year over the period of record (16 years). **Table 4-157** outlines the annualized frequency for heat waves, based on FEMA NRI data, for Contra Costa County.

Table 4-157. Heat Wave Annualized Frequency *(FEMA National Risk Index)*

Location	Events on Record *(2005 – 2021)*	Annualized Frequency
Contra Costa County	27	1.8 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

4.6.8.6. Past Events

NCEI has reported 95 severe thunderstorm events which include 92 high wind events (58 mph or greater) and five (5) tornado events between 1950 – 2023. There have been no hail events greater than one (1) inch reported by NCEI. Additionally, NCEI has reported 35 heavy rainfall events between 1950 and 2023 in Contra Costa County. Additionally, there have been eight (8) flood disasters, and six (6) severe storm disasters declared in Contra Costa County between 1950 and 2023. A notable event occurred between December 26, 2022, through January 17, 2023, a series of six (6) storm systems moved through the San Francisco Bay area resulting in widespread flooding, including river flooding. In Contra Costa County, the event resulted in a series of Flood Warnings and rainfall amounts ranged from 6.2 inches to 20.07 inches.[250] On January 9, 2023, a Major Disaster Declaration (DR-3591) was issued for this event.

Table 4-158 lists strong wind events, **Table 4-159** lists tornado events, **Table 4-160** lists heavy rainfall events, and **Table 4-161** lists heat events that have occurred in the Contra Costa County between 1950 and 2023 according to NCEI.

Table 4-158. Strong Winds Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	3/28/2023	07:48	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS (ZONE)	East Bay Hills	CA	3/28/2023	09:40	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	3/28/2023	10:10	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	3/21/2023	13:04	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	3/21/2023	14:29	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	3/14/2023	07:45	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS (ZONE)	East Bay Hills	CA	3/14/2023	11:20	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS (ZONE)	East Bay Hills	CA	3/9/2023	21:20	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	2/21/2023	13:33	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	2/21/2023	15:22	High Wind	0	0	0.00K	0.00K

[250] National Weather Service, San Francisco Bay Area, California Weather Forecast Office. (2023). A Parade of Storms Impact Bay Area. Retrieved from https://www.weather.gov/mtr/AtmosphericRivers_12_2022-01_2023.

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
EAST BAY HILLS (ZONE)	East Bay Hills	CA	2/21/2023	16:30	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS (ZONE)	East Bay Hills	CA	12/27/2022	01:50	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS (ZONE)	East Bay Hills	CA	12/27/2022	03:10	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	12/7/2020	03:15	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	10/25/2020	23:50	High Wind	0	0	0.00K	0.00K
WALNUT HGTS	Contra Costa County	CA	8/16/2020	02:50	Thunderstorm Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	11/26/2019	19:18	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	11/26/2019	19:28	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	2/14/2019	01:28	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	2/14/2019	03:49	High Wind	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	1/16/2019	1528	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	1/16/2019	16:21	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	1/16/2019	17:13	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	1/16/2019	17:28	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	1/16/2019	18:28	High Wind	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	1/16/2019	18:38	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	1/9/2019	00:10	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	11/28/2018	23:45	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	10/7/2018	02:00	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	10/8/2017	21:15	High Wind	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	2/20/2017	16:50	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	2/17/2017	09:07	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	2/17/2017	11:04	High Wind	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	2/9/2017	12:09	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	2/7/2017	04:50	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	2/7/2017	05:28	High Wind	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	2/7/2017	09:30	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	1/22/2017	01:18	High Wind	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	1/7/2017	07:00	High Wind	1	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	2/6/2015	11:10	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	2/6/2015	11:18	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	2/6/2015	13:00	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	2/6/2015	14:28	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	12/30/2014	16:00	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	12/11/2014	04:00	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	12/11/2014	07:18	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	12/11/2014	07:30	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	10/27/2013	19:45	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	10/27/2013	20:12	High Wind	0	0	25.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	10/27/2013	23:18	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	10/4/2013	01:45	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	5/1/2013	02:00	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	5/1/2013	07:17	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	4/8/2013	00:18	High Wind	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	4/8/2013	02:12	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	11/28/2012	11:28	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	12/1/2011	01:45	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	3/19/2011	20:00	High Wind	0	0	100.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	2/15/2011	20:30	High Wind	0	0	150.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	1/20/2010	07:00	High Wind	0	1	245.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	1/19/2010	03:00	High Wind	0	0	40.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	1/19/2010	03:00	High Wind	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	1/19/2010	04:00	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	11/28/2009	07:00	High Wind	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	10/27/2009	11:00	High Wind	0	0	50.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	10/27/2009	21:00	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	10/13/2009	08:00	High Wind	0	0	2.500M	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	10/13/2009	08:00	High Wind	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	10/13/2009	08:00	High Wind	0	0	20.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	4/14/2009	16:00	High Wind	0	0	80.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	2/15/2009	03:39	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	1/4/2008	90:00	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	1/4/2008	09:00	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	1/4/2008	09:00	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	1/4/2008	10:00	High Wind	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	1/4/2008	12:00	High Wind	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	1/4/2008	12:00	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	12/27/2006	08:00	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	2/27/2006	10:00	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	2/27/2006	18:54	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	2/27/2006	19:00	High Wind	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	12/31/2005	03:00	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	12/31/2005	07:46	High Wind	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	12/18/2005	05:00	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	12/18/2005	07:57	High Wind	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	12/18/2005	13:00	High Wind	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	12/1/2005	12:00	High Wind	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	12/1/2005	12:28	High Wind	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	12/1/2005	13:30	High Wind	0	0	0	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	12/1/2005	17:39	High Wind	0	0	0	0.00K
					TOTAL	**1**	**1**	**3.260M**	**0.00K**

Table 4-159. Tornado Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
BRENTWOOD	Contra Costa County	CA	1/23/2010	12:54	Tornado (EF1)	0	0	25.00K	0.00K
RICHMOND	Contra Costa County	CA	12/5/1998	19:30	Tornado (F0)	0	0	200.00K	0.00K
BRENTWOOD	Contra Costa County	CA	2/19/1998	12:30	Tornado (F0)	0	0	50.00K	0.00K
CONTRA COSTA CO.	Contra Costa County	CA	9/18/1989	17:00	Tornado (F0)	0	0	0.00K	0.00K
CONTRA COSTA CO.	Contra Costa County	CA	9/18/1989	17:10	Tornado (F0)	0	0	0.00K	0.00K
					TOTAL	**0**	**0**	**275.00K**	**0.00K**

Table 4-160. Heavy Rainfall Past Events

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
AMBROSE	Contra Costa County	CA	1/10/2017	18:57	Heavy Rain	0	0	0.00K	0.00K
DIABLO	Contra Costa County	CA	2/9/2015	04:11	Heavy Rain	0	0	0.00K	0.00K
ORINDA VLG	Contra Costa County	CA	3/13/2012	00:00	Heavy Rain	0	0	50.00K	0.00K
GIANT	Contra Costa County	CA	6/4/2011	03:00	Heavy Rain	0	0	0.00K	50.00K
WALNUT CREEK	Contra Costa County	CA	4/11/2010	17:00	Heavy Rain	0	0	10.00K	0.00K
SW SJ VALLEY (ZONE)	SW San Joaquin Valley (Zone)	CA	9/3/2001	07:42	Heavy Rain	0	0	0.00K	0.00K
E CENTRAL SJ VALLEY	E Central San Joaquin Valley (Zone)	CA	9/3/2001	07:42	Heavy Rain	0	0	0.00K	0.00K
KERN CTY MTNS (ZONE)	Kern County Mountains (Zone)	CA	9/3/2001	12:35	Heavy Rain	0	0	0.00K	0.00K
INDIAN WELLS VLY (ZONE)	Indian Wells Valley (Zone)	CA	9/3/2001	12:35	Heavy Rain	0	0	0.00K	0.00K
SE KERN CTY DESERT (ZONE)	SE Kern County Desert (Zone)	CA	9/3/2001	12:35	Heavy Rain	0	0	0.00K	0.00K
MONO (ZONE)	Mono (Zone)	CA	7/5/2001	14:30	Heavy Rain	0	0	0.00K	0.00K
MONO (ZONE)	Mono (Zone)	CA	7/2/2001	19:30	Heavy Rain	0	0	0.00K	0.00K
E CENTRAL SJ VALLEY	E Central San Joaquin Valley (Zone)	CA	9/1/2000	03:40	Heavy Rain	0	0	0.00K	250.00K
E CENTRAL SJ VALLEY (ZONE)	E Central San Joaquin Valley (Zone)	CA	2/13/2000	00:00	Heavy Rain	0	0	0.00K	0.00K
E CENTRAL SJ VALLEY (ZONE)	E Central San Joaquin Valley (Zone)	CA	2/1/2000	01:00	Heavy Rain	0	0	0.00K	0.00K
SOUTHERN SAN JOAQUIN VALLEY (ZONE)	Southern San Joaquin Valley	CA	9/22/1999	07:30	Heavy Rain	0	0	0.00K	5.00M
CENTRAL SJV (ZONE)	Central San Joaquin Valley (Zone)	CA	9/9/1998	01:00	Heavy Rain	0	0	0.00K	0.00K
SOUTH SJV (ZONE)	South San Joaquin Valley (Zone)	CA	9/4/1998	00:00	Heavy Rain	0	0	0.00K	5.00M
N VENTURA (ZONE)	N Ventura (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
X N LOS ANGELES (ZONE)	X N Los Angeles (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
W SANTA BARBARA (ZONE)	W Santa Barbara (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
N LOS ANGELES T X N (ZONE)	N Los Angeles T X N (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
C VENTURA (ZONE)	C Ventura (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
C LOS ANGELES (ZONE)	C Los Angeles (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
X SW LOS ANGELES (ZONE)	X SW Los Angeles (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
X W SAN LUIS OBISPO (ZONE)	X W San Luis Obispo (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
X SE LOS ANGELES (ZONE)	X SE Los Angeles (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
X S VENTURA (ZONE)	X S Ventura (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
X S SANTA BARBARA (ZONE)	X S Santa Barbara (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
X N SANTA BARBARA (ZONE)	X N Santa Barbara (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
SC SAN LUIS OBISPO (ZONE)	Sc San Luis Obispo (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
SAN LUIS OBISPO T SC & X W (ZONE)	San Luis Obispo T Sc & X W (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
S VENTURA T X S (ZONE)	S Ventura T X S (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
P C SANTA BARBARA (ZONE)	P C Santa Barbara (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
P C SANTA BARBARA (ZONE)	P C Santa Barbara (Zone)	CA	11/10/1997	02:00	Heavy Rain	0	0	0.00K	0.00K
					TOTAL	**0**	**0**	**60.00K**	**10.30M**

Table 4-161. Heat Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
EAST BAY INTERIOR VALLEYS	East Bay Interior Valleys	CA	7/21/2006	12:00	Heat	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	7/21/2006	12:00	Heat	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	7/22/2006	14:00	Heat	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	7/25/2007	07:00	Heat	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	5/17/2009	10:00	Heat	0	0	10.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	5/17/2009	10:00	Heat	0	10	20.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	5/17/2009	12:00	Heat	0	1	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	6/27/2009	11:00	Heat	1	1	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	6/18/2017	14:00	Heat	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	6/20/2017	20:30	Heat	0	0	0.00K	0.00K

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	4/24/2019	15:00	Heat	0	1	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	8/14/2019	07:00	Heat	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	8/14/2019	16:30	Heat	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys (Zone)	CA	6/17/2021	15:00	Heat	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	6/10/2022	15:00	Heat	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	6/21/2022	15:00	Heat	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	6/21/2022	15:00	Heat	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	6/21/2022	15:00	Heat	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	8/16/2022	15:00	Heat	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	9/4/2022	09:00	Heat	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	9/4/2022	09:00	Heat	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	9/5/2022	14:00	Heat	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	9/5/2022	14:00	Heat	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	9/6/2022	14:00	Heat	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	9/6/2022	14:00	Heat	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	9/8/2022	14:00	Heat	0	0	0.00K	0.00K
					TOTAL	**1**	**13**	**30.00K**	**0.00K**

4.6.8.7. Vulnerability and Impacts

Life Safety and Health: All residents within Contra Costa County would be vulnerable and impacted by severe weather events. A study by the California Energy Commission states that heat wave/extreme heat events have claimed more lives in California than all other disaster events combined.[251] However, the underserved and at risk population face unique vulnerabilities and impacts as a result of severe weather. These groups include, but are not limited to, households in poverty, outdoor workers, individuals with

[251] Association of Bay Area Governments. (n.d.). Extreme Heat. Retrieved from https://abag.ca.gov/our-work/resilience/data-research/extreme-heat.

chronic illnesses, those with limited English proficiency, the elderly population and seniors living alone, and undocumented individuals.[252]

- **Households in Poverty:** Households in poverty include those with an income at or below $24,300 for a household of four (4). In Contra Costa County, households in poverty may live in structures that are less resilient to severe weather which increases the likelihood that severe thunderstorms, strong winds, and heavy rainfall can damage the structures, and cause mold and mildew. Due to fewer financial resources, this population may not be able to complete preparedness and recovery activities (i.e., fix flood damage). Furthermore, this population can be physically harmed or experience a decrease in quality of life due to severe weather. High concentration of this population is located in central Richmond, North Richmond and San Pablo, tracts of Concord and Martinez, and in Bay Point, Pittsburg, and Antioch. Poverty is associated with greater vulnerability to heat wave/extreme heat events in a number of ways. The long-standing association between low income and poor health outcomes, as well as pre-existing health conditions among people in poverty, play a key role in vulnerability. Impoverished and low-income individuals who are uninsured may be less likely to seek medical help if they become ill, may live in poorly insulated housing, and may also be less likely to use fans or air conditioning out of concern for high utility bills. During extreme heat days, temperatures in uninsulated homes may reach unhealthy temperatures. Households in poverty are located throughout the County, however those in central and eastern Contra Costa may face the greatest exposure from extreme heat.
- **Individuals Experiencing Homelessness** are those who do not have a permanent home, including those who live in their vehicles or temporary shelters. This population is highly exposed to severe weather because they experience a lack of permanent shelter which is often temporary. Additionally, this population faces greater exposure to extreme heat because they lack access to permanent shelter. Dehydration is common among homeless individuals, which makes health related complications from extreme heat more likely. Homeless individuals are more likely to suffer respiratory infections, which are exacerbated by extreme heat, and those on medication are also at greater risk as some medications interfere with the body's ability to maintain a safe internal temperature during times of extreme temperatures. The homeless population in the central and eastern portion of the County are more vulnerable to heat wave/extreme heat events. In 2024, there are 2,843 people experiencing homelessness in Contra Costa County, an 18.5% increase from 2023.[253]
- **Outdoor Workers:** Includes, but are not limited to, workers in agriculture, construction, building maintenance, landscaping, and refinery operations fields. This population is significantly vulnerable to heat wave/extreme heat events because these jobs, often physically intense, require them to be outside and risk heat related illnesses (e.g., heat cramps, heat exhaustion, heat stroke). Furthermore, outdoor work may also be halted during high temperatures, which can cause significant economic hardships.
- **Individuals with Chronic Illnesses:** Includes those that have long term or permanent health conditions that can be exacerbated by heat wave/extreme heat conditions (e.g., cardiovascular disease, respiratory conditions, diabetes, cerebrovascular diseases). These individuals may be taking medication that can reduce their body's ability to maintain safe internal temperatures.

[252] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.
[253] Contra Costa Health. (2024). Health, Housing, and Homelessness Data Reports (Point-in-Time Count). Retrieved from https://www.cchealth.org/services-and-programs/homeless-services/data.

Furthermore, severe weather may cause power outages which can affect those that are electrically dependent.

- **People with Limited English Proficiency:** This group includes those that speak English "less than very well", per the United States Census Bureau definition. In Conta Costa County, 158,965 people (38.2%) have limited English proficiency (i.e., speak English "less than very well"). This population are more likely to live in low income areas which are also most likely to be located within low lying areas. Flooding due to heavy rainfall can cause significant damage to homes resulting in uninhabitable and unhealthy conditions to live in. Additionally, individuals with limited English proficiency may have limited access to information and resources designed to prevent or mitigate flooding risk due to language or cultural differences. Other languages spoken in the County are primarily Spanish, Mandarin, Cantonese, Tagalog, and Persian. Other than English, the most commonly spoken language in Contra Costa County is Spanish (18.7%). The higher proportion with limited English proficiency occurs in the cities of Richmond, Concord, and San Pablo.
- **Senior (65 years old and over) and Seniors Living Alone:** The elderly population (i.e., seniors), especially those with access and functional needs, may have physical limitations that make it harder to evacuate in the event of an emergency due to severe weather (e.g., flooding due to heavy rainfall). Furthermore, the elderly population may lack access to social connections and community support that can assist in preparing for and responding to emergency events, evacuating, improving home resiliency, managing medical needs, and locating support services. These individuals are especially vulnerable to the health effects associated with heat wave/extreme heat events. A high concentration of the elderly population lives in central Contra Costa County, Bethel Island, eastern part of Richmond, and several parts of Walnut Creek. Seniors living alone may have caretakers, but for the most part are living alone. This population is generally more vulnerable compared to other seniors because this group may have mobility issues that prohibits them from taking action during a severe weather event. In 2022, there were approximately 33,102 (8.0%) seniors living alone.[254]
- **Undocumented Individuals:** Includes people who do not have formal permission to live in the United States (i.e., do not have citizenship, permanent residency, visas, or other similar status). This population is most likely to fall in the households in poverty and low income categories, which are considered to be at risk populations during a flooding event and are more likely to live in low lying areas in structures that are not waterproofed or build above the 100-year flood elevations. Additionally, most of this population has outdoor occupations or work in highly unregulated environment which leaves them susceptible to harm from heat wave/extreme heat conditions. Outdoor work may also be halted during high temperatures, which can cause significant economic hardships. Undocumented agricultural workers may face economic hardship if crops, vineyards, or rangeland are damaged by heat wave/extreme heat conditions. Furthermore, agricultural workers who are undocumented are more likely to be let go when farms experience economic hardship. There are no official counts of how many undocumented individuals live in Contra Costa County, but in 2019 there was an estimate of 63,000.[255]

[254] United States Census Bureau. (2022). DP02: Selected Social Characteristics in the United States (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP02?g=050XX00US06013.
[255] Migration Policy Institute. (2019). Profile of the Unauthorized Population: Contra Costa County, CA. Retrieved from https://www.migrationpolicy.org/data/unauthorized-immigrant-population/county/6013.

Severe weather will impact County residents differently. For example, extreme heat thresholds for West County are lower than those in Central or East County, even so, West County residents may be particularly vulnerable since they are unaccustomed to continuous high temperatures.

Table 4-162 summarizes the vulnerable and at-risk population for severe weather in Contra Costa County.

Table 4-162. Vulnerability and At Risk Population

Category	Estimate	Percent
Households in Poverty[256]	7,600	12.0%
Low Income Households[257]	25,340	41.0%
Homeless Population[258]	2,372	0.2%
Population with Disability[259]	131,448	11.4%
Language Other than English[260]	416,505	38.0%
Speak English "Less than very well"[261]	158,965	14.5%
Spanish Spoken at Home[262]	204,442	18.7%
Foreign Born[263]	312,050	27.0%
65 Years and Over[264]	201,136	17.4%
Seniors (65 years and over) Living Alone[265]	45,672	22.7%
Undocumented Individuals[266]	There are no official counts of how many undocumented individuals live in Contra Costa County, but in 2019 there was an estimate of 63,000.	

[256] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.
[257] Ibid.
[258] Contra Costa Health. (2023). Health, Housing, and Homelessness Data Reports (Point-in-Time Count). Retrieved from https://www.cchealth.org/services-and-programs/homeless-services/data.
[259] United States Census Bureau. (2022). S1810: Disability Characteristics (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S1810?g=050XX00US06013.
[260] United States Census Bureau. (2022). S1601: Language Spoken at Home (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S1601?g=050XX00US06013.
[261] Ibid.
[262] Ibid.
[263] United States Census Bureau. (2022). DP02: Selected Social Characteristics in the United States (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP02?g=050XX00US06013.
[264] United States Census Bureau. (2022). DP05: Demographics and Housing Estimates (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP05?g=050XX00US06013.
[265] United States Census Bureau. (2022). DP02: Selected Social Characteristics in the United States (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP02?g=050XX00US06013.
[266] Migration Policy Institute. (2019). Profile of the Unauthorized Population: Contra Costa County, CA. Retrieved from https://www.migrationpolicy.org/data/unauthorized-immigrant-population/county/6013.

Table 4-166 outlines the vulnerability of the total population exposed to severe weather, and **Table 4-167** outlines the severe weather impacts to population and life safety, underserved/equity population, and essential operations, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Property Damage and Critical Infrastructure: All property and critical infrastructure in Contra Costa County is vulnerable during the severe weather events profiled in this section, but properties that are structurally compromised or in particular vulnerable locations are more susceptible to the impacts of severe weather. Those in higher elevations and on ridges may be more prone to wind damage. Extreme heat events are not known for causing direct damage to buildings, but may damage building systems such as heating, ventilation, and air conditioning (HVAC) systems. Mobile homes and properties in poor condition or closer to overhead power lines and large trees may be more vulnerable to damage. In Contra Costa County, approximately 1.3% of the occupied housing units are mobile homes.[267] Due to the unpredictability of thunderstorm strength and path, most critical infrastructure located above ground is equally exposed to the storm's impacts.

Electrical transmission and distribution lines are power lines that carry high voltage electricity between power plants and customers. There are a number of transmission lines throughout the County primarily owned by Pacific Gas & Electric (PG&E) and other lines in the eastern portion of the County are owned by Western Area Power Administration and the Transmission Agency of Northern California. The entire electric infrastructure is vulnerable to strong winds which can cause power outages and impact residents and businesses. Heat wave/extreme heat conditions will most likely affect electricity transmission and distribution lines within the eastern and central portion of Contra Costa County because temperatures in this area are projected to substantially increase on extreme heat days. Furthermore, extreme heat can cause an increase in air conditioning use during these events which can stress and overload the grid subsequently causing power outages and damage to the lines.[268]

Heavy rain and thunderstorms, particularly those that result in hail, could significantly impact motorists travelling along major roadways. Depending on the severity of the storm, these events could slow traffic, reduce visibility, and increase the likelihood of vehicle accidents, which may result in greater traffic delays.

Incapacity and loss of roads are the primary transportation failures resulting from severe weather, mostly associated with secondary hazards. Landslides caused by heavy prolonged rainfall events can block roads. High winds can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating population, and disrupting ingress and egress. Of particular concern are roads providing access to isolated areas and to the elderly. Prolonged obstruction of major routes can disrupt the shipment of goods and other commerce. Large, prolonged storms can have negative economic impacts for an entire region. Severe windstorms and downed trees can create serious impacts on overhead power lines and infrastructure and above ground communication lines. Loss of electricity and phone connection would leave certain portion of the population isolated because residents would be unable to call for assistance.

Extreme heat is not known for causing direct impacts on critical facilities and infrastructure, but some impacts may occur in extreme cases, such as Public Safety Power Shutoff.

[267] United States Census Bureau. (2022). S2504: Physical Housing Characteristics for Occupied Housing Units (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S2504?g=050XX00US06013.
[268] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.

There are a total of 554 critical assets (i.e., schools, nursing homes, fire stations, police stations, and hospitals) throughout the County and 100% of these assets are susceptible to severe weather impacts to varying degrees. **Table 4-163** provides a breakdown of critical assets that are located within Contra Costa County. *Refer to the flood profile for a breakdown of critical assets within the 100-year and 500-year floodplain (**Table 4-101**) and the landslide profile for a breakdown of critical assets within medium, high, and very high landslide susceptibility areas (**Table 4-122**).*

Table 4-163. Critical Assets Vulnerable to Severe Weather

Asset	Estimate	Percent *(of total assets)*
Schools *(public schools, private schools)*	360	100.0%
Nursing Homes	78	100.0%
Fire Stations	81	100.0%
Police Stations	24	100.0%
Hospitals	11	100.0%

Table 4-166 outlines the total property value exposed to severe weather and how the changes in development in the past five (5) years, have affected the vulnerability of the community to severe weather. **Table 4-167** outlines the severe weather impacts on total property damage, potential future development, and the economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Environment: The environment is highly exposed to all the severe weather events profiled in this Plan. In Contra Costa County, the following ecosystems and natural resources are vulnerable to severe weather, including extreme heat:[269]

- **Agriculture:** Agricultural operations can be significantly damaged by strong winds, hail, and severe thunderstorms. Strong winds can flatten crops and food crops can be damaged by hail. Additionally, heat wave/extreme heat conditions can damage crops or reduce yield, make crops more difficult to manage, and can lead to the death of crops. For example, wine grapes are expected to experience a decline in fruit quality due to heat wave/extreme heat events. Damage to agriculture due to severe weather can result in economic hardship for the farm owners in the area.
- **Aquatic:** Aquatic habitat (i.e., streams, reservoirs, ponds, and sloughs or channels) are impacted by heat wave/extreme heat. This ecosystem includes the Delta and shoreline areas that are submerged by water. In Contra Costa County, the three (3) large reservoirs include San Pablo Reservoir, Briones Reservoir, and Los Vaqueros Reservoir. Aquatic wildlife species include various duck species, California red-legged frog, western pond turtle, and juvenile and spawning adult Chinook salmon. Extreme heat events can cause water temperatures in aquatic habitats to increase, which can alter water quality and other water characteristics. Native fish species may have a more difficult time surviving in warmer waters and non-native species may out compete native species.
- **The Delta:** The Sacramento-San Joaquin River Delta spans from the City of Pittsburg in the west, Locke in the east, Sacramento to the North, and Tracy to the south. The Delta primarily

[269] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.

encompasses the northern and easternmost borders of Contra Costa County and provides opportunities for boating, fishing, transportation, and a water source for the County. Severe weather events have the potential to damage harbors, marinas, and outdoor recreation centers within the Delta impacting fishery and recreation based economies. Additionally, extreme heat can alter the Delta's water quality, and cause water temperatures to rise, fish to die, and algae to grow.

- **Rangeland:** Includes lands where many livestock species (e.g., cattle) are raised and most are located in the eastern portion of Contra Costa County. Temperatures above 100°F can create heat stress, increase the risk of infection, reduce milk production and fertility, and may lead to the death of animals.
- **Riparian Woodland and Shrub:** Riparian woodland and shrub ecosystems consist of Valley foothill riparian, undetermined shrub, and riverine habitat. These areas are scattered throughout Contra Costa County and have numerous wildlife species (e.g., gray fox, striped skunk, broad-handed mole, mule deer, dusky-footed woodrat, yellow warbler, northern flicker, white tailed kite, and Cooper's hawk). Severe storms can cause trees to fall in riparian ecosystems, which can disrupt the flow of water through the systems and impact aquatic wildlife in the streams.
- **Wetland:** Wetland ecosystems, located adjacent to the San Francisco Bay and Delta, include permanent wetland, seasonal wetland, fresh emergent wetland, alkali wetland, and marshes. Warmer waters may change wetland habitats to the point that native species can no longer survive. Warmer temperatures may also cause harmful algal growth that can harm both plant and wildlife species.

Table 4-167 outlines severe weather impacts on the environment and economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Changes in Development and Impact of Future Development: There have been no significant changes in development that have affected the risks associated with severe weather. Future increases in population within the SHFA may expose more of the population to floods. Growth over the past decade has considerably increased. Between 2010 and 2022, as outlined in **Table 3-3**, the population in Contra Costa County grew 10.6%, from 1,046,025 to 1,156,966 residents. The Bay Area Association of Governments (ABAG) growth forecasts predict a steady increase in households through 2050. From 2015 to 2050, ABAG projects that the County's number of households will grow by 44%.[270]

The ability to withstand impacts lies in rigorous land use practices and consistent enforcement of codes and regulations for new construction. Contra Costa County is StormReady certified by the NWS, which means that the County has achieved the industry standard for severe weather preparedness and communication. Additionally, the County has adopted the International Building Code in response to California mandates. This Code is equipped to deal with the impacts of severe weather events. Land use policies identified in general plans within the planning area also address many of the secondary impacts (e.g., flood and landslide) of the severe weather hazard. With these tools, the planning partners are well equipped to deal with future growth and the associated impacts of severe weather.

Table 4-166 outlines how the changes in development in the past five (5) years have affected the vulnerability of the community to severe weather. **Table 4-167** outlines the severe weather impacts on potential future development, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

[270] Bay Area Association of Government. (2020). Plan Bay Area 2050 Final Blueprint Growth Pattern. Retrieved from https://planbayarea.org/digital-library/plan-bay-area-2050-final-blueprint-growth-pattern.

Effects of Climate Change in Severity of Impacts: Atmospheric rivers are part of the water cycle in the western United States often occurring in the fall and winter, and when beneficial they result in much needed rain to the region. For example, persistent drought events can end when atmospheric rivers make landfall in the area. However, when these systems produce too much water at once it can result in a significant amount of damage. As global temperatures continue to increase, the amount and severity of atmospheric rivers are projected to increase. Warmer air and oceans serve as fuel for these systems to become larger and stronger, and the atmosphere is capable of holding more moisture. Some research shows that atmospheric rivers are expected to be 25% longer and wider resulting in heavy rainfall and strong winds over an area for a longer period of time. As rainfall increases, soil will become extremely saturated and unable to absorb additional water increasing runoff which can overwhelm rivers and result in flooding and landslides. Studies have determined that by 2090 atmospheric river events could cause up to $3.2 Billion of damages annually.[271]

As global average temperatures continue to increase, scientists expect that heat wave/extreme heat events will become more common, more severe, and last longer. Subsequently leading to an increase of heat-related illnesses and deaths.[272] By the middle of the 21st century (2040 to 2070), Contra Costa County is likely to have an average of 15 to 20 extreme heat days per year. By the end of the century, the County is projected to experience an average of 21 to 37 extreme heat days per year.[273]

Climate change is expected to increase ambient average air temperature, particularly in the summer. The outer Bay Area will likely experience greater temperature increases than coastal or bayside jurisdictions, though likely not as great as in eastern portion of the County. The frequency, intensity, and duration of extreme heat events and heat waves are also expected as regional climate impacts.

Table 4-167 outlines the climate change impacts to severe weather in Contra Costa County, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

[271] United States Department of Agriculture Climate Hubs. (n.d.). Atmospheric Rivers in the Northwest. Retrieved from https://www.climatehubs.usda.gov/hubs/northwest/topic/atmospheric-rivers-northwest-0.
[272] U.S. Environmental Protection Agency and the Centers for Disease Control and Prevention. (2016). Climate Change and Extreme Heat: What You Can Do to Prepared. Retrieved from https://www.epa.gov/sites/default/files/2016-10/documents/extreme-heat-guidebook.pdf.
[273] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.

Table 4-164. Probability of Occurrence

Hazard Event	Probability of Occurrence		Probability Factor	Weighted Factor
Severe Thunderstorm	High	Significant hazard event is likely to occur annually.	3	N/A
Strong Winds / Damaging Winds	High	Significant hazard event is likely to occur annually.	3	N/A
Tornado	Low	Significant hazard event is likely to occur within 100 years.	1	N/A
Heavy Rainfall	High	Significant hazard event is likely to occur annually.	3	N/A
Heat Wave / Extreme Heat	High	Significant hazard event is likely to occur annually.	3	N/A

Table 4-165. Extent Factors

Hazard Event	Extent Factor	Extent		Extent Factor	Weighted Factor
Severe Thunderstorm	***Extent/Intensity***	Low	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a low-intensity incident.	1	3
	Catastrophic	Low	Catastrophic hazard event is likely to occur at least once in 51 or more years.	1	3
Strong Winds / Damaging Winds	***Extent/Intensity***	Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2	6
	Catastrophic	Low	Catastrophic hazard event is likely to occur at least once in 51 or more years.	1	3
Tornado	***Extent/Intensity***	Low	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a low-intensity incident.	1	3
	Catastrophic	Low	Catastrophic hazard event is likely to occur at least once in 51 or more years.	1	3
Heavy Rainfall	***Extent/Intensity***	Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2	6
	Catastrophic	Low	Catastrophic hazard event is likely to occur at least once in 51 or more years.	1	3
Heat Wave / Extreme Heat	***Extent/Intensity***	Medium	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a medium-intensity incident.	2	6
	Catastrophic	Low	Catastrophic hazard event is likely to occur at least once in 51 or more years.	1	3

Table 4-166. Vulnerability Factors

Hazard Event	Vulnerability Factor	Vulnerability		Vulnerability Factor	Weighted Factor
Severe Thunderstorm	***Population Exposure***	High	30% or more of the population is exposed to the hazard.	3	9
	Property Exposure	High	25% or more of the total assessed property value is exposed to the hazard.	3	6
	Changes in Development	Low	Changes in development have increased the vulnerability/exposure of the community to the hazard by 4% or less.	1	1
Strong Winds / Damaging Winds	***Population Exposure***	Medium	15% to 29% of the population is exposed to the hazard.	2	6
	Property Exposure	Medium	10% to 24% of the total assessed property value is exposed to a hazard.	2	4
	Changes in Development	Low	Changes in development have increased the vulnerability/exposure of the community to the hazard by 4% or less.	1	1
Tornado	***Population Exposure***	Low	14% or less of the population is exposed to the hazard.	1	3
	Property Exposure	Low	9% or less of the total assessed property value is exposed to a hazard.	1	2
	Changes in Development	Low	Changes in development have increased the vulnerability/exposure of the community to the hazard by 4% or less.	1	1
Heavy Rainfall	***Population Exposure***	High	30% or more of the population is exposed to the hazard.	3	9
	Property Exposure	Medium	10% to 24% of the total assessed property value is exposed to a hazard.	2	4
	Changes in Development	Low	Changes in development have increased the vulnerability/exposure of the community to the hazard by 4% or less.	1	1
Heat Wave / Extreme Heat	***Population Exposure***	High	30% or more of the population is exposed to the hazard.	3	9
	Property Exposure	No Vulnerability	None of the total assessed property value is exposed to a hazard.	0	0
	Changes in Development	Low	Changes in development have increased the vulnerability/exposure of the community to the hazard by 4% or less.	1	1

Table 4-167. Impact Factors

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
Severe Thunderstorm	***Population and Life Safety***	Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3
	Underserved/Equity	Low	Underserved populations exposed to the hazard are likely to experience minimal adverse/disproportionate impacts, such as ambulatory injuries.	1	3
	Property Damage	Low	Less than $500,000 in property damages is expected from a single major hazard event or less than 5% of the property value within the jurisdiction.	1	2
	Economic	Low	Total economic impact is not likely to be greater than $100,000.	1	1
	Environmental	Low	Environmental impact from a single major hazard event is likely to be minimal, requiring little to no outside resources and support, and/or minimal repair, clean-up, restoration, or preservation work.	1	1
	Essential Operations	Low	Impact less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	1	1
	Future Development	Low	Future development trends will minimally increase impact/consequence of this hazard.	1	1
	Climate Change	Medium	Climate Change trends will increase the risk of this hazard and its impacts, but not significantly.	2	2
Strong Winds / Damaging Winds	***Population and Life Safety***	Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3
	Underserved/Equity	Low	Underserved populations exposed to the hazard are likely to experience minimal adverse/disproportionate impacts, such as ambulatory injuries.	1	3
	Property Damage	Medium	More than $500,000 but less than $5 Million in property damages is expected from a single major hazard event, or damages are expected to occur to more than 5% but less than 15% of the property value within the jurisdiction.	2	4
	Economic	Low	Total economic impact is not likely to be greater than $100,000.	1	1
	Environmental	Low	Environmental impact from a single major hazard event is likely to be minimal, requiring little to no outside resources and support, and/or minimal repair, clean-up, restoration, or preservation work.	1	1

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
	Essential Operations	Low	Impact less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	1	1
	Future Development	Low	Future development trends will minimally increase impact/consequence of this hazard.	1	1
	Climate Change	Medium	Climate Change trends will increase the risk of this hazard and its impacts, but not significantly.	2	2
Tornado	***Population and Life Safety***	Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3
	Underserved/Equity	Low	Underserved populations exposed to the hazard are likely to experience minimal adverse/disproportionate impacts, such as ambulatory injuries.	1	3
	Property Damage	Low	Less than $500,000 in property damages is expected from a single major hazard event or less than 5% of the property value within the jurisdiction.	1	2
	Economic	Low	Total economic impact is not likely to be greater than $100,000.	1	1
	Environmental	Low	Environmental impact from a single major hazard event is likely to be minimal, requiring little to no outside resources and support, and/or minimal repair, clean-up, restoration, or preservation work.	1	1
	Essential Operations	Low	Impact less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	1	1
	Future Development	Low	Future development trends will minimally increase impact/consequence of this hazard.	1	1
	Climate Change	Medium	Climate Change trends will increase the risk of this hazard and its impacts, but not significantly.	2	2
Heavy Rainfall	***Population and Life Safety***	Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3
	Underserved/Equity	Low	Underserved populations exposed to the hazard are likely to experience minimal adverse/disproportionate impacts, such as ambulatory injuries.	1	3
	Property Damage	Low	Less than $500,000 in property damages is expected from a single major hazard event or less than 5% of the property value within the jurisdiction.	1	2
	Economic	Low	Total economic impact is not likely to be greater than $100,000.	1	1

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
	Environmental	Low	Environmental impact from a single major hazard event is likely to be minimal, requiring little to no outside resources and support, and/or minimal repair, clean-up, restoration, or preservation work.	1	1
	Essential Operations	Low	Impact less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	1	1
	Future Development	Low	Future development trends will minimally increase impact/consequence of this hazard.	1	1
	Climate Change	High	Climate Change trends will significantly increase the risk of this hazard and its impacts.	3	3
Heat Wave / Extreme Heat	***Population and Life Safety***	Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3
	Underserved/Equity	Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2	6
	Property Damage	No Impact	Little to no property damage is expected from a single major hazard event.	0	0
	Economic	Low	Total economic impact is not likely to be greater than $100,000.	1	1
	Environmental	No Impact	No environmental impacts from a single major hazard event are likely.	0	0
	Essential Operations	Low	Impact less than 24 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	1	1
	Future Development	Low	Future development trends will minimally increase impact/consequence of this hazard.	1	1
	Climate Change	High	Climate Change trends will significantly increase the risk of this hazard and its impacts.	3	3

4.6.8.8. FEMA NRI Expected Annual Loss Estimates

A hail NRI EAL score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to hail when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-168** outlines the hail EAL for Contra Costa County.

Table 4-168. Hail Expected Annual Loss *(FEMA National Risk Index)*

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Contra Costa County	$10,280	$42,961	$1,290	$54,531	40.1	Relatively Low
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

A strong wind NRI EAL score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to strong winds when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-169** outlines the strong wind EAL for Contra Costa County.

Table 4-169. Strong Wind Expected Annual Loss *(FEMA National Risk Index)*

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Contra Costa County	$14,927	$5,591	$76	$20,594	9.4	Very Low
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

A tornado NRI EAL score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to tornadoes when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-170** outlines the tornado EAL for Contra Costa County.

Table 4-170. Tornado Expected Annual Loss *(FEMA National Risk Index)*

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Contra Costa County	$361,249	$930,045	$213	$1.3 Million	58.8	Relatively Moderate
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

A riverine flooding NRI EAL score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to riverine flooding when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL

score results in a higher Risk Index score. **Table 4-171** outlines the riverine flooding EAL for Contra Costa County.

Table 4-171. Riverine Flooding Expected Annual Loss *(FEMA National Risk Index)*

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Contra Costa County	$4.0 Million	$4.1 Million	$291,636	$8.4 Million	96.3	Very High
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

A heat wave NRI EAL score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to heat waves when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-172** outlines the heat wave EAL for Contra Costa County.

Table 4-172. Heat Wave Expected Annual Loss *(FEMA National Risk Index)*

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Contra Costa County	$2.6 Million	$485	$18,780	$2.6 Million	96.1	Very High
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.8.9. FEMA Severe Weather Risk Index Scores

The hail Risk Index score and rating represent a community's relative risk for hail when compared to the rest of the United States. **Table 4-173** illustrates the hail Risk Index rating and score for Contra Costa County.

Table 4-173. Hail Risk Index *(FEMA National Risk Index)*

Jurisdiction	Rating	Score
Contra Costa County	Relatively Low	36.0
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

The strong wind Risk Index score and rating represent a community's relative risk for strong winds when compared to the rest of the United States. **Table 4-174** illustrates the strong wind Risk Index rating and score for Contra Costa County.

Table 4-174. Strong Wind Risk Index *(FEMA National Risk Index)*

Jurisdiction	Rating	Score
Contra Costa County	Very Low	6.6
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

The tornado Risk Index score and rating represent a community's relative risk for tornadoes when compared to the rest of the United States. **Table 4-175** illustrates the tornado Risk Index rating and score for Contra Costa County.

Table 4-175. Tornado Wind Risk Index *(FEMA National Risk Index)*

Jurisdiction	Rating	Score
Contra Costa County	Relatively Moderate	55.0
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

The riverine flooding Risk Index score and rating represent a community's relative risk for riverine flooding when compared to the rest of the United States. **Table 4-176** illustrates the riverine flooding Risk Index rating and score for Contra Costa County.

Table 4-176. Riverine Flooding Risk Index *(FEMA National Risk Index)*

Jurisdiction	Rating	Score
Contra Costa County	Very High	96.2
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

The heat wave Risk Index score and rating represent a community's relative risk for heat waves when compared to the rest of the United States. **Table 4-177** illustrates the heat wave Risk Index rating and score for Contra Costa County.

Table 4-177. Heat Wave Risk Index *(FEMA National Risk Index)*

Jurisdiction	Rating	Score
Contra Costa County	Very High	95.7
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

Table 4-178 represents the Severe Weather Total Risk Score for Contra Costa County, based on the Risk Assessment Methodology, as defined in this Plan. For further details on how the probability, extent, vulnerability, and impact factors were calculated, please refer to **Table 4-164** through **Table 4-167**. Additional details on how the Total Risk Score was calculated can be found in the Risk Assessment Methodology in Section 4.3 of this Plan.

Table 4-178. Severe Weather Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Severe Thunderstorm	3	6	16	14	36	54
Strong Winds/Damaging Winds	3	9	11	16	36	54
Tornado	1	6	6	14	26	16
Heavy Rainfall	3	9	14	15	38	56
Heat Wave/Extreme Heat	3	9	10	15	34	51

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.9. Tsunami

4.6.9.1. Description

The term *tsunami* comes from the Japanese word "harbor wave" because of the devastating effects these waves had on low-lying coastal communities. [274]

A tsunami is a series of extremely long waves caused by seismic activity, volcano activity, or landslides. However, based on records dating back to 1900, over 80% of tsunamis are generated by earthquakes. Generally, subduction zone earthquakes of magnitude 7.5 or greater at plate boundaries are the most frequent cause of tsunamis. [275] When an earthquake occurs below or near the ocean, waves radiate outward in all directions away from the epicenter, sometimes crossing an entire ocean basin. Additionally, tsunamis also may be generated by submarine and subaerial landslides (which may also be caused by earthquakes), submarine volcanic eruptions, and the collapse of volcanic edifices. [276]

Tsunamis, unlike regular waves, move through the entire water column from the ocean floor to the ocean surface. [277] The speed of tsunami depends on the depth of the ocean, but in the deep ocean they can move at over 500 mph. The height or amplitude of a tsunami wave in deep water is generally three (3) feet or less, and thus may not be noticeable to people on ships. As tsunami waves approach land, however, and as the ocean shallows, the waves slow to around 30 to 30 miles per hour but grow significantly in height. [278]

Tsunamis are often confused with tidal waves; the three (3) main differences between the two (2) are the following: [279]

- A tsunami's water level changes occur much faster, 10 to 15 minutes, than a tidal wave which gradually changes over six (6) to 12 hour periods.
- Tsunami waves travel much faster than tidal waves. A tsunami in the deep ocean can move faster than 500 mph while a tidal wave moves at approximately 23 mph.
- The incoming waves of a tsunami can be significantly larger than a tidal wave. The world's largest tidal ranges at 52 feet higher than low tide, while tsunamis can reach 131 feet, striking coastlines with much lower tidal ranges.

Scientists are beginning to better understand another type of tsunami called meteotsunamis. These are large waves (six (6) feet of higher) driven by air pressure disturbances associated with fast-moving weather events (e.g., severe thunderstorms, squalls, other storm fronts). Meteotsunamis are amplified by a shallow continental shelf and inlet or other coastal features. The characteristics of meteotsunamis are very similar to a seismic tsunami and as a result can be confused with storm surge. Although

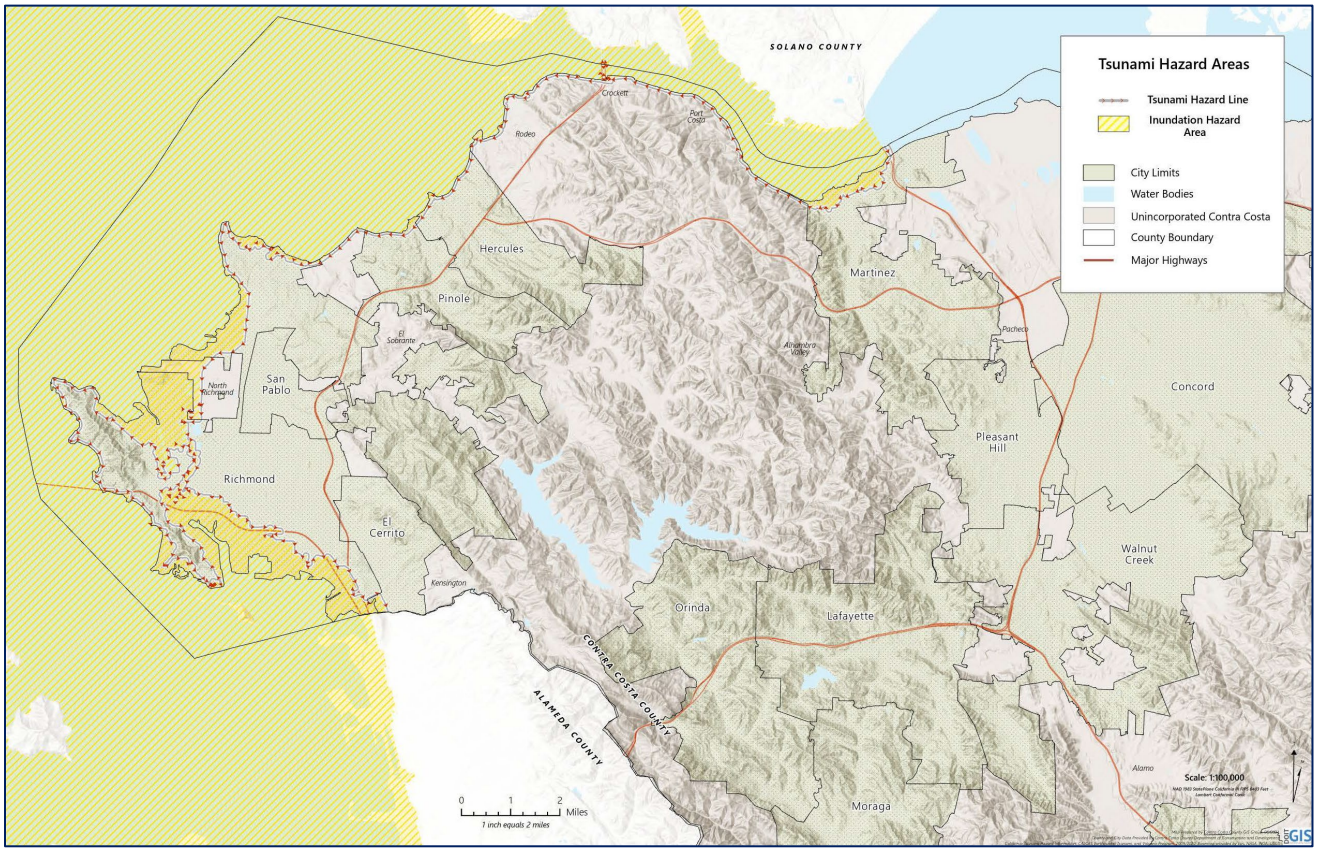
[274] Exploring our Fluid Earth. (n.d.). Tsunamis. Retrieved from https://manoa.hawaii.edu/exploringourfluidearth/physical/coastal-interactions/tsunamis.
[275] Pacific Northwest Seismic Network. (n.d.). Frequently Asked Questions. Retrieved from https://pnsn.org/outreach/faq.
[276] National Oceanic and Atmospheric Administration. (2023). Tsunamis: Introduction to the Tsunamis. Retrieved from https://www.noaa.gov/jetstream/tsunamis.
[277] National Oceanic and Atmospheric Administration. (n.d.). U.S. Department of Commerce. Tsunamis. Retrieved from https://www.noaa.gov/education/resource-collections/ocean-coasts/tsunamis.
[278] National Oceanic and Atmospheric Administration. (2023). Tsunamis: Introduction to the Tsunamis. Retrieved from https://www.noaa.gov/jetstream/tsunamis.
[279] Exploring our Fluid Earth. (n.d.). Tsunamis. Retrieved from https://manoa.hawaii.edu/exploringourfluidearth/physical/coastal-interactions/tsunamis.

scientists have been able to identify atmospheric conditions that produce meteotsunamis, the ability to forecast and issue advisories remains uncertain. [280] Water level analyses and meteorological data in the United States have determined that meteotsunamis occur more often than expected; therefore, these should be included in coastal hazard mitigation planning. [281]

4.6.9.2. Hazard Location

Coastal areas of Contra Costa County are vulnerable to tsunamis. **Figure 4-24** illustrates Tsunami Hazard Areas within Contra Costa County which represent areas that could be exposed to tsunami hazards during a tsunami event. Areas in yellow are advised to evacuate immediately after an earthquake that lasts a long time or if an official evacuation notification is received. Residents and visitors are advised to evacuate on foot to a green area. The California Tsunami Hazard Area maps and data were developed with the best current available scientific information. They are based on the State of California 2009 Tsunami Inundation Maps for Emergency Planning and enhanced high-resolution, 975-year return period probabilistic tsunami inundation model results. [282]

Figure 4-24. Contra Costa County Tsunami Hazard Areas



[280] National Oceanic and Atmospheric Administration, National Ocean Service. (n.d.). What is a Meteotsunami? Retrieved from https://oceanservice.noaa.gov/facts/meteotsunami.html.
[281] Horillo, J., Cheng, W., Joe, A., and Shang, Y. (2022). Tsunami Inundation Maps Development and Continuation of the Meteotsunami Characterization for the GOM. Retrieved from https://www.tamug.edu/tsunami/Files/report_NTHMP_2022_FY21-web.pdf.
[282] California Department of Conservation, California Geological Survey. (2022). California Tsunami Maps. Retrieved from https://www.conservation.ca.gov/cgs/tsunami/maps.

4.6.9.3. Hazard Extent/Intensity

Tsunami intensity is measured by the Papadopoulos and Imamura Scale. In 2001, the 12-point tsunami scale was proposed by Gerassimos Papadopoulos and Fumihiko Imamura. The scale has 12 divisions, and it is consistent with the 12-grade seismic intensity scale. Additionally, the scale is arranged according to the effects on humans, nature, and objects (i.e., vessels), and buildings. [283] **Table 4-179** outlines the Papadopoulos and Imamura Tsunami Scale.

Table 4-179. Papadopoulos and Imamura Tsunami Scale

Level	Damage	Wave Height *(feet)*	Description
I	Not Felt	< 3.3 (< 1 meter)	--
II	Scarcely Felt	< 3.3 (< 1 meter)	Felt by a few people on board small vessels. Not observed on the coast. No effect, no damage.
III	Weak	< 3.3 (< 1 meter)	Felt by most people on board small vessels. Observed by a few people on the coast. No effect. No damage.
IV	Largely Observed	< 3.3 (< 1 meter)	Felt by all people on board small vessels and by a few people on board larger vessels. Observed by most people on the coast. Few small vessels move slightly onshore. No damage.
V	Strong	< 3.3 (< 1 meter)	Felt by all people on board large vessels and observed by all on the coast. Few people are scared and run to higher ground. Many small vessels move strongly onshore, few of the vessels crash into each other or overturn. Traces of sand layer are left behind in grounds of favorable conditions. Limited flooding of cultivated land. Limited flooding of outdoors facilities (e.g., gardens) of near-shore structures.
VI	Slightly Damaging	6.6 (2 meters)	Many people are frightened and run to higher ground. Most small vessels move violently onshore, or strongly crash into each other, or overturn. Damage and flooding in a few wooden structures. Most masonry buildings are able to withstand.
VII	Damaging	13.1 (4 meters)	Most people are frightened and try to run to higher ground. Many small vessels are damaged. Few large vessels violently oscillate. Objects of various sizes and stability overturn and drift. Sand later and accumulation of pebbles are left behind. Few aquaculture rafts are washed away. Many wooden structures are damaged, few are completely destroyed or washed away. Damage and flooding in few masonry buildings.

[283] Intergovernmental Oceanographic Commission. (n.d.). Tsunami Intensity Scale. Retrieved from https://neamtic.ioc-unesco.org/index.php?option=com_content&view=article&id=209&Itemid=442.

Level	Damage	Wave Height *(feet)*	Description
VIII	Heavily Damaging	13.1 (4 meters)	Everyone escapes to higher ground, but some are washed away. Most small vessels are damaged, and many are washed away. Few large vessels have moved ashore or crashed into each other. Big objects are drifted away. There is erosion and littering on the beach. Extensive flooding. Slight damage in tsunami-control forests and stop drifts. Many aquaculture rafts are washed away, a few partially damaged. Most wooden structures are washed away or demolished. Significant damage to a few masonry buildings. Most reinforced concrete buildings sustain damage and flooding is observed.
IX	Destructive	26.2 (8 meters)	Many people are washed away. Most small vessels are destroyed or washed away. Many large vessels are violently moved onshore, few are destroyed. There is erosion and littering on the beach. Local ground subsidence. Partial destruction in tsunami control forest and stop drifts. Most aquaculture rafts are washed away and many are partially damaged. Significant damage in many masonry buildings and few reinforced concrete buildings suffer from major damage.
X	Very Destructive	26.2 (8 meters)	General panic. Most people are washed away. Most large vessels are moved violently onshore, many are destroyed or collided with buildings. Small boulders from the bottom of the sea are moved inland. Cars overturned and drifted. Oil spill, fires are ignited. Extensive ground subsidence. Extreme damage in many masonry buildings, and a few reinforced concrete buildings suffer major damage. Artificial embankments collapse, port water breaks are damaged.
XI	Devastating	52.5 (16 meters)	Lifelines are interrupted. Extensive fires. Water backwash drifts cars and other objects into the sea. Big boulders from the bottom of the sea are moved inland. Catastrophic damage in many masonry buildings. Few reinforced concrete buildings suffer from significant damage.
X	Completely Devastating	105 (32 meters)	Practically all masonry buildings are demolished. Most reinforced concrete buildings suffer from significant damage.

4.6.9.4. Warning Time

In the event of a tsunami, NOAA's Tsunami Warning Centers are responsible for issuing tsunami advisories, watches, and warnings. There are two (2) tsunami warning centers – the Pacific Tsunami Warning Center (PTWC) and the National Tsunami Warning Center (NTWC) which is responsible for the continental United States, Alaska, and Canada. **Table 4-180** outlines the four (4) levels of tsunami alerts issued by the NTWC.[284]

[284] National Oceanic and Atmospheric Administration. (2017). User's Guide for the Tsunami Warning System in the U.S. National Tsunami Warning Center Area-of-Responsibility. Retrieved from https://www.tsunami.gov/operations/opsmanual.pdf.

Table 4-180. National Tsunami Warning Center Alerts

Type	Definition
Tsunami Information Statement	Issues to inform that an earthquake has occurred, or that a tsunami warning, watch or advisory has been issued for another section of the ocean. In most cases, information statements are issued to indicate there is no threat of a destructive basin wide tsunami and to prevent unnecessary evacuations as the earthquake may have been felt in coastal areas. Information statements may indicate for distant regions that a large event is being evaluated and could be upgraded to a warning, advisory, or watch.
Tsunami Watch	Issued to alert emergency management officials and the public of an event which may later impact the watch area. The watch area may be upgraded to a warning or advisory (or canceled) based on updated information and analysis. Therefore, emergency management officials and the public should prepare to take action. Watches are normally issued based on seismic information without confirmation that a destructive tsunami is underway.
Tsunami Advisory	Issued when a tsunami with the potential to generate strong currents or waves dangerous to those in or very near the water is imminent, expected, or occurring. The threat may continue for several hours after initial arrival, but significant inundation is not expected for areas under an advisory. Appropriate actions to be taken by local officials may include closing beaches, evacuating harbors and marinas, and the repositioning of ships to deep waters when there is time to safely do so. Advisories are normally updated to continue the advisory, expand/contract affected areas, upgrade to a warning, or cancel the advisory.
Tsunami Warning	Issued when a tsunami with the potential to generate widespread inundation is imminent, expected, or occurring. Warnings alert the public that dangerous coastal flooding accompanied by powerful currents is possible and may continue for several hours after initial arrival. Warnings alert emergency management officials to take action for the entire tsunami hazard zone. Appropriate actions to be taken by local officials may include the evacuation of low-lying coastal areas, and the repositioning of ships to deep waters when there is time to safely do so. Warnings may be updated, adjusted geographically, downgraded, or canceled. To provide the earliest possible alert, initial warnings are normally based only on seismic information.

4.6.9.5. Probability and Frequency

The probability of occurrence for a tsunami in Contra Costa County is low because a significant hazard event is likely to occur within 100 years.

Probability of Future Hazard Events

The tsunami annualized frequency value represents the average number of recorded tsunami hazard occurrences, in event days, per year over the period of record (222 years). **Table 4-181** outlines the annualized frequency for tsunami, based on FEMA NRI data, for Contra Costa County.

Table 4-181. Tsunami Annualized Frequency *(FEMA National Risk Index)*

Location	Events on Record *(1800 – 2021)*	Annualized Frequency
Contra Costa County	5	0.0 events per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

4.6.9.6. Past Events

Contra Costa County has not been impacted by a tsunami. However, NCEI has reported one (1) tsunami event between 1950 and 2023 within the San Francisco Bay area, listed in **Table 4-182** The evening of March 10, 2011, a magnitude 8.9 earthquake struck near the coast of Honshu, Japan. The earthquake generated a tsunami significantly affecting California on March 11, 2011, damaging coastal areas in Santa Cruz and Monterey counties. [285]

Table 4-182. Tsunami Events (1950 – 2023)

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	3/11/2011	09:12	Tsunami	0	0	50.00K	0.00K
					TOTAL	**0**	**0**	**50.00K**	**0.00K**

4.6.9.7. Vulnerability and Impacts

Life Safety and Health: A tsunami poses significant threats to the life safety and health of the population within shoreline areas in the northwest portion of the County which includes the unincorporated areas of Bay Point, North Richmond, and other western areas, and the cities of Richmond, Pinole, Hercules, and Martinez, as illustrated in **Figure 4-24**. These areas are subject to tsunami inundation as illustrated in the California Tsunami Hazard Areas Maps. Immediate dangers from a tsunami involve primarily that of drowning and traumatic injury due to debris during the wave. A tsunami contaminates water and food supplies, and the lack of clean essentials can cause significant injury or death. Furthermore, contamination from tsunami increases the risk of infection. [286]

In the event of a tsunami, the underserved and at-risk populations within tsunami inundation areas face unique vulnerabilities and impacts. These groups include, but are not limited to, households in poverty, individuals experiencing homelessness, the elderly population including those with access and functional needs, population without access to lifelines, and individuals with limited English proficiency.[287]

- **Households in Poverty:** Includes those with an income at or below $24,300 for a household of four (4). This population is more likely to live in low lying areas within tsunami inundation areas and the 100-year floodplain, and dwellings may not be waterproofed. In Contra Costa County, the households in poverty along the coastline of North Richmond to Port Costa are vulnerable to tsunamis.
- **Individuals Experiencing Homelessness:** Includes those who do not have a permanent home, including those who live in their vehicles or temporary shelters. This population is uniquely vulnerable to tsunamis because most of the homeless encampments are located along the coastal cities near and within coastal flood areas in the County. Therefore, a tsunami can damage or destroy these encampments and other homeless facilities located within the coastline resulting

[285] National Centers for Environmental Information. (2011). Storm Events Database. https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=288765.
[286] Centers for Disease Control. (n.d.). Health Effects of Tsunamis. Retrieved from https://www.cdc.gov/disasters/tsunamis/healtheff.html.
[287] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.

in additional hardship for this population. In 2024, there are 2,843 people experiencing homelessness in Contra Costa County, an 18.5% increase from 2023.[288]

- **Senior (65 years old and over):** The elderly population (i.e., seniors), especially those with access and functional needs, may have physical limitations that make it harder to evacuate in the event of an emergency, such as a tsunami. Furthermore, this population may lack access to social connections and community support that can assist in preparing for and responding to emergency events, evacuating, improving home resiliency, managing medical needs, and locating support services.
- **Individuals Without Access to Lifelines:** Includes individuals who do not have access to basic technology or services (e.g., transportation, modern communication). This population is vulnerable because not having access to these can create barriers to prepare and respond to emergency events (e.g., tsunami evacuation order), may be unable to evacuate in a timely manner, and may become isolated if transit services are not operating. For example, this population may be unaware of a tsunami evacuation order and may be unable to evacuate in a timely manner.
- **People with Limited English Proficiency:** This group includes those that speak English "less than very well", per the United States Census Bureau definition. In Conta Costa County, 158,965 people (38.2%) have limited English proficiency (i.e., speak English "less than very well"). This population may have limited access to tsunami emergency information and resources designed to prevent or mitigate tsunami risk due to language or cultural differences.

Table 4-183 summarizes the vulnerable and at-risk population for tsunamis in Contra Costa County.

Table 4-183. Vulnerability and At Risk Population

Category	Estimate	Percent
Households in Poverty[289]	7,600	12.0%
Low Income Households[290]	25,340	41.0%
Homeless Population[291]	2,843	0.2%
65 Years and Over[292]	201,136	17.4%
Seniors (65 years and over) Living Alone[293]	45,672	22.7%

[288] Contra Costa Health. (2024). Health, Housing, and Homelessness Data Reports (Point-in-Time Count). Retrieved from https://www.cchealth.org/services-and-programs/homeless-services/data.
[289] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.
[290] Ibid.
[291] Contra Costa Health. (2024). Health, Housing, and Homelessness Data Reports (Point-in-Time Count). Retrieved from https://www.cchealth.org/services-and-programs/homeless-services/data.
[292] United States Census Bureau. (2022). DP05: Demographics and Housing Estimates (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP05?g=050XX00US06013.
[293] United States Census Bureau. (2022). DP02: Selected Social Characteristics in the United States (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP02?g=050XX00US06013.

Category	Estimate	Percent
Households Without Vehicle[294]	8,872	1.6%
Spanish Spoken at Home[295]	204,442	18.7%
Speak English "Less than very well"[296]	158,965	38.2%
Language Other than English[297]	416,505	38.0%

Table 4-187 outlines the vulnerability of the total population exposed to tsunamis, and **Table 4-188** outlines the tsunami impacts to population and life safety, underserved/equity population, and essential operations, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Property Damage and Critical Infrastructure: Roads are the primary resource for evacuation to higher ground before and during a tsunami event. Roads also can serve as flood control facilities for low depth, low velocity floods by acting as levees or berms and diverting or containing flood flows. The major roads in the planning area that intersect tsunami inundation areas are Eastshore Freeway, John T. Knox Freeway, and Richmond Parkway. These are major roads that may be impacted by a tsunami, based on exposure (they are evacuation routes for tsunami events). Evacuation routes are identified in emergency response plans in effect within the planning area.

In Contra Costa County, there is a range from the large, state-owned bridges that carry interstate freeways, to locally owned bridges that carry rural roads and pedestrians over small creeks. Countywide, there are over 400 bridges where approximately 80 are owned by the County and 160 are owned by Caltrans. There are 26 bridges that are within the 100-year flood zone and could potentially be affected by a tsunami. Some of these bridges are located in low lying areas that could become flooded during a tsunami event if located by the coastline. Additionally, flood control infrastructure (i.e., levees, dikes, and drainage channels), meant to prevent the creeks, Delta, and other bodies of water from overflowing and causing floods could fail during a tsunamis and cause flooding in these areas. Although the Contra Costa County Flood Control District is responsible for local flood control projects, many of these levees and drainage facilities in the Delta region of the County are privately owned and operated. Portions of Interstate 80 and 680, and State Route 4, and the Benecia-Martinez Bridge and the Carquinez Bridge, which are major transportation routes to the area, may be exposed to tsunami flooding.

Armtrak, freight line, and the BART within coastal areas may also be exposed to tsunami flooding. There are three (3) standard rail lines that run through Contra Costa County which are operated by Union Pacific, Burlington Northern Santa Fe, and Richmond Pacific Railroad Corporation. These run along the western, northern, and eastern boundaries of the County, along Interstate 80, State Route 4, and Byron Highway. The aforementioned rail lines are used for freight trains; however, the Capitol Corridor commuter train runs along the Union Pacific railway. Additionally, the BART operates its own separate rail lines used exclusively for public transit. Two (2) BART rail lines are located in the County – one beginning in Richmond and heading south toward Berkeley and another one in the central part of the County extending from the City of Orinda to the City of Antioch. Flooding from a tsunami can cause damage to the tracks and result in the system to completely shutting down.

[294] United States Census Bureau. (2022). S0801: Commuting Characteristics by Sex. Retrieved from https://data.census.gov/table/ACSST1Y2022.S0801?g=050XX00US06013.
[295] United States Census Bureau. (2022). S1601: Language Spoken at Home (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S1601?g=050XX00US06013.
[296] Ibid.
[297] Ibid.

Three (3) wastewater treatment plants – Rodeo sewage treatment plans, West Contra Costa Wastewater, and Mt. View Sanitary District – are within low lying or coastal flooding areas. During a tsunami event, flooding to these facilities can exacerbate wet weather flows into the treatment plants and if the pumps and control panels are not waterproofed or salt resistant, the system can fail. Additionally, if the Delta levee fails the Mokelumne Aqueduct could be exposed to coastal flooding and the Contra Costa Canal and the Clifton Court Forebay are also within the coastal flooding area. In the event that these levees fail during a tsunami event, these water and wastewater infrastructure would also fail resulting in the contamination of freshwater, reducing the availability of drinking and agricultural water.

In Contra Costa County, there are approximately 61 industrial buildings within the coastal flooding areas. Tsunamis can cause serious damage to industrial structures and increase the potential of a hazardous materials release that can contaminate soil, water, and air in the surrounding areas.[298]

There are a total of 554 critical assets (i.e., schools, nursing homes, fire stations, police stations, and hospitals) throughout the County and none are located within the tsunami hazard areas. **Table 4-184** provides a breakdown of critical assets that are located within tsunami hazard areas in Contra Costa County.

Table 4-184. Critical Assets Vulnerable to Tsunami

Asset	Estimate	Percent *(of total assets)*
Schools *(public schools, private schools)*	0	0.0%
Nursing Homes	0	0.0%
Fire Stations	0	0.0%
Police Stations	0	0.0%
Hospitals	0	0.0%

Table 4-187 outlines the total property value exposed to tsunamis and how the changes in development in the past five (5) years, have affected the vulnerability of the community to tsunamis. **Table 4-188** outlines the tsunami impacts on total property damage, potential future development, and the economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Environment: Inundation of water by tsunami and introduction of foreign debris could be hazardous to the environment. All wildlife inhabiting the inundated area is exposed. The vulnerability of aquatic habitat and associated ecosystems would be highest in low lying areas close to the southern portion of San Francisco Bay coastline. Tsunami waves can carry destructive debris and pollutants that can devastate the environment. Millions of dollars spent on habitat restoration and conservation in Contra Costa County could be destroyed as a result of one significant tsunami. There are currently no tools available to measure these impacts. However, the potential financial impact of a tsunami event on the environment could equal or exceed the impact on property. Community planners and emergency managers should take this into account when preparing for the tsunami hazard and considering future development. Additionally, industrial buildings located within the coast are vulnerable to tsunamis and damage to these

[298] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.

structures can lead to severe environmental concerns due to the potential of hazardous materials released to the soil, water, and air.[299]

Table 4-188 outlines tsunami impacts on the environment and economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Changes in Development and Impact of Future Development: Construction and development on coastal areas of San Francisco Bay is strictly regulated. There has been minimal development in these areas of Contra Costa County since the Hazard Mitigation Plan was completed. Expected future development will be closely managed with the County through land use ordinances. Due to the increasing risk from tsunamis due to sea level rise, development in the coastal zone will be minimized.

Table 4-187 outlines how the changes in development in the past five (5) years have affected the vulnerability of the community to tsunamis. **Table 4-188** outlines the tsunami impacts on potential future development, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Effects of Climate Change in Severity of Impacts: Sea level rise due to climate change is making coastal communities more vulnerable to tsunamis because a rise in sea level can exacerbate tsunamis, even small ones, which can travel further inland. A warming climate can increase the risk of underwater and above ground landslides which can generate tsunamis on impact when the landslide enters the water or when water is rapidly moving due to an underwater landslide. Although the correlation between climate change, volcano activity, and earthquakes is not fully understood, experts believe that melting ice can also increase volcanic and earthquake activity, both of which can produce tsunamis. This could be due to isostatic rebound, also known as post-glacial rebound, which is the rise of land masses that were depressed by the weight of ice sheets during the last ice age. [300] As ice continues to melt, stress to the Earth's crust changes potentially increasing the risk of volcano activity. Furthermore, the weight of ice suppresses fault movement and earthquake, but when the weight is removed faults can become unstable. [301]

Table 4-188 outlines the climate change impacts to tsunamis in Contra Costa County, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

[299] Ibid.
[300] National Snow and Ice Data Center. (n.d.). Cryosphere Glossary: Isostatic Rebound. Retrieved from https://nsidc.org/learn/cryosphere-glossary/isostatic-rebound.
[301] Cunneen, J. (2022). 5 Ways Climate Change Increases the Threat of Tsunamis, From Collapsing Ice Shelves to Sea Level Rise. Retrieved from https://theconversation.com/5-ways-climate-change-increases-the-threat-of-tsunamis-from-collapsing-ice-shelves-to-sea-level-rise-175247.

Table 4-185. Probability of Occurrence

Hazard Event	Probability of Occurrence		Probability Factor	Weighted Factor
Tsunami	Low	Significant hazard event is likely to occur within 100 years.	1	N/A

Table 4-186. Extent Factors

Hazard Event	Extent Factor	Extent		Extent Factor	Weighted Factor
Tsunami	***Extent/Intensity***	Low	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a low-intensity incident.	1	3
	Catastrophic	Low	Catastrophic hazard event is likely to occur at least once in 51 or more years.	1	3

Table 4-187. Vulnerability Factors

Hazard Event	Vulnerability Factor	Vulnerability		Vulnerability Factor	Weighted Factor
Sea Level Rise	***Population Exposure***	Low	14% or less of the population is exposed to the hazard.	1	3
	Property Exposure	Low	9% or less of the total assessed property value is exposed to a hazard.	1	2
	Changes in Development	Low	Changes in development have increased the vulnerability/exposure of the community to the hazard by 4% or less.	1	1

Table 4-188. Impact Factors

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
Sea Level Rise	***Population and Life Safety***	Low	Populations exposed to this hazard are likely to experience minimal adverse impacts, such as ambulatory injuries.	1	3
	Underserved/Equity	Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2	6
	Property Damage	Medium	More than $500,000 but less than $5 Million in property damages is expected from a single major hazard event, or damages are expected to occur to more than 5% but less than 15% of the property value within the jurisdiction.	2	4
	Economic	High	Where the total economic impact is likely to be greater than $10 Million.	3	3

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
	Environmental	High	Environmental impact from a single major hazard event is likely to be significant, requiring extensive outside resources and support; and/or repair, clean-up, restoration, and/or preservation work.	3	3
	Essential Operations	Medium	Impact between 24 and 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	2	2
	Future Development	Low	Future development trends will minimally increase impact/consequence of this hazard.	1	1
	Climate Change	Low	Climate Change trends will minimally increase the risk of this hazard and its impacts.	1	1

4.6.9.8. FEMA NRI Expected Annual Loss Estimates

A tsunami NRI EAL score, and rating represent a community's relative level of expected building and population loss each year due to tsunamis when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-189** outlines the tsunami EAL for Contra Costa County.

Table 4-189. Tsunami Expected Annual Loss *(FEMA National Risk Index)*

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Contra Costa County	$2,012	$38,659	N/A	$40,671	82.0	Very High
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.9.9. FEMA Tsunami Risk Index Scores

The tsunami Risk Index score and rating represent a community's relative risk for tsunamis when compared to the rest of the United States. **Table 4-190** illustrates the tsunami Risk Index rating and score for Contra Costa County.

Table 4-190. Tsunami Risk Index *(FEMA National Risk Index)*

Jurisdiction	Rating	Score
Contra Costa County	Relatively High	66.2
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

Table 4-191 represents the Tsunami Total Risk Score for Contra Costa County, based on the Risk Assessment Methodology, as defined in this Plan. For further details on how the probability, extent, vulnerability, and impact factors were calculated, please refer to **Table 4-185** through **Table 4-188**. Additional details on how the Total Risk Score was calculated can be found in the Risk Assessment Methodology in Section 4.3 of this Plan.

Table 4-191. Tsunami Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Tsunami	1	6	6	22	34	20

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.10. Wildfire

4.6.10.1. Description

Wildfires are unplanned fires that occur in wildlands (e.g., forest, rangelands, or grasslands) and they are nearly impossible to prevent and difficult to control. These extreme events are common in the western United States, usually occurring during the summer and fall.[302] Free-burning fires can occur whenever combustible fuel (e.g., grasses, shrubs, trees, dead leaves) in the presence of oxygen at an extremely high temperature becomes gas (flames are the visual indicator of heated gas). Smoldering fires can occur with lower temperature heat sources and, over time, can reach ignition temperature when rapid fire growth occurs. Wildfires can be ignited by natural occurrences (e.g., lightning strike) or by human causes (e.g., unattended campfire, debris burning, or arson). In 2022, 87% of wildfires in the United States were ignited by humans; meaning that they could have been prevented.[303] However, weather conditions and topography determine the behavior of wildfire. Wind, high temperatures, and low humidity create a perfect environment for a wildfire to grow; furthermore, flames burn faster when they are moving uphill versus downhill.

Wildfires can be classified in three (3) different classes, listed in **Table 4-192**, and it is not uncommon to have all three (3) types of fire.[304]

Table 4-192. Types of Wildfires

Type	Description
Ground Fires	Mostly burn in decayed roots below ground and in the duff later which is comprised by dead plant materials (e.g., leaves, bark, needles, and twigs). Ground fires are sustained by glowing combustion (without flames) and go undetected for a long period of time because the produce little to no smoke and spread slowly.
Surface Fires	Burn loose needles, moss, lichen, herbaceous vegetation, shrubs, small trees, and saplings that are located at or near the surface of the ground, mostly by flaming combustion. Surface fires can grow in intensity to scorch or consume the forest canopy, a characteristic that is seen in crown fires depending on the following – amount of surface fuel (high), fuel moisture content (low), slope and/or wind speed (high), resultant surface flame length (high), height of the base of tree crowns (small), and density and compactness of tree crowns (tight).
Crown Fires	Usually ignited by a surface fire, crown fires burn forest canopy fuels, which include live and dead foliage/ branches, lichens in trees, and tall shrubs that lie well above the surface fuels. Crown fires can be passive (involve the burning of individual trees or small groups of trees, often called torching) or active (also referred to as running crown fires, present a solid wall of flame from the surface through the canopy fuel layers as seen in the photo below.

Wildfires are a necessary part of the natural ecosystem in California, but they become a hazard when they extend out of control into developed areas, resulting in loss of property, injuries, or the loss of life. The wildfire risk in the United States has increased in the last few decades with the increasing encroachment of residences and other structures into the wildland environment and the increasingly large number of people living in wildland areas.

[302] United States Department of Agriculture. (n.d.). Wildfire. Retrieved from https://www.climatehubs.usda.gov/taxonomy/term/398.
[303] United States Forest Service. (n.d.). About Wildfires. Retrieved from https://smokeybear.com/en/about-wildland-fire.
[304] Northwest Fire Science Consortium. (n.d.). What are Types of Fire? Retrieved from https://www.nwfirescience.org/sites/default/files/publications/Types%20of%20Fire.pdf.

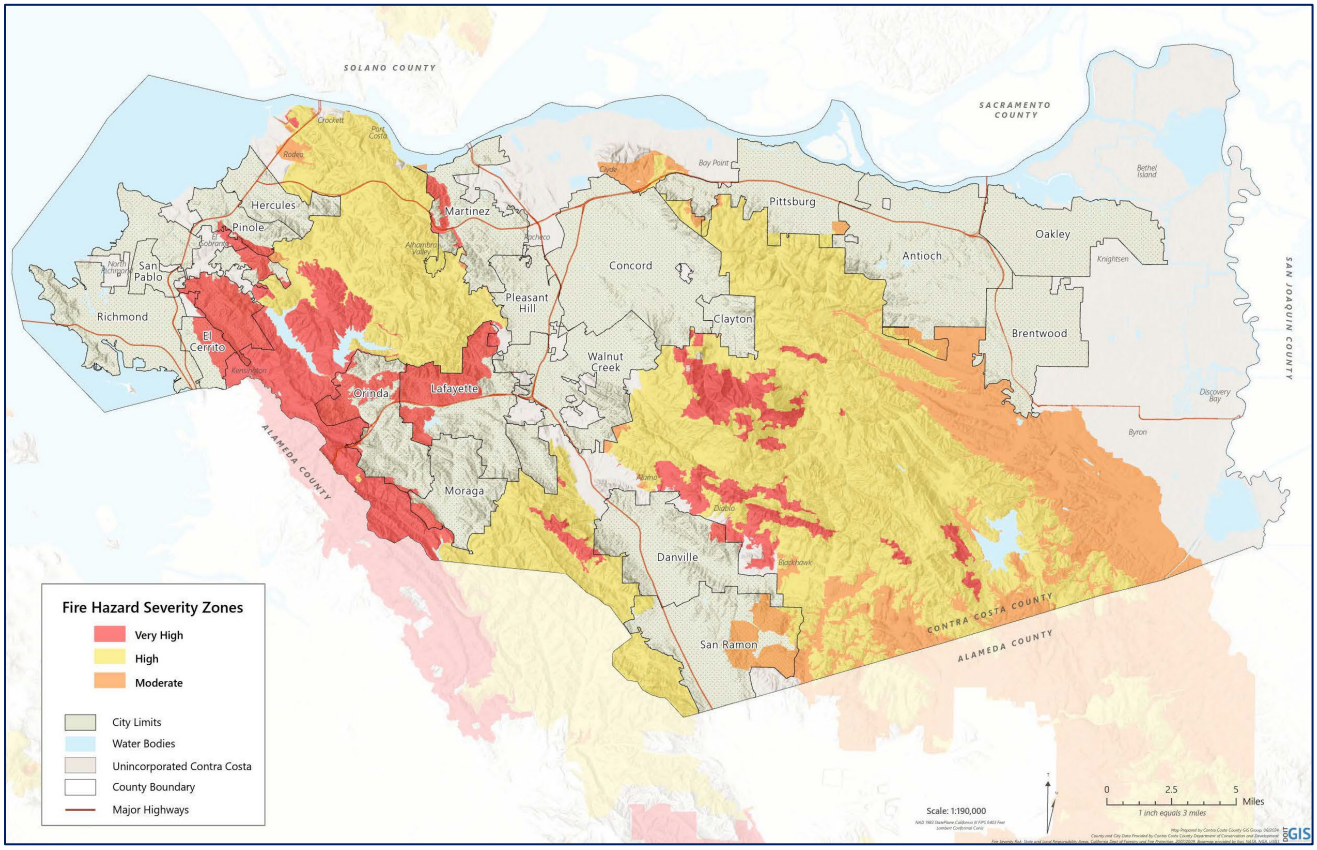
The Contra Costa County Fire Protection District (CCCFPD) provides fire prevention, suppression, and emergency medical response for advanced and basic life support to nine (9) cities and much of the unincorporated areas the central and western Contra Costa County The CCCFPD operates 30 stations throughout its jurisdictional area and has a staff of over 250 uniformed personnel. [305]

4.6.10.2. Hazard Location

In Contra Costa County, 192,192 acres are classified as very high, high, or moderate fire hazard zones (i.e., Fire Hazard Severity Zones). [306] The geography, weather patterns, and vegetation in the East Bay area provide ideal conditions for recurring wildfires. Especially vulnerable are the East Bay Hills in Lamorinda (which includes Lafayette, Moraga, and Orinda). Parts of Walnut Creek, including the area surrounding Rossmoor, Clayton, the Danville/San Ramon area, and the San Pablo - El Cerrito, El Sobrante area are vulnerable to wildfires.

Additionally, peat fires, which occur in the Sacramento/San Juaquin Delta on reclaimed land east of the City, can result in heavy smoke. This can affect air quality and result in hazardous atmospheric particulate matter. **Figure 4-25** illustrates the Fire Hazard Severity Zones (FHSZ) in the State Responsibility Area (SRA) and **Figure 4-26** illustrates the Wildland Urban Interface areas in Contra Costa County.

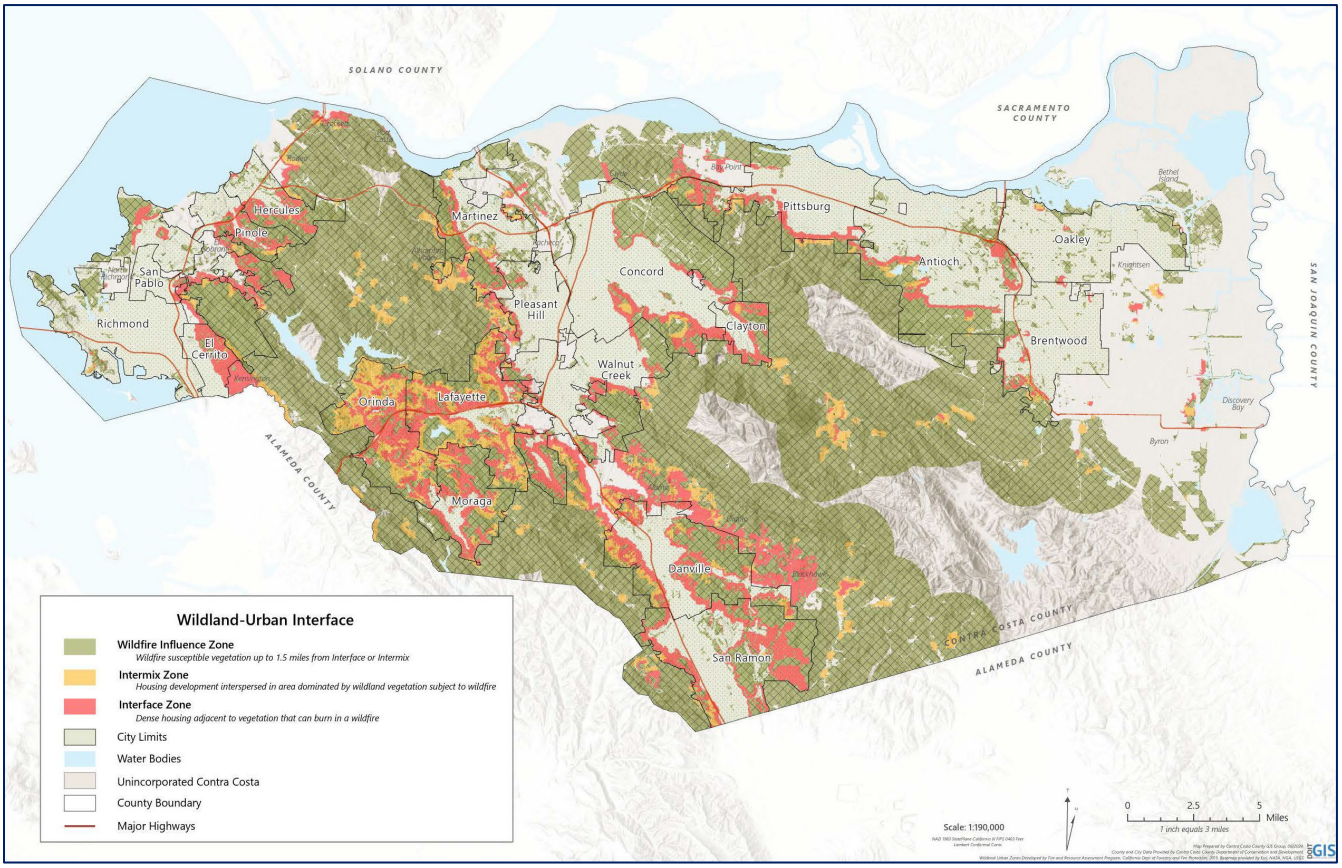
Figure 4-25. Contra Costa County Fire Hazard Severity Zones



[305] Contra Costa County Fire Protection District. (n.d.). Station Addresses. Retrieved from https://cccfpd.org/station-address/.

[306] State of California and the Department of Forestry and Fire Protection. (2023). State Responsibility Area Fire Hazard Severity Zones: Contra Costa County. Retrieved from https://osfm.fire.ca.gov/what-we-do/community-wildfire-preparedness-and-mitigation/fire-hazard-severity-zones/fire-hazard-severity-zones-maps-2022.

Figure 4-26. Contra Costa County Wildland-Urban Interface



4.6.10.3. Hazard Extent/Intensity

Wildfires are considered a natural and necessary component of wildland ecology. As a result, wildfires are not considered a major hazard unless their movement threatens lives, homes, communities, critical infrastructure, and natural and cultural resources.

CAL FIRE modeled and mapped wildfire hazard zones using a science based and field tested computer model that designates a hazard score based on the factors that influence fire likelihood and fire behavior. Ultimately, three (3) levels of FHSZ were identified – moderate, high, and very high.

The model also is based on frequency of fire weather, ignition patterns, and expected rate-of spread. It accounts for flying ember production, which is the principal driver of the wildfire hazard in densely developed areas. A related concern in built-out areas is the relative density of vegetative fuels that can serve as sites for new spot fires within the urban core and spread to adjacent structures. The model refines the zones to characterize fire exposure mechanisms that cause ignitions to structures. Significant land-use changes need to be accounted for through periodic model updates. Figure 13-1 shows the FHSZ mapping for Contra Costa County. Table 13-2 lists the total area mapped in each zone. Most of the mapped zones are in the unincorporated county.

Even if a wildfire is not occurring within Contra Costa County, wildfire smoke can affect the visibility and air quality of the region. Wildfire smoke is a mix of gases and fine particles from burning vegetation, building materials, and other materials. The Air Quality Index (AQI) is used by the United States

Environmental Protection Agency (EPA) to report air quality. The AQI is divided into six (6) categories, listed in **Table 4-193**, each of which corresponds to a different level of health concern.

Table 4-193. Air Quality Index for Ozone and Particle Pollution

Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert. The risk of health effects is increased for everyone.
Maroon	Hazardous	301 or higher	Health warning of emergency conditions. Everyone is more likely to be affected.
EPA establishes an AQI for five (5) major air pollutants regulated by the Clean Air Act. Each of these pollutants has a national air quality standard set by EPA to protect public health - ground-level ozone, particle pollution (also known as particulate matter, including PM2.5 and PM10), carbon monoxide, sulfur dioxide, and nitrogen dioxide.			

4.6.10.4. Warning Time

When weather conditions are conducive to wildfire ignition, the NWS local Forecast Office issues a series of advisories. **Table 4-194** outlines the fire advisories issued by NWS as conditions warrant. [307]

Table 4-194. National Weather Service Fire Advisories

Type	Definition
Fire Weather Watch	Issued to alert land managers and the public that upcoming weather conditions (e.g., combination of strong winds and low humidity, dry and unstable air mass, and/or lightning) could result in extensive wildland fire occurrence or extreme fire behavior. It is issued when critical fire weather conditions are possible but not imminent or occurring.
Red Flag Warning	Issued by NWS, in conjunction with land management agencies, to alert land managers to an ongoing or imminent critical fire weather pattern (e.g., combination of strong winds and low humidity, dry and unstable air mass, and/or lightning). It is issued when fire conditions are ongoing or expected to occur shortly.
Extreme Fire Behavior	Issued when a wildfire is likely to run out of control. It is often hard to predict because fires tend to behave erratically and sometimes dangerously. To issue this alert, one (1) or more of the following criteria must be met – moving fast (i.e., high rate of spread), prolific crowning and/or spotting, presence of fire whirls, and/or strong convection column.

4.6.10.5. Probability and Frequency

The probability of occurrence for a wildfire in Contra Costa County is medium because a significant hazard event is likely to occur every 25 years. However, isolated and lower-impact events occur annually.

[307] National Weather Service. (n.d.). Understanding Wildfire Warnings, Watches and Behavior. Retrieved from https://www.weather.gov/safety/wildfire-ww.

From 2010 to 2022, there were 24 wildfires in Contra Costa County[308], most burning over 100 acres each. Some burned considerably more acreage, most notably the 2020 Santa Clara Unit Complex Fire, which burned 396,824 acres in total (3,305 acres in Contra Costa County). As noted below, NCEI has reported 18 wildfire events between 1950 and 2023 in Contra Costa County. While this is fewer than the number reported by the County, wildfires remain a significant threat.

Probability of Future Hazard Events

Because of climate change, fire activity is projected to increase where development expands in the WUI, in addition to the dry hills around Mount Diablo.

The wildfire annualized frequency value represents the modeled frequency of wildfire hazard occurrences, in event days, per year. **Table 4-195** outlines the annualized frequency for wildfire, based on FEMA NRI data, for Contra Costa County.

Table 4-195. Wildfire Annualized Frequency *(FEMA National Risk Index)*

Location	Events on Record *(2021 Dataset)*	Annualized Frequency
Contra Costa County	N/A	0.306% chance per year
Annualized frequency is defined as the expected frequency or probability of a hazard occurrence per year.		

4.6.10.6. Past Events

NCEI has reported 18 wildfire events, listed **Table 4-196**, between 1950 and 2023 in Contra Costa County. None of its wildfires have caused sufficient damage to trigger a state or federal disaster declaration.

Table 4-196. Wildfire Events (1950 – 2023)

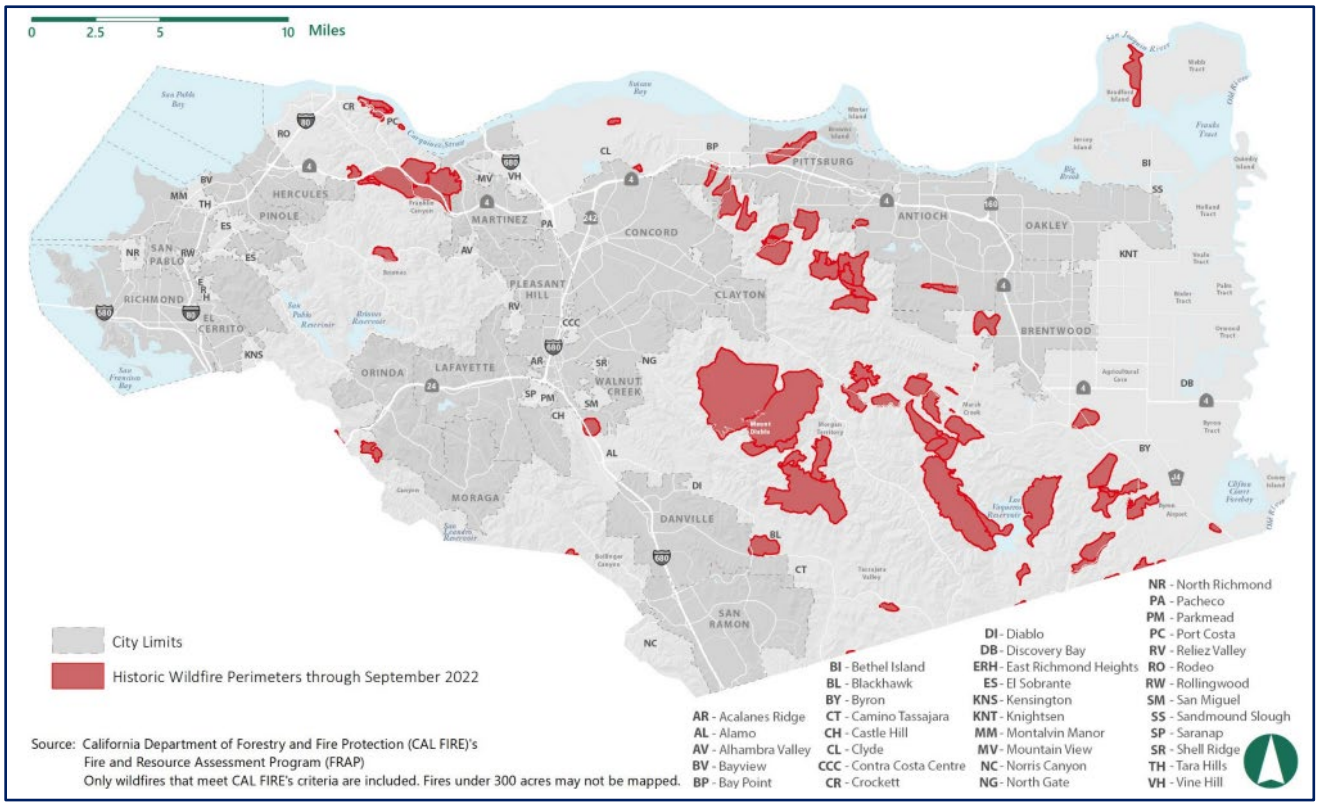
Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	5/20/2022	11:00	Wildfire	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	7/11/2021	08:22	Wildfire	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	9/1/2020	00:00	Wildfire	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	8/16/2020	04:00	Wildfire	0	6	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	7/20/2020	13:15	Wildfire	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	7/6/2020	13:00	Wildfire	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	7/4/2020	12:28	Wildfire	0	0	0.00K	0.00K

[308] Contra Costa County. (2023). Public Review Draft Contra Costa County 2045 General Plan – Health and Safety Element. Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2024/02/Chapter_9_Health-and-Safety-Element.pdf.

Location	County / Zone	State	Date	Time	Type	Death	Injury	Property Damage	Crop Damage
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	7/4/2020	22:00	Wildfire	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	6/6/2020	16:00	Wildfire	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	10/27/2019	07:50	Wildfire	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	10/27/2019	10:30	Wildfire	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	10/27/2019	13:00	Wildfire	0	0	0.00K	0.00K
SAN FRANCISCO BAY SHORELINE (ZONE)	San Francisco Bay Shoreline	CA	10/27/2019	13:45	Wildfire	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	10/27/2019	15:00	Wildfire	0	0	0.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	10/24/2019	20:40	Wildfire	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	10/10/2019	00:00	Wildfire	0	0	0.00K	0.00K
EAST BAY INTERIOR VALLEYS (ZONE)	East Bay Interior Valleys	CA	8/7/2019	12:00	Wildfire	0	0	5.00K	0.00K
EAST BAY HILLS AND THE DIABLO RANGE (ZONE)	East Bay Hills And The Diablo Range	CA	6/11/2019	11:34	Wildfire	0	0	5.00K	0.00K
					TOTAL	**0**	**6**	**10.00K**	**0.00K**

Figure 4-27 illustrates the perimeters of wildfires from 1950 to 2022. These are areas that have previously burned, regardless of their location within or outside of a Fire Hazard Severity Zone, are likely to burn again.

Figure 4-27. Contra Costa County Historic Wildfire Perimeters



4.6.10.7. Vulnerability and Impacts

Life Safety and Health: There have been no recorded incidents of loss of life from wildfires within the planning area in the last several decades. Given the immediate response times to reported fires, the likelihood of injuries and casualties is minimal; therefore, injuries and casualties were not estimated for the wildfire hazard. Even so, wildfire risk and activity in the planning area are expected to significantly increase due to climate change. The 2024 Climate Action Plan (draft version) identified the increased risk for landslides and floods because of wildfires.

The entire population within a wildfire hazard area is vulnerable to wildfires and the entire County population is vulnerable to wildfire smoke. However, the underserved and at risk population face unique vulnerabilities and impacts as a result of wildfires and wildfire smoke. These groups include, but are not limited to, children, households in poverty, individuals experiencing homelessness, population living on single access roads, people with chronic illnesses, individuals with limited English proficiency, individuals without access to lifelines, and elderly.

- **Children (under 10 years old):** The younger population will be susceptible to pollution from poor air quality and wildfire because they spend more time outside, have a weaker immune system, and a child's respiratory system is still developing which makes them more vulnerable. In Contra Costa County, there are approximately 130,099 (11.2%) children under 10 years old as of 2022.[309] The highest concentration of children lives in parts of the cities of Concord, Richmond, Pittsburg, Brentwood, and San Ramon.

[309] United States Census Bureau. (2022). S0101: Age and Sex (2022: ACS 1-Year Estimates Subject Tables). Retrieved from https://data.census.gov/table/ACSST1Y2022.S0101?g=050XX00US06013.

- **Households in Poverty:** Includes those with an income at or below $24,300 for a household of four (4) people. This population may have financial limitations or neighborhood characteristics that makes it difficult to maintain defensible space in fire prone areas; therefore, making them more susceptible to wildfire damage. Some of these homes are located within the WUI.
- **Individuals Experiencing Homelessness:** Includes those who do not have a permanent home, including those who live in their vehicles or temporary shelters. This population may face significant health issues that can reduce lung function, pneumonia, asthma, and cardiovascular issues. Furthermore, these individuals may not have adequate access to healthcare. In Contra Costa County, homeless encampments located near Bay Point, Lafayette, Alamo, El Sobrante and other WUI areas may be in danger of being burned during a wildfire.
- **Individuals Living on Single Access Roads:** Includes the population living in areas with a single route in and out (i.e., accessible via one (1) roadway) of the neighborhood or area. This population can become isolated from the community and emergency services in the event that the only route is destroyed or blocked due to a wildfire. In Contra Costa County, several neighborhoods and communities in the Delta, and in the hillside areas in the central and western side of the County, are only accessible via one (1) roadway.
- **Individuals with Chronic Illnesses:** Includes those that have long term or permanent health conditions that can be exacerbated by wildfire smoke (e.g., cardiovascular disease, respiratory conditions, diabetes, cerebrovascular diseases). A wildfire that is not within Contra Costa County can impact the area with wildfire smoke, even when the wildfire is taking place thousands of miles away.
- **People with Limited English Proficiency:** This group includes those that speak English “less than very well”, per the United States Census Bureau definition. In Conta Costa County, 158,965 people (38.2%) have limited English proficiency (i.e., speak English “less than very well”). This population is more likely to live in neighborhoods that make it difficult to maintain defensible space that can protect their homes from wildfire. Additionally, individuals with limited English proficiency may have limited access to evacuation information and resources designed to prevent or mitigate wildfire risk due to language or cultural differences. Other languages spoken in the County are primarily Spanish, Mandarin, Cantonese, Tagalog, and Persian. Other than English, the most commonly spoken language in Contra Costa County is Spanish (18.7%). The higher proportion with limited English proficiency occurs in the cities of Richmond, Concord, and San Pablo.
- **Individuals Without Access to Lifelines:** Includes individuals who do not have access to basic technology or services (e.g., transportation, modern communication). This population is vulnerable because not having access to these can create barriers to prepare and respond to emergency events (e.g., wildfire), may be unable to evacuate in a timely manner, and may become isolated if transit services are not operating. For example, this population may be unaware of a wildfire event or evacuation order which may prohibit them from evacuating in a timely manner.
- **Senior (65 years old and over) and Seniors Living Alone:** The elderly population (i.e., seniors), especially those with access and functional needs, may have physical limitations that make it harder to evacuate in the event of an emergency due to a wildfire. Furthermore, the elderly population may lack access to social connections and community support that can assist in preparing for and responding to emergency events, evacuating, improving home resiliency, managing medical needs, and locating support services. These individuals are especially vulnerable to the health effects associated with wildfire smoke. A high concentration of the elderly population lives in central Contra Costa County, Bethel Island, eastern part of Richmond, and several parts of Walnut Creek. Seniors living alone may have caretakers, but for the most part

are living alone. This population is generally more vulnerable compared to other seniors because this group may have mobility issues that prohibit them from evacuating. In 2022, there were approximately 33,102 (8.0%) seniors living alone.[310]

Children, elderly, individuals with chronic illnesses, outdoor workers, and those experiencing homelessness are at a higher risk of the health effects attributed to wildfire smoke exposure. Short term exposure (i.e., over a few days) can cause irritation to the eyes and respiratory tract, respiratory symptoms (e.g., coughing, phlegm, wheezing, difficulty breathing), respiratory effects (e.g., bronchitis, reduced lung function, increased risk of asthma exacerbation and aggravation of other lung diseases, increased risk of emergency room visits and hospital admissions), cardiovascular effects (e.g., heart failure, heart attack, stroke, increased risk of emergency room visits and hospital admissions), and increased risk of premature death. Cumulative short-term exposure (i.e., over multiple days to a few weeks) can reduce lung function; and studies have not evaluated the health effects attributed to wildfire smoke exposure over multiple wildfire season (i.e., long-term exposure).[311]

Table 4-202 outlines the vulnerability of the total population exposed to wildfires, and **Table 4-203** outlines the wildfire impacts to population and life safety, underserved/equity population, and essential operations, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Property Damage and Critical Infrastructure: Within the SRA and Very High FHSZ, there are existing homes, businesses, and public land uses, as well as associated infrastructure like major roadways (e.g., State Road 24 and State Road 4), electrical transmission lines, water and wastewater distribution systems, and communication facilities. Most of this development occurred prior to recent wildfire hazard mapping.

In Contra Costa County, there are electrical transmissions and distribution lines that are located in the mountainous areas which are located within the high fire hazards severity zones. Electrical transmission and distribution lines are power lines that carry high-voltage electricity long distances between power plants and electricity customers. This infrastructure can be damaged or destroyed by wildfires and cause residents and businesses within the County to lose power if electricity lines fail.

State Road 4 and 24, and Interstate 80 go through areas in the County that are within the moderate and very high fire hazard zones. In the event of a wildfire within this areas, can cause damage to roadways and road closures which can result in disruptions to commute and traffic patterns in the region. Furthermore, closures on Highways 4 and 24 may prevent those in eastern and central Contra Costa County from traveling to the west. Single access roads, primarily located in hillside communities that are also within high or very high fire hazard severity zones, can be damaged or blocked due to wildfires.

There are 24 industrial buildings in the County that are within the fire hazard zone. Holding tanks and manufacturing centers that contain hazardous materials can be damaged by wildfires and release toxic materials into the air, water, and soil of the surrounding communities. [312]

[310] United States Census Bureau. (2022). DP02: Selected Social Characteristics in the United States (2022: ACS 1-Year Estimates Data Profiles). Retrieved from https://data.census.gov/table/ACSDP1Y2022.DP02?g=050XX00US06013.
[311] United States Environmental Protection Agency. (n.d.). Wildfire Smoke and Your Patients' Health. Retrieved from https://www.epa.gov/wildfire-smoke-course/health-effects-attributed-wildfire-smoke.
[312] Ibid.

There are a total of 554 critical assets (i.e., schools, nursing homes, fire stations, police stations, and hospitals) throughout the County; seven (7) (1.3%) are located within the medium FHSZ, 12 (2.2%) are located within the high FHSZ, and 16 (2.9%) are located within the very high FHSZ. **Table 4-197** provides a breakdown of critical assets that are located within the FHSZ in Contra Costa County.

Table 4-197. Critical Assets in Vulnerable to Wildfire

Asset	Estimate	Percent *(of total asset)*
Medium Fire Hazard Severity Zone		
Schools *(public schools, private schools)*	7	1.9%
Nursing Homes	0	0.0%
Fire Stations	0	0.0%
Police Stations	0	0.0%
Hospitals	0	0.0%
High Fire Hazard Severity Zone		
Schools *(public schools, private schools)*	4	1.1%
Nursing Homes	0	0.0%
Fire Stations	8	9.9%
Police Stations	0	0.0%
Hospitals	0	0.0%
Very High Fire Hazard Severity Zone		
Schools *(public schools, private schools)*	12	3.3%
Nursing Homes	0	0.0%
Fire Stations	4	4.9%
Police Stations	0	0.0%
Hospitals	0	0.0%

Table 4-202 outlines the total property value exposed to wildfires and how the changes in development in the past five (5) years have affected the vulnerability of the community to wildfires. **Table 4-203** outlines the wildfire impacts on total property damage, potential future development, and the economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Environment: Fire is a natural and critical ecosystem process in most terrestrial ecosystems, dictating in part the types, structure, and spatial extent of native vegetation. However, wildfires can cause severe environmental impacts. In Contra Costa County, the following ecosystems and natural resources are vulnerable to wildfires:[313]

[313] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.

- **Agriculture:** Crops, farms, and agriculture fields can be damaged by the smoke and ash from wildfires within and outside of Contra Costa County. Therefore, even though many agricultural lands are not within fire hazard zones, they can still be impacted by wildfires. Smoke and ash can change crops (e.g., wine grapes) and change nutrients in the soil which can cause plants to die or not produce as many usable fruits. This can cause significant economic hardship for farmers.
- **Regional Parks:** Many regional parks within the County are located within high or very high fire hazard severity zones. Wildfire can destroy park facilities, damage trails and walking paths, and damage scenic views and vistas within the parks. This can impact the County economy because it may reduce the number of visitors to the parks.
- **Riparian Woodland and Shrub:** Riparian woodland and shrub ecosystems consist of Valley foothill riparian, undetermined shrub, and riverine habitat. These areas are scattered throughout Contra Costa County and have numerous wildlife species (e.g., gray fox, striped skunk, broad-handed mole, mule deer, dusky-footed woodrat, yellow warbler, northern flicker, white tailed kite, and Cooper's hawk). Wildfire can damage these ecosystems due to loss of canopy and changes in soil structure, erosion, and shifts in the specific composition due to change in the structure of the habitat.
- **Woodland:** Woodland ecosystems include oak savannah, oak woodland, and mixed evergreen forest. These ecosystems are primarily located on the hillsides and mountainous regions of western and central Contra Costa County and have numerous wildlife species (e.g., deer mouse, western gray squirrel, coyote, red-tailed hawk, barn owl, great horned owl, and acorn woodpecker). Fire sensitivity varies by species; however, most species have an elevated vulnerability to wildfires. Widespread devastation can be caused by wildfires through the woodland areas particularly if trees have been weakened or killed by drought, extreme heat, and/or pests or infestation.

Table 4-203 outlines the wildfire impacts on the environment and economy, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Changes in Development and Impact of Future Development: Changes in development, since completion of the previous Plan, have not had a significant impact on the County wildfire hazards. However, fire activity is projected to increase where development expands in the WUI areas, in addition to the dry hills around Mount Diablo. Nonetheless, Contra Costa County intends to protect against and adapt to the increases in frequency and intensity of wildfire events through a series of implementation actions outlined in in the Couty's Climate Action Plan. This strategy aims to increase community resilience to the direct and indirect effects of wildfires. Public and private property shall be designed and maintained to minimize the risk of damage from wildfires; infrastructure systems will be hardened and designed to include redundancy; and emergency management plans and practices for wildfires will be responsive to the needs of underserved communities. Strategies such as this should help reduce the impacts of future development within wildfire hazards areas.

Table 4-202 outlines how the changes in development in the past five (5) years have affected the vulnerability of the community to wildfires. **Table 4-203** outlines the wildfire impacts on potential future development, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Effects of Climate Change in Severity of Impacts: Changes in climate are creating warmer and drier conditions which are leading to longer and more active wildfire seasons. Studies have shown that the number of large wildfires has more than doubled in the western United States. Furthermore, projections show that a one (1) degree Fahrenheit increase in the average annual temperature could increase the

average burned area per year by as much as 600% (in some types of forests) in the western United States. [314]

In California, wildfires are expected to increase in frequency and severity due to climate change. As temperatures continue to rise, an increase in drought conditions, and forestry pests and diseases are likely to create more fuel in State and federal wildlands and a greater chance that a small fire can develop into a more dangerous wildfire. Excessive heat and dry conditions have already contributed to the rapid spread of wildfires during past events in Contra Costa County. Additionally, climate change is also expected to extend the fire season throughout much (or even all) of the year.[315]

Table 4-198 indicates the 25-year heat and precipitation projections for Contra Costa County.[316] **Table 4-199** outlines the wildfire associated climate indicators for Contra Costa County projected through the end of the century.[317]

Table 4-198. 25-Year Climate Projections for Contra Costa County

Higher Emissions (RCP8.5)
Contra Costa County is expected to experience a 47% increase in extremely hot days and a 5% increase in days with heavy precipitation within 25 years.
By 2049, Contra Costa County is expected to experience 11 more days that reach above 95°F (from six (6) days to 11 days per year).
By 2049, Contra Costa County is expected to have a 2°F increase (from 61°F to 63°F) in average annual temperatures.
By 2049, Contra Costa County is expected to experience 0.1 more days of heavy precipitation per year (from 2.8 days to 2.9 days per year).
By 2049, Contra Costa County is expected to have a 0.3 inch increase (from 19.6″ to 19.9″) in average annual precipitation.
Lower Emissions (RCP4.5)
Contra Costa County is expected to experience a 32% increase in extremely hot days and a 13% increase in days with heavy precipitation within 25 years.
By 2049, Contra Costa County is expected to experience seven (7) more days that reach above 95°F (from 22 days to 29 days per year).
By 2049, Contra Costa County is expected to have a 1°F increase (from 61°F to 62°F) in average annual temperatures.
By 2049, Contra Costa County is expected to experience 0.3 more days of heavy precipitation per year (from 2.5 days to 2.8 days per year).
By 2049, Contra Costa County is expected to have a 0.4 inch increase (from 19″ to 19.5″) in average annual precipitation.

[314] NOAA. (2023). Wildfire Climate Connection. Retrieved from https://www.noaa.gov/noaa-wildfire/wildfire-climate-connection.
[315] Contra Costa County. (2023). Climate Action Plan (Public Review Draft). Retrieved from https://envisioncontracosta2040.org/wp-content/uploads/2023/10/CoCoCounty-2024CAP-PublicDRAFT-10-10-23_Final.pdf.
[316] Northeast Regional Climate Center. (n.d.). Neighborhoods at Risk: Climate Projections. Retrieved from https://nar.headwaterseconomics.org/.
[317] Climate Mapping for Resilience and Adaptation. (n.d.). Climate Mapping for Resilience and Adaptation Assessment Tool. Retrieved from https://livingatlas.arcgis.com/assessment-tool/explore/details.

Table 4-199. Future Climate Indicators for Contra Costa County

Indicators	Modeled History (1976 – 2005)	Early Century (2015 – 2044)		Mid Century (2035 – 2064)		Late Century (2070 – 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min – Max	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*	*Min – Max*
Precipitation							
Days per year with no precipitation (*Dry Days)*	**281 days**	**286 days**	**283 days**	**285 days**	**285 days**	**285 days**	**288 days**
	277 – 285	275 – 291	274 – 291	275 – 298	267 – 296	275 – 296	271 – 307
Maximum number of consecutive dry days	**95 days**	**97 days**	**98 days**	**97 days**	**99 days**	**98 days**	**102 days**
	85 – 113	84 – 113	88 – 110	83 – 118	82 – 117	80 – 121	76 – 139
Days per year with precipitation *(Wet Days)*	**84 days**	**82 days**	**82 days**	**80 days**	**80 days**	**80 days**	**77 days**
	80 – 88	74 – 91	74 – 91	68 – 91	69 – 98	70 – 90	58 – 94
Temperature Thresholds							
Annual days with maximum temperature greater than 90°F	**36 days**	**55 days**	**57 days**	**62 days**	**68 days**	**70 days**	**90 days**
	36 – 43	47 – 63	51 – 65	51 – 74	55 – 84	57 – 91	72 – 124
Annual days with maximum temperature greater than 100°F	**5 days**	**10 day**	**11 days**	**13 days**	**16 days**	**17 days**	**29 days**
	4 – 6	7 – 14	8 – 16	9 – 22	9 – 28	10 – 22	19 – 57

Table 4-203 outlines the climate change impacts to wildfires in Contra Costa County, as outlined in the risk assessment methodology in Section 4.3 of this Plan.

Table 4-200. Probability of Occurrence

Hazard Event	Probability of Occurrence		Probability Factor	Weighted Factor
Wildfire	Medium	Significant hazard event is likely to occur within 25 years.	2	N/A

Table 4-201. Extent Factors

Hazard Event	Extent Factor	Extent		Extent Factor	Weighted Factor
Wildfire	***Extent/Intensity***	High	Historical and/or probabilistic models/studies for this hazard indicate the possibility of a high-intensity incident.	3	9
	Catastrophic	High	Catastrophic hazard event is likely to occur at least once in 10 years.	3	9

Table 4-202. Vulnerability Factors

Hazard Event	Vulnerability Factor	Vulnerability		Vulnerability Factor	Weighted Factor
Wildfire	***Population Exposure***	Medium	15% to 29% of the population is exposed to the hazard.	2	6
	Property Exposure	Medium	10% to 24% of the total assessed property value is exposed to a hazard.	2	4
	Changes in Development	Medium	Changes in development have increased the vulnerability/exposure of the community to the hazard between 5% and 9%.	2	2

Table 4-203. Impact Factors

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
Sea Level Rise	***Population and Life Safety***	Medium	Populations exposed to this hazard are likely to experience some adverse impacts, such as injuries requiring acute medical care.	2	6
	Underserved/Equity	Medium	Underserved populations exposed to the hazard are likely to experience some adverse/disproportionate impacts, such as injuries requiring acute medical care.	2	6
	Property Damage	High	More than $5 Million in property damages is expected from a single major hazard event, or damages are expected to occur to 15% or more of the property value within the jurisdiction.	3	6
	Economic	Medium	Total economic impact is likely to be greater than $500,000, but less than or equal to $10 Million.	2	2

Hazard Event	Impact Factor	Impact		Impact Factor	Weighted Factor
	Environmental	High	Environmental impact from a single major hazard event is likely to be significant, requiring extensive outside resources and support; and/or repair, clean-up, restoration, and/or preservation work.	3	3
	Essential Operations	Medium	Impact between 24 and 72 hours on the ability of the jurisdiction to meet the essential day-to-day operational demands and needs of the community from a single major hazard event.	2	2
	Future Development	High	Future development trends will significantly increase the impact/consequence of this hazard.	3	3
	Climate Change	High	Climate Change trends will significantly increase the risk of this hazard and its impacts.	3	3

4.6.10.8. FEMA NRI Expected Annual Loss Estimates

A wildfire NRI EAL score, and rating represent a community's relative level of expected building, population, and agriculture loss each year due to wildfires when compared to the rest of the United States. The EAL score is positively associated to a community's risk; therefore, a higher EAL score results in a higher Risk Index score. **Table 4-204** outlines the wildfire EAL for Contra Costa County.

Table 4-204. Wildfire Expected Annual Loss *(FEMA National Risk Index)*

Jurisdiction	Population Equivalence	Building Value	Agriculture Value	Total Expected Annual Loss	Expected Annual Loss Score	Rating
Contra Costa County	$161,110	$5.7 Million	$0	$5.8 Million	96.7	Very High
Expected annual loss scores are calculated utilizing an equation that combines values for exposure, annualized frequency, and historic loss ratios (Expected Annual Loss = Exposure x Annualized Frequency x Historic Loss Ratio).						

4.6.10.9. FEMA Wildfire Risk Index Scores

The wildfire Risk Index score and rating represent a community's relative risk for wildfires when compared to the rest of the United States. **Table 4-205** illustrates the wildfire Risk Index rating and score for Contra Costa County.

Table 4-205. Wildfire Risk Index *(FEMA National Risk Index)*

Jurisdiction	Rating	Score
Contra Costa County	Very High	95.9
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience (Expected Annual Loss x Social Vulnerability / Community Resilience = Risk Index).		

Table 4-206 represents the Wildfire Total Risk Score for Contra Costa County, based on the Risk Assessment Methodology, as defined in this Plan. For further details on how the probability, extent, vulnerability, and impact factors were calculated, please refer to **Table 4-200** through **Table 4-203**. Additional details on how the Total Risk Score was calculated can be found in the Risk Assessment Methodology in Section 4.3 of this Plan.

Table 4-206. Wildfire Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Wildfire	2	18	12	31	61	59

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.11. Other Hazard of Concern

FEMA only requires and reviews natural hazards in hazard mitigation plans. However, Contra Costa County decided to include human-caused and technological hazards in this Hazard Mitigation Plan for the following reasons:

- Contra Costa County takes a proactive approach to disaster preparedness in order to protect the public safety of all citizens.
- Preparation for and response to a human-caused disaster involves much of the same staff training, critical decision making, and commitment of resources as a natural hazard.
- The multi-hazard mitigation planning effort is an opportunity to inform the public about all hazards, including human-caused and technological hazards.
- The likelihood of a human-caused and technological hazard event in the planning area is greater than that of several of the natural hazards identified in this Plan.

Due to the nature of non-natural hazards and the discretionary status regarding their inclusion, the following hazards of interest have been briefly and qualitatively assessed for the sake of public education and informing their inclusion within the hazard ranking and mitigation process.

4.6.11.1. Cybersecurity Threats

Description

A cybersecurity threat is an act or threat that poses potentially devastating disruptions to the digital infrastructure of a person or organization, often for financial or terror-related reasons. Generally, attacks last minutes to days, but large-scale events and their impacts can last much longer. As information technology continues to grow in capability and interconnectivity, cyber threats become increasingly frequent and destructive.

Cyber threats differ by motive, attack type and perpetrator profile. Motives range from the pursuit of financial gain to political or social aims. Cyber threats are difficult to identify and comprehend. Types of threats include using viruses to erase entire systems, breaking into systems, and altering files, using someone's personal computer to attack others, or stealing confidential information. The spectrum of cyber risks is limitless, with threats having a wide range of effects on the individual, community, organizational, and national threat.

Cyberattacks and cyberterrorism are terms for cyber security threats that often are used interchangeably, though they are not the same. All cyberterrorism is a form of cyberattack, but not all cyberattacks are cyberterrorism.

Cyber Attacks

A cyber attack is an attempt by cybercriminals, hackers, or other digital adversaries to access a computer network or system, usually for the purpose of altering, stealing, destroying, or exposing information.

Public and private computer systems can experience a variety of cyberattacks, from blanket malware infection to targeted attacks on system capabilities. Cyberattacks specifically seek to breach information technology security measures designed to protect an individual or organization. The initial attack is followed by more severe attacks for the purpose of causing harm, stealing data, or financial gain. Organizations are prone to different types of attacks that can be automated or targeted. **Table 4-207** describes the 10 most common types of cyberattack. [318]

Table 4-207. Common Types of Cyberattacks

Type	Description
Malware	Also known as a malicious software, is any program or code that is created with the intent to do harm to a computer, network, or server. Malware is the most common type of cyberattack, mostly because this term encompasses many subsets such as ransomware, trojans, spyware, viruses, worms, keyloggers, bots, cryptojacking, and any other type of malware attack that leverages software in a malicious way.
Denial of Service Attacks	A malicious, targeted attack that floods a network with false requests in order to disrupt business operations. Users are unable to perform routine and necessary tasks (e.g., accessing e-mail, websites, online accounts or other resources that are operated by a compromised computer or network). While most of these attacks do not result in lost data and are typically resolved without paying a ransom, they cost the organization time, money, and other resources in order to restore critical business operations.
Phishing	Uses e-mail, SMS, phone, social media, and social engineering techniques to entice a victim to share sensitive information (e.g., passwords, account numbers) or to download a malicious file that will install viruses on their computer or phone.

[318] Baker, K. (2023). 10 Most Common Types of Cyber Attacks. Retrieved from https://www.crowdstrike.com/cybersecurity-101/cyberattacks/most-common-types-of-cyberattacks/.

Type	Description
Spoofing	A technique where a cybercriminal disguises themselves as a known or trusted source. The adversary is able to engage with the target and access their systems or devices with the ultimate goal of stealing information, extorting money, or installing malware or other harmful software on the device.
Identity Based Attacks	These are hard to detect. When a valid user's credentials have been compromised and an adversary is masquerading as that user, it is often very difficult to differentiate between the user's typical behavior and that of the hacker using traditional security measures and tools.
Code Injection Attacks	The attacks consist of an attacker injecting malicious code into a vulnerable computer or network to change its course of action.
Supply Chain Attacks	Targets a trusted third-party vendor who offers services or software vital to the supply chain.
Insider Threats	Internal actors such as current or former employees that pose danger to an organization because they have direct access to the company network, sensitive data, and intellectual property (IP), as well as knowledge of business processes, company policies or other information that would help carry out such an attack.
Domain Name System Tunneling	Leverages domain name system (DNS) queries and responses to bypass traditional security measures and transmit data and code within the network; and once infected, the hacker can freely engage in command-and-control activities.
Internet of Things Based Attacks	Targets an Internet of Things (IoT) device or network; and once compromised, the hacker can assume control of the device, steal data, or join a group of infected devices to create a botnet to launch DoS or DDoS attacks.

Cyberterrorism

Cyberterrorism is the use of computers and information, particularly over the Internet, to recruit others to an organization's cause, cause physical or financial harm, or cause a severe disruption of infrastructure service. Such disruptions can be driven by religious, political, or other motives. Like traditional terrorism tactics, cyberterrorism seeks to evoke very strong emotional reactions, but it does so through information technology rather than a physically violent or disruptive action. Cyberterrorism has three (3) main types of objectives, listed in **Table 4-208**.

Table 4-208. Counterterrorism Objectives

Type	Description
Organizational	Includes specific functions outside of or in addition to a typical cyberattack. Terrorist groups today use the internet on a daily basis. This daily use may include recruitment, training, fundraising, communication, or planning. Organizational cyberterrorism can use platforms such as social media as a tool to spread a message beyond country borders and instigate physical forms of terrorism. Additionally, systematic attacks may be used as tools for training new members in cyberterrorism.
Undermining	Seeks to hinder the normal functioning of computer systems, services, or websites. Such methods include defacing, denying, and exposing information. While undermining tactics are typically used due to high dependence on online structures to support vital operational functions, they typically do not result in grave consequences unless undertaken as part of a larger attack. Undermining attacks on computers include the following: • Directing conventional kinetic weapons against computer equipment, a computer facility, or transmission lines to create a physical attack that disrupts the reliability of equipment. • Using electromagnetic energy, most commonly in the form of an electromagnetic pulse, against computer equipment or data transmissions. By

Type	Description
	overheating circuitry or jamming communications, an electronic attack disrupts the reliability of equipment and the integrity of data. • Directing malicious code against computer processing code, instruction logic, or data. The malicious code can generate a stream of network packets that disrupt data or logic by exploiting vulnerability in computer software, or a weakness in computer security practices. This type of cyberattack can disrupt the reliability of equipment, the integrity of data, and the confidentiality of communications
Destructive	The destructive objective for cyberterrorism is what organizations fear most. Through the use of computer technology and the Internet, the terrorists seek to inflict destruction or damage on tangible property or assets, and even death or injury to individuals. There are no cases of pure destructive cyberterrorism as of the date of this plan.

Hazard Location

This hazard is not geography-based. Attacks can originate from any computer to affect any other computer in the world. If a system is connected to the Internet or operating on a wireless frequency, it is susceptible to exploitation. Targets of cyber attacks can be individual computers, networks, organizations, business sectors, or governments. Financial institutions and retailers are often targeted to extract personal and financial data that can be used to steal money from individuals and banks. The most affected sectors are finance, energy and utilities, and defense and aerospace, as well as communication, retail, and health care. Both public and private operations in Contra Costa County are threatened on a near-daily basis by millions of current cyberattacks developed to automatically seek technological vulnerabilities.

Hazard Extent/Intensity

An international study released by Malwarebytes in 2016 found that cyber ransom threats caused 34% of business victims to lose revenue and 20% had to stop business immediately. The study also reported that nearly 60% of all cyber ransom attacks demanded over $1,000, over 20% asked for more than $10,000, and 1% asked for over $150,000.

Warning Time

There is no warning time for cyber security threats. The top vector for spreading cyber ransom threats is e-mail.

Probability and Frequency

Cybersecurity threats are experienced on a daily basis, often without being noticed. Up-to-date virus protection software used in public and private sectors prevents most cyber-attacks from becoming successful. Programs that promote public education on virus protection are an effective way to mitigate cyber-threats. Cyberterrorism is much less common than cyber-attacks, though the frequency is unknown.

Past Events

Cybersecurity threats have not been publicly reported against local government agencies, schools, hospitals, or businesses in Contra Costa County.

California law requires a business to notify any California resident whose unencrypted personal information was acquired or is reasonably believed to have been acquired by an unauthorized person (California Civil Code Sections 1798.29(a) and1798.82(a)). The law also requires that a copy of any

breach notice sent to more than 500 California residents be provided to the California Attorney General. The California Attorney General sent out notices notifying individuals of nearly 2,900 data breaches between 2012 and July 2022. [319]

Vulnerability and Impacts

Life Safety: All populations who directly use a computer or receive services from automated systems are vulnerable to cybersecurity threats. Certain types of attacks would impact specific segments of the population. If the cybersecurity threat targeted the Pacific Gas and Electric Company (PG&E) power or utility grid, individuals with medical needs would be impacted the most. These populations are most vulnerable because many of the life-saving systems they rely on require power. If an attack occurred during extreme hot weather, individuals 65 years old and above would be vulnerable to the effects of the lack of air conditioning. These individuals might require an air conditioned shelter operating on a back-up generator. If a cyber attack targeted a facility storing or manufacturing hazardous materials, individuals living adjacent to these facilities would be vulnerable.

Property: Cyber threats can cause physical damage if real assets or end consumers are affected by service disruption. This might occur if cyber threats target industries related to utilities, life support, transportation, human services, or telecommunications. In many cases, attacks on these systems initially will not be detected, and any malfunction will be thought to be system failure. Cybersecurity incidents can result in the theft or modification of important data – including personal, agency, or corporate information – and the sabotage of critical processes, including the provision of basic services by government or private-sector entities.

Critical Facilities and Infrastructure: A catastrophic cybersecurity threat can have far-ranging effects on public and private infrastructure systems. All critical facilities and infrastructure that are operated by electricity and/or a computer system are vulnerable to the cybersecurity threat. Cyber threats may affect structures if any critical electronic systems suffer service disruption. For instance, a cyber attack may cripple the electronic system that controls a cooling system or pressure system, resulting in physical damage to the structure from components overheating, or an explosion if pressure relief systems are rendered inoperable.

Economic: Cyber threats can have extensive fiscal impacts. Companies and government services can lose large sums of unrecoverable revenue from site downtime and compromise of sensitive confidential data. The economic impact of data and telecommunications losses can be high as computer security breaches, crime conducted via the internet such as identify theft, and many other forms of cyber attack occur daily. Millions of dollars are lost each year as criminals and cyberterrorists steal sensitive information and funds from individuals and organizations.

[319] California Governor's Office of Emergency Services. (2023). California State Hazard Mitigation Plan. Retrieved from https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-1_11.10.2023.pdf.

Cybersecurity Threat Total Risk Score

Table 4-209 represents the cybersecurity threat Total Risk Score for the Contra Costa County, based on the Risk Assessment Methodology, as defined in this Plan.

Table 4-209. Cybersecurity Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Cybersecurity Threat	2	12	7	13	32	34

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.11.2. Hazardous Materials Incidents

Description

Hazardous materials are present in nearly every city and county in the United States in facilities that produce, store, or use them. For example, water treatment plants use chlorine on-site to eliminate bacterial contaminants. Hazardous materials are transported along interstate highways and railways daily. Even the natural gas used in every home and business is a dangerous substance when a leak occurs. Many businesses, through intentional action, lack of awareness or accidental occurrences, have contamination in and around their property.

Title 49 of the CFR lists thousands of hazardous materials, including gasoline, insecticides, household cleaning products, and radioactive materials. State-regulated substances that have the greatest probability of adversely impacting the community are listed in the CCR, Title 19.

The most common types of hazardous material incidents are listed in **Table 4-210**.

Table 4-210. Hazardous Materials Incident Types

Incident Type	Description
Fixed-Facility	This is the uncontrolled release of materials from a fixed site capable of posing a risk to health, safety, and property. It is possible to identify and prepare for a fixed-site incident because laws require facilities to notify state and local authorities about what is being used or produced at the site.
Transportation	A hazardous materials transportation incident is any event resulting in uncontrolled release of materials during transport that can pose a risk to health, safety, and property. Transportation incidents are difficult to prepare for because there is little if any notice about what materials could be involved should an accident happen. Hazardous materials transportation incidents can occur anywhere, although most occur on interstate highways or major federal or state highways, or on the major rail lines. In addition to materials such as chlorine that are shipped throughout the country by rail, thousands of shipments of radiological materials, mostly medical materials, and low-level radioactive waste, take place via ground transportation across the United States. Many incidents occur in sparsely populated areas and affect very few people.
Interstate Pipeline	A significant number of interstate natural gas, heating oil, and petroleum pipelines run through California. These are used to provide natural gas to utilities in California and to transport these materials from production facilities to end-users.

Business practices and the laws that regulate them have changed dramatically over the years. Hazardous materials management is regulated by federal and state codes. The state fire marshal and the Pipeline and Hazardous Materials Safety Administration enforce oil and gas pipeline safety regulations. The federal government enforces hazardous material transport pursuant to its interstate commerce regulation authority.

The Department of Toxic Substances Control (DTSC), a Division of the California Environmental Protection Agency, acts to protect California from exposure to hazardous wastes by cleaning up existing contamination and looking for ways to reduce the hazardous waste produced in the state. The DTSC regulates hazardous waste in California primarily under the authority of the federal Resource Conservation and Recovery Act, and the California Health and Safety Code. Other laws that affect hazardous waste are specific to handling, storage, transportation, disposal, treatment, reduction, cleanup, and emergency planning.

DTSC reviews and monitors legislation to ensure that proposed regulations reflect DTSC goals. DTSC's major program areas develop regulations and consistent policies and procedures. Under the Resource Conservation and Recovery Act, DTSC has the authority to implement permitting, inspection, compliance and corrective action programs to ensure that people who manage hazardous waste follow state and federal requirements. As such, the management of hazardous sites in the planning area is under regulation by the DTSC, to ensure that state and federal regulations pertaining to hazardous waste are followed.

Businesses are required to disclose all hazardous materials and waste above certain designated quantities that they use, store, or handle at their facility. They must prepare chemical inventory and business emergency plans, review the plans regularly, and perform annual training. Any release or possible release of hazardous material must be reported to the Cal OES Warning Center. Businesses using certain regulated substances (a list of about 260 specific flammable or toxic chemicals) must develop a risk management plan. The risk management plan includes analysis of operations on-site, and projection of off-site consequences with accompanying mitigation plans.

Hazard Location

The following locations have the potential of hazardous materials releases:

- **Business and Industrial Areas:** Retail, manufacturing and light industrial firms are areas of concern. These facilities have the highest concentration of hazardous materials at fixed facilities in the planning area due to their manufacturing operations. Each business is required to file a detailed plan with the Contra Costa Health Services Hazardous Materials Program regarding materials on-site and safety measures taken to protect the public.
- **Agricultural Areas:** Accidental releases of pesticides, fertilizers, and other agricultural chemicals may be harmful to both humans and the environment. Agricultural pesticides are transported daily in and around the planning area en route to destinations in rural areas.
- **Illegal Drug Operations:** Illegal operations such as laboratories for methamphetamine can pose a threat. Laboratory residues are often dumped along roadways or left in rented hotel rooms, creating a serious health threat to unsuspecting individuals and to the environment.
- **Illegal Dumping Sites:** Hazardous wastes such as used motor oil, solvents, or paint are occasionally dumped in remote areas or along roadways, creating a potential health threat to unsuspecting individuals and to the environment.
- **Transportation Routes:** The County's transportation system consists of a network of federal, state, and county roads, airports, and rail service that all have the potential for hazardous material incidents:
    - Interstates 80, 580, and 680, State Routes 4, 24, 123, and 242
    - Amtrak long distance and intercity trains through the County
    - Railroad lines: Union Pacific owns 60 miles of lines, BNSF Railway has 55 miles of line, and two smaller lines (Sacramento Northern and Bay Point) operate in the County
    - General Aviation Airports: Buchanan Field, in the unincorporated county near Concord and Pleasant Hill; and Byron Airport near the Town of Byron.
- **Pipelines:** Gas and hazardous liquid pipelines in Contra Costa County are vulnerable and possible sites for hazardous materials incidents.

Hazard Extent/Intensity

Hazardous materials come in the form of explosives, flammable and combustible substances, poisons and radioactive materials. Hazards can occur during production, storage, transportation, use or disposal. The release or spill of hazardous materials requires a different response depending on factors such as the amount, type, and location of the spill. Each location should have its own specific cleanup procedure, and all personnel handling such material should have received instruction on that procedure. There has been no fatality in the County from hazardous material release since the Walnut Creek pipeline explosion in 2004. The last hazardous material release that had a fatality at a fixed facility was the MBA Polymers dust explosion in 2000.

Warning Time

Hazardous material incidents occur without predictability under circumstances that give responders little time to prepare. Contra Costa County uses the Community Warning System to disseminate information to the public in the event of a release or threatened release of a hazardous material. The system includes the integration of warning sirens, the local media, NOAA weather radios, computer terminals, emergency response personnel pages, and emergency phone notification through the telephone emergency notification system. The system also sends out text messages and provides information over Facebook and X (formerly Twitter). Contra Costa Health Services' Hazardous Materials Incident Response Team provides general data to first responders to advise evacuations or sheltering in place.

Probability and Frequency

Hazardous material incidents may occur at any time in the planning area, given the presence of transportation routes dividing the planning area, the location of businesses and industry that use hazardous materials, the presence of scattered illegitimate businesses such as clandestine drug laboratories, and the improper disposal of hazardous waste.

Past Events

Table 4-211 lists the number of hazardous material incidents in Contra Costa County reported to the Cal OES Warning Center from 2018 through 2023.[320] Additional historical hazardous material spill report data is available on the Cal OES website. The records show 164 hazardous materials spills in Contra Costa County over the five (5) year timeframe.

Table 4-211. Hazardous Materials Incidents (Reported to CalOES)

Spill Site	2018	2019	2020	2021	2022	2023	Total
Airport	0	0	0	0	0	0	**0**
Industrial Plant	0	1	0	1	0	0	**2**
Merchant/Business	4	2	6	2	4	1	**19**
Military Base	0	0	0	0	0	0	**0**
Oil Field	0	0	0	0	0	0	**0**
Other	3	0	1	1	1	2	**8**
Pipeline	0	0	0	0	0	0	**0**
Railroad	1	1	1	1	1	3	**8**

[320] California Office of Emergency Services. (2023). Spill Release Reporting: Spill Report View. Retrieved from https://w3.calema.ca.gov/operational/malhaz.nsf/$defaultview.

Spill Site	2018	2019	2020	2021	2022	2023	Total
Refinery	8	15	1	2	4	3	**33**
Residence	7	4	2	4	3	1	**21**
Road	8	3	3	2	5	4	**25**
School	1	0	0	0	0	0	**1**
Service Station	2	1	0	0	1	2	**6**
Ship/Harbor/Port	1	0	2	1	1	0	**5**
Treatment/Sewage Facility	0	0	1	0	1	0	**2**
Utilities/Substation	0	0	0	1	0	0	**1**
Waterways	4	5	5	9	6	4	**33**
Total	**39**	**32**	**22**	**24**	**27**	**20**	**164**

Vulnerability and Impacts

Life Safety: People near facilities producing, storing, or transporting hazardous substances are at higher risk. Populations downstream, downwind, and downhill of a released substance are particularly vulnerable. A spill of a toxic airborne chemical in a populated area could have greater potential for loss of life. Depending on the characteristics of the substance released, more people in a larger area may be in danger from explosion, absorption, injection, ingestion, or inhalation. Often, people in the radius area (outside the immediate affected area) are evacuated as a precaution or told to shelter-in-place, depending on the release type and wind conditions.

Property: The impact of a fixed-facility hazardous materials incident will likely be localized to the property where it occurs. The impact of a spill of a small amount of a liquid chemical may be limited to remediation of soil.

Critical Facilities and Infrastructure: The impact of a hazardous material spill or transportation incident will likely be localized to the particular facility, hospital, port, airport, railroad, road, highway, or interstate. The potential losses vary because of the variable nature of the hazardous material spill, but costs from product loss, property damage and decontamination and other costs can add up to millions of dollars.

Environment: Depending on the characteristic of the hazardous material or the volume of product involved, the affected area can be as small as a room in a building or as large as many square miles that require soil remediation. More widespread effects occur when a product contaminates the municipal water supply or water system such as a port, river, lake, or aquifer. Such environmental damage can linger for decades.

Economic: Large hazardous material spills can drive away tourists. Transportation incidents can temporarily shut down transportation routes. Studies that look at economic effects from bridge and highway losses consistently report job loss and economic losses in the billions of dollars. For example, 43% of businesses reporting losses after the 1994 Northridge Earthquake said they were due to transportation issues.

Hazardous Materials Incident Total Risk Score

Table 4-212 represents the hazardous materials incident Total Risk Score for the Contra Costa County, based on the Risk Assessment Methodology, as defined in this Plan.

Table 4-212. Hazardous Materials Incidents Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Hazardous Materials Incident	2	15	9	16	40	41

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.11.3. Utility Interruptions

Description

Power Failure

A power failure is any interruption or loss of electrical service due to disruption of power generation or transmission caused by an accident, sabotage, natural hazards, equipment failure, or fuel shortage. These interruptions can last anywhere from a few seconds to several days. Power failures are considered significant only if the local emergency management organization is required to coordinate basic services such as the provision of food, water, and heating as a result. Power failures are common with severe weather and winter storm activity.

PG&E is responsible for operating and maintaining the electrical transmission and distribution system in the planning area. Calpine Corporation energy centers in the Cities of Antioch and Pittsburg generate electricity from natural gas and geothermal resources and sell it to PG&E. Crockett Cogeneration operates a natural gas fired plant in Crockett, California and sells to PG&E. Refineries in the planning area have power generation plants that supply their operations. A co-generation facility next to the Tesoro refinery produces electricity for Tesoro and can sell it to PG&E.

Public Safety Power Shutoffs

A public safety power shutoff (PSPS) is an event in which a major electric power provider (e.g., PG&E) temporarily shuts off electrical power to a selected area to prevent power lines from sparking wildfires and threatening human lives. Utilities usually implement these during days with sustained winds or strong gusts, or other factors. The duration of a shutoff event is tied directly to the weather that triggers it; the shutoff typically ends within 24 hours after the weather conditions have subsided. However, PSPS events may extend beyond the 24-hour timeframe, depending on conditions.

PSPS events often target wildland areas with high wildfire risk, but they can impact a much wider region. The targeted area is the area at risk due to weather conditions. Given the long, connected nature of power supply systems, a shutoff event targeted to a small at-risk zone can affect power to larger areas beyond. [321]

Water or Wastewater Disruption

Water or wastewater disruption is a secondary impact from a natural disaster or intentional act. In the planning area, water service is provided by the City of Antioch, Contra Costa Water District, East Bay Municipal Utility District, Diablo Water District, Golden State Water Company and the Martinez Water District. Sewer services are provided by Central Contra Costa Sanitary District, Ironhouse Sanitary District, Delta Diablo Sanitation District, Mountain View Sanitary District, West County Wastewater District, Dublin San Ramon Services District, Rodeo Sanitary District, Pinole Sanitary District, Hercules Sanitary District, and Crockett Community Services District.

A breach in the pipelines that carry water through the planning area would have significant temporary impacts until alternative water sources are pumped and treated. Long-term disruption would have significant impacts on residences and businesses in the planning area if demand exceeds secondary supplies and water conservation measures do not provide enough relief to reduce demand to equal the secondary supplies.

[321] California Governor's Office of Emergency Services. (2023). California State Hazard Mitigation Plan. Retrieved from https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-1_11.10.2023.pdf.

Disruption of the planning area's wastewater collection and wastewater treatment plants would have significant regional impacts. Such disruption could result if the system were to be overwhelmed by a significant storm or discharge of materials in such quantities that the treatment plant could not adequately treat the waste. Natural hazards such as earthquakes or floods, major power outages, or terrorism directed at the facilities and systems could disrupt the process of collecting and treating millions of gallons of sewage. Wastewater treatment plants may also have emergencies internal to the plant such as oxygen deficiencies that render them incapable of treating waste. The disruption of service may also have significant environmental impacts on the waterways adjacent to the treatment plants.

Data and Telecommunications Interruptions

The loss of data or telecommunications is often a secondary hazard to natural and other human-caused hazards. Data and telecommunications provide a primary method for service to the community by the government and the private sector. A loss of data and telecommunications could result in loss of emergency dispatch capabilities, emergency planning services, infrastructure monitoring capabilities, access to statistical data, and access to financial and personnel records.

Pipeline Interruptions

Pipelines are often considered the safest and most reliable way to transport natural gas, crude oil, liquid petroleum products, and chemical products, but there is still an inherent risk due to the nature of the hazardous materials.

Failures of pipelines can occur when pipes corrode, are damaged during excavation, are incorrectly operated, or are damaged by other forces. One of the worst hazardous material incidents in the County involved a pipeline carrying gasoline in November 2004 in Walnut Creek. The released gasoline ignited, and five people were killed.

Intra-state liquid petroleum pipelines are regulated by the Office of the State Fire Marshal Pipeline Safety Division. Natural gas pipelines are regulated by the California Public Utilities Commission. Pipelines are also monitored by supervisory control and data acquisition systems that measure flow rate, temperature and pressure. These systems transfer real-time data via satellite from the pipelines to a control center where valves, pumps, and motors are remotely operated. If tampering with the pipeline occurs, an alarm sounds. The ensuing valve reaction is instantaneous, with the system isolating any rupture and setting off a chain reaction that shuts down pipeline pumps and alerts pipeline operators within seconds.

Transmission pipelines and distribution pipelines provide different services. Transmission pipelines transport raw material for further refinement. These pipes are large and far reaching, operating under high pressure. Distribution pipelines provide processed materials to end users. These are smaller in diameter, some as small as half an inch, and operate under lower pressure. More serious accidents occur on distribution pipelines than on any other type due to their number, intricate networking, and location in highly populated areas.

Hazard Location

Electrical generation, transmission, and distribution system are located throughout the planning area.

Hazard Extent/Intensity

The severity of utility failure and power interruptions varies too widely to be able to be measured. Electricity, for example, may be out for a few hours to several weeks, depending on the cause of the event.

Warning Time

Utility failure and power interruptions occur at any time without warning. However, they usually are a secondary effect from a storm event, landslide, earthquake, and human-caused issues.

Probability and Frequency

The probability and frequency of utility failure and power interruption incidents is likely to remain constant, but the length of time a utility is shut down should lessen in the future as more redundancies are built into infrastructure and utilities. In addition, leak detection sensors alert utilities to faults and failures more quickly.

Past Events

Table 4-213 lists utility interruption incidents that have occurred in Contra Costa County between 2018 and 2023.

Table 4-213. Utility Interruption Past Events

Date	Event Summary
08/17/2021	A PSPS was implemented by PG&E and it was concentrated along central Contra Costa County.
11/20/2019	A 24-hour PSPS was implemented by PG&E which resulted in 23,000 residents without power.
10/26/2019	Due to extreme heat, low humidity, and wind Countywide PSPSs were implemented by PG&E. At its height over 50,000 residents experienced long term utility interruptions. There were significant wildfire impacts. Multiple PSPSs impacted the County. The County EOC was activated and proclaimed an emergency.
10/10/2019	Due to extreme heat, low humidity, and wind Countywide PSPS were implemented by PG&E. At its height over 50,000 residents experienced long term utility interruptions. The County EOC was partially activated.

Vulnerability and Impacts

Life Safety: The entire planning area is vulnerable to utility interruptions.

Property: All property is exposed and vulnerable to some type of utility infrastructure failure throughout the planning area.

Critical Facilities and Infrastructure: Critical facilities are vulnerable to utility interruption. But the adverse effect of damaged critical facilities can extend beyond direct physical damage. It can disrupt health care, fire, and police services, impair search and rescue, and emergency medical care.

Environment: The environment is vulnerable to utility interruption if the utility has a spill that contaminates water and/or open land, or creates a wildfire that burns acres.

Economic: Utility losses could cause a reduction in employment and wholesale and retail sales, a need for utility repairs, and increased medical risks. Local governments might lose tax revenues, and the finances of private utility companies and the businesses that rely on them would be disrupted.

Utility Interruptions Total Risk Score

Table 4-214 represents the utility interruptions Total Risk Score for the Contra Costa County, based on the Risk Assessment Methodology, as defined in this Plan.

Table 4-214. Utility Interruptions Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Utility Interruptions	3	9	7	18	34	51

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.11.4. Active Shooter Incidents

Description

Active shooter incidents are typically motivated by the desire to maximize human casualties. They are differentiated from other attack types by the indiscriminate nature of the victim's targets of opportunity rather than actions directed toward a specific target. The Federal Bureau of Investigation (FBI) defines an active shooter as one (1) or more individuals actively engaged in killing or attempting to kill people, with a firearm, in a populated area. [322] They may use small arms (e.g., revolvers, automatic pistols, rifles, shotguns, assault rifles, light machine guns), light weapons (e.g., medium caliber and explosive ordinance, grenade launchers, rocket propelled grenades), or both, depending on the type of attack. The following are characteristics that police and sheriff departments have often seen associated with active shooters.

- Active shooters may focus on specific individuals, or they may be intent on killing as many randomly chosen people as possible.
- Their purpose is usually an expression of hatred or rage, rather than financial gain or motives associated with other types of crimes. Thus, police tactics of containment and negotiation may be an inadequate response to an active shooter.
- They chose a site that they are familiar with and have made detailed plans for the attack. In many cases, they are very well armed.
- Active shooters often, but not always, are suicidal. Escaping the police is not usually a priority and in general, they have not attempted to hide their identity.
- The location chosen for the incident usually has a tactical advantage.

Active shooter incidents are unpredictable and evolve quickly. Because active shooter incidents are often over within five (5) to 10 minutes, before law enforcement arrives on the scene, individuals at the scene must be prepared both mentally and physically to deal with the shooting in progress situation. In most cases, active shooters use firearms and there is no pattern or method to their selection of victims. [323]

Hazard Location

According to recent studies, 77% of active shooter incidents occur in commercial, education, or government environments. Usually, the shooter is familiar with the chosen area and the area offers a tactical advantage.

Hazard Extent/Intensity

The severity of an active shooter incident may vary from a few injured people to multiple injuries and fatalities.

Warning Time

The only warning of an active shooter incident is if a citizen notices unusual happenings and reports them before the shooting starts. The incident itself may be over in 5 to 10 minutes.

[322] Federal Bureau of Investigation. (2023). Active Shooter Incidents in the United States in 2022. Retrieved from https://www.fbi.gov/file-repository/active-shooter-incidents-in-the-us-2022-042623.pdf/view.
[323] Cybersecurity & Infrastructure Security Agency. (n.d). Active Shooter Preparedness. Retrieved from https://www.cisa.gov/topics/physical-security/active-shooter-preparedness.

Probability and Frequency

While the probability and frequency of active shooter incidents has been low in the planning area, these incidents can happen anywhere and at any time.

Past Events

On October 31, 2019, five (5) people were killed and four (4) were wounded when a shooter opened fire during a Halloween block party in the City of Orinda.[324] Based on the FBI annual active shooter reports, between 2018 and 2022, a total of 23 active shooter incidents have occurred in in the State of California.[325, 326, 327, 328, 329] Between 2018 and 2023, the deadliest active shooter incident in California occurred in 2018 when the shooter opened fire at the Borderline Bar and Grill in Thousand Oaks killing 11.[330] While not located in Contra Costa County, this event highlights that active shooters can target any location where there is a gathering of individuals.

Vulnerability and Impacts

Life Safety: All individuals in the planning area are considered to be at risk of active shooter incidents.

Property: The intent of an active shooter is to harm persons; property may be incidentally damaged, but the shooter's intent does not generally focus on property.

Critical Facilities and Infrastructure: Critical facilities are unlikely to experience significant damage from an active shooter incident.

Environment: The environment is unlikely to experience significant damage from an active shooter incident.

Economic: Economic impacts can occur from loss of patrons coming to a local business where an incident occurred, down time from a closed business, and loss of wages for an individual who was injured or killed.

[324] Navarro, H. (2023). List: California Mass Shootings of the Past Decade. Retrieved from https://www.nbclosangeles.com/news/list-california-mass-shootings/3081419/.
[325] Federal Bureau of Investigation. (2019). Active Shooter Incidents in the United States in 2018. Retrieved from https://www.fbi.gov/file-repository/active-shooter-incidents-in-the-us-2018-041019.pdf/view.
[326] Federal Bureau of Investigation. (2020). Active Shooter Incidents in the United States in 2019. Retrieved from https://www.fbi.gov/file-repository/active-shooter-incidents-in-the-us-2019-042820.pdf/view.
[327] Federal Bureau of Investigation. (2021). Active Shooter Incidents in the United States in 2020. Retrieved from https://www.fbi.gov/file-repository/active-shooter-incidents-in-the-us-2020-070121.pdf/view.
[328] Federal Bureau of Investigation. (2022). Active Shooter Incidents in the United States in 2021. Retrieved from https://www.fbi.gov/file-repository/active-shooter-incidents-in-the-us-2021-052422.pdf/view.
[329] Federal Bureau of Investigation. (2023). Active Shooter Incidents in the United States in 2022. Retrieved from https://www.fbi.gov/file-repository/active-shooter-incidents-in-the-us-2022-042623.pdf/view.
[330] Kesslen, B. (2021). Gunman in 2018 Thousand Oaks Shooting Motivated by Hatred of College Students, Report Says. Retrieved from https://www.nbcnews.com/news/us-news/gunman-2018-thousand-oaks-shooting-motivated-hatred-college-students-report-n1272936.

Active Shooter Incident Total Risk Score

Table 4-215 represents the active shooter incident Total Risk Score for the Contra Costa County, based on the Risk Assessment Methodology, as defined in this Plan.

Table 4-215. Active Shooter Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Active Shooter Incident	2	9	5	15	29	32

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

4.6.11.5. Terrorism

Description

Terrorism can take many forms, but its overall goal is to cause as much disruption and fear as possible within the targeted population. The Federal Bureau of Investigation (FBI) defines terrorism as the unlawful use of force or violence against people or property to intimidate or coerce a government or civilian population in protest of political or social objectives. [331] Additionally, the FBI further defines international and domestic terrorism. International terrorism is a violent and criminal act committed by individuals and/or groups who are inspired by, or associated with, designated foreign terrorist organizations or nations (18 USC §2331 (1)). Domestic terrorism is a violent and criminal act committed by individuals and/or groups to further ideological goals stemming from domestic influences (e.g., political, religious, social, racial, or environmental) (18 USC §2331 (5)). [332]

Typically, terrorism events involve mass casualty incidents and take place without warning. The most common methods of these incidents include mass shootings, explosive devices, and bladed instruments. [333] Cars, buses, trains, aircraft, and marine vessels have been used as conveyances and as weapons in terrorist acts. In recent years terrorists have utilized additional methods including kidnappings, biological weapons, and cyberattacks to inflict terror on the targeted population. *Cybersecurity and active shooter will be addressed separately in this Plan.*

The goal of a terrorist attack is to cause maximum disruption and fear; therefore, an economically significant area is a logical and potential target. A terrorism event within the Contra Costa County area would cause significant economic disruption, along with potentially cascading effects.

California's population, industrial infrastructure, economic importance, international reputation, media industry, and numerous iconic features combine to make the state a potential target for both domestic and international terrorist attacks. Terrorists typically exploit vulnerabilities caused by technological hazards and may include hazardous materials release; biological agents that result in epidemics; or attempts to damage the state's critical infrastructure including cyberattacks, which pose potentially devastating disruptions to essential communications (e.g., voice, e-mail, and internet connectivity).

According to the United States Department of Homeland Security (DHS), the greatest number of domestic terrorism incidents between 2010 and 2022 occurred in states with major metropolitan areas such as California (Los Angeles, San Diego, and San Francisco). [334]

Hazard Location

Contra Costa County has identified numerous high-profile targets for potential terrorist incidents. Large population centers, high visibility tourist attractions, and critical infrastructure accessible to the public present security challenges of an ongoing nature in the planning area.

Hazard Extent/Intensity

The severity of a terrorist attack may vary from a few injured people to multiple injuries and fatalities.

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[331] U.S Department of Justice Office of Justice and Programs. (1987). FBI and Terrorism. Retrieved from: https://www.ojp.gov/ncjrs/virtual-library/abstracts/fbi-and-terrorism.
[332] Federal Bureau of Investigation. (n.d.). Terrorism. Retrieved from https://www.fbi.gov/investigate/terrorism.
[333] Counter Terrorism Ethics. (n.d.). Terrorist Group: Al Qaeda Weapons Use. Retrieved from https://counterterrorismethics.tudelft.nl/the-past-present-and-future-weapon-use-of-al-qaeda/.
[334] U.S. Government Accountability Office. (2023). The Rising Threat of Domestic Terrorism in the U.S. and Federal Efforts to Combat It. Retrieved from https://www.gao.gov/blog/rising-threat-domestic-terrorism-u.s.-and-federal-efforts-combat-it.

Warning Time

According to experts, fewer than 5% of all terrorism incidents are preceded by a warning or threat.

Probability and Frequency

The probability of a terrorist event varies with the method of attack, as follows:

- **Chemical:** The risk of a chemical event is present in the planning area. The petroleum and agricultural community uses and stores significant amounts of chemicals that could be used in destructive ways.
- **Explosives:** The elements necessary to construct a Weapons of Mass Destruction (WMD) explosive are readily available. Agricultural communities maintain sufficient products for use in explosive devices. Pipe bomb and suspicious package events have occurred in Contra Costa County, though none have been specifically identified as a WMD.
- **Radiological/Nuclear:** The major transportation arteries for vehicles or rail that cross through or near the planning area contribute to the risk of a radiological event. Such products can pass through any of the regional transportation corridors.
- **Biological:** Anthrax incidents that occurred in the U.S. in October 2001 demonstrate the potential for spreading terror through biological weapons. An agent also could be introduced to livestock, causing harm to public health and the economy.
- **Combined Hazards:** WMD agents can be combined to have a greater total effect. Given the risks associated with chemical agents in Contra Costa County, the possibility of a combined event exists.

Past Events

Terrorism incidents in Contra Costa County have been limited. The most recent was a pipe bomb found in December 2015 at a person's home that threatened a Richmond mosque.

Vulnerability and Impacts

Life Safety: Although terrorism has not resulted in a large number of deaths in Contra Costa County, it can be deadly and widespread. Any individuals exposed to human-caused hazards are considered to be at risk, particularly those working as first responders.

Property: All structures in the planning area are physically vulnerable to a terrorism event. Factors that affect vulnerability include an emphasis on accessibility, opportunities for roof access, driveways underneath structures, unmonitored areas, and the proximity of structures to transportation corridors and underground pipelines.

Critical Facilities and Infrastructure: The U.S. Office of Homeland Security created the 2003 National Strategy for the Physical Protection of Critical Infrastructure of Critical Infrastructure and Key Assets, which lays a foundation to work together to prepare and protect critical infrastructure and key assets nationwide from terrorist events. Owners of critical facilities and infrastructure know that they are vulnerable to terrorism and have executed preparedness planning and exercises for years and fortified these facilities to minimize their vulnerability.

Environment: A terrorism event using a WMD could cause harm to the environment, but no platforms currently existing for estimating the level of harm. The best gauge of vulnerability of the environment

would be a review of damage from past terrorism events. Capturing such data from future events could be beneficial in measuring the vulnerability of the environment.

Economic: Economic impacts from a terrorist event could be significant. The cost of a terrorist act would be felt in terms of loss of life and property and disruption of business activity. Recovery would take significant resources and expense at the local level.

Terrorism Total Risk Score

Table 4-216 represents the terrorism Total Risk Score for the Contra Costa County, based on the Risk Assessment Methodology, as defined in this Plan.

Table 4-216. Terrorism Total Risk Score

Hazard Event	Probability	Consequence				Total Risk
	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score*
Terrorism *(Weapons of Mass Destruction)*	1	18	11	27	56	31

Consequence: *Sum of all weighted factors.*
Extent: *Sum of the weighted Extent factors.*
Vulnerability: *Sum of the weighted Vulnerability factors.*
Impact: *Sum of the weighted Impact factors.*
Total Risk Score *= Probability x Consequence*
** Normalized to 100*

Total Risk Score Legend

Classification	Probability Factor	Extent	Vulnerability	Impact	Consequence Score	Total Risk Score
Low (L)	1	0 – 6	0 – 6	0 – 12	0 – 24	0 – 24
Medium (M)	2	7 – 12	7 – 12	13 – 26	25 – 50	25 – 54
High (H)	3	13 – 18	13 – 18	27 – 39	51 – 75	55 and above

*The **legend**—specifically the assignment of low, medium, and high—provides an additional means to qualitatively assess the probability factor, sum of weighted factors, and the total risk scores for each hazard. The **Consequence Score** represents the sum of the Extent, Vulnerability, and Impact Factors. The **Total Risk Score** is a measure of Probability and Consequence.*

CHAPTER 5. MITIGATION STRATEGY

The heart of a Hazard Mitigation Plan is the Mitigation Strategy, which serves as the long-term blueprint for reducing the potential losses identified in the Hazard Risk Assessment. The Mitigation Strategy describes how the community will accomplish the overall purpose of the planning process. In this section, mitigation goals and objectives were reevaluated and updated; and mitigation actions were updated, identified, evaluated, and prioritized.

5.1 MITIGATION GOALS

In this section of the Plan, the Hazard Risk Assessment identified Conta Costa County is prone to 15 hazards (**Table 4-1**) – 10 natural and five (5) human-caused/technological. The Steering Committee and community stakeholders understand that although hazards cannot be eliminated altogether, the many communities within Contra Costa County can work together toward building disaster-resilient communities. **Table 5-1** outlines a list of five (5) goals and 19 objectives. The goals represent the County's long term and strategic vision to accomplish and achieve successful mitigation efforts. The associated objectives are specific strategies and steps identified to assist the communities in attaining the listed goals.

Table 5-1. Contra Costa County Mitigation Goals and Objectives

Goals	
1	Save (or protect) lives and reduce injury.
2	Increase resilience of infrastructure and critical facilities.
3	Avoid (minimize or reduce) damage to property.
4	Encourage the development and implementation of long-term, cost-effective, and environmentally sound mitigation projects.
5	Build and support capacity to enable local government and the public to prepare for, respond to and recover from the impact of natural hazards.

Objectives		Can be Applied to These Goals
1	Increase resilience of infrastructure and critical facilities.	1, 3, 5
2	Sustain reliable local emergency operations and facilities during and after a disaster.	1, 5
3	Inform the public on the risk from hazards of concern and increase awareness, preparation, mitigation, response, and recovery activities to promote public safety.	1, 3, 5
4	Minimize the impacts of known hazards on current and future land uses by providing incentives for hazard mitigation.	1, 3, 5
5	Prevent or discourage new development in hazardous areas or ensure that, if building occurs in high-risk areas, it is done in a way to minimize risk.	1, 3, 5
6	At the local government level, continually improve understanding of the location and potential impacts of hazards, using the best available data and science.	1, 2, 3, 4, 5
7	Encourage all development to meet applicable standards for life safety.	1, 2, 3, 5
8	Monitor plan progress annually to integrate the local hazard mitigation plan with the results of disaster and hazard specific planning efforts.	1, 2, 3, 5
9	Promote development and use of floodplain management best practices through programs (e.g., Community Rating System).	3, 4, 5

Objectives		Can be Applied to These Goals
10	Provide or improve flood protection with flood control structures and drainage maintenance plans.	2, 3, 4
11	Enhance codes and their enforcement where feasible, so that new construction can withstand the impacts of known hazards and to lessen the impact of development on the environment's ability to absorb the impact of natural hazards.	1, 3
12	Consider the impacts of known hazards in all planning mechanisms that address current and future land uses within the planning area.	1, 3
13	Eliminate or minimize disruption of local government operations caused by known hazards.	1, 3, 4
14	Consider open space land uses within identified high-hazard risk zones.	1, 2, 3, 4, 5
15	Retrofit, acquire, or relocate identified high-risk structures, including those known to experience repetitive losses.	1, 3, 4
16	Establish a partnership among all levels of government and the business community to improve and implement methods to protect property.	1, 2, 3, 4, 5
17	Encourage hazard mitigation measures that promote and enhance natural processes and minimize adverse impacts on the ecosystem.	2, 3, 4
18	Promote and implement hazard mitigation plans and projects that are consistent with state, regional, and local climate action and adaptation goals, policies, and programs.	1, 2, 3, 4, 5
19	Identify and implement inclusive actions that reduce vulnerability for Contra Consta County residents and visitors.	1

5.2 MITIGATION STRATEGIES AND ACTIONS

Plan participants assessed hazard mitigation actions, including actions from FEMA guidance documents, the 2018 Contra Costa County Hazard Mitigation Plan, and suggestions from participating communities and their respective stakeholders during a series of workshops and public meetings that took place throughout the County in December 2023. Supporting documentation for stakeholders and public engagement can be found in **Appendix B** and **C**, respectively. A summary of Unincorporated Contra Costa County's mitigation actions status is listed in **Table 5-2** and all mitigation actions can be found in **Appendix A.**

Mitigation actions and status for each plan participant can be found in their respective annexes.

Table 5-2. Contra Costa County Mitigation Actions Summary

Status	Mitigation Action Total
Ongoing	13
In Progress/In Work	6
Not Started	2
Delayed/Deferred	1
New	25
TOTAL	**47**
Completed	8
Deleted/No Longer Needed	1

Mitigation Actions per Natural Hazard			
Climate Change	21	Landslide	18
Dam and Levee Failure	17	Sea Level Rise	22
Drought	17	Severe Weather *(Severe Thunderstorms (hail, strong winds, and tornadoes), Heavy Rainfall, Heat Wave)*	20
Earthquake	25	Tsunami	19
Flood	33	Wildfire	26

The mitigation actions in **Volume 1** and each jurisdiction's annex are organized as follows:

- **New Mitigation Actions:** New actions identified during this plan development process.
- **Ongoing Mitigation Actions:** These ongoing actions were included in the previous update and have no definitive end. During this Plan update, the ongoing mitigation actions were modified and/or amended, as needed, to better define the action.
- **In Progress/In Work:** These actions were included in the previous update and are underway during this Plan update. These actions have not been completed but are in progress.
- **Completed Mitigation Actions:** Completed actions since the previous plan iteration.
- **Not Started Mitigation Actions:** These actions were included in the previous update but have not been started. During this Plan update, these mitigation actions were modified and/or amended, as needed, to better define the action.
- **Deferred/Delayed Mitigation Actions:** Actions are deferred when risk cannot be validated, or additional time is needed to validate the potential impacts and benefits of the action.
- **Deleted/No Longer Needed Mitigation Actions:** These actions are no longer relevant or applicable because other mitigation actions addressed the mitigating need, or the hazard vulnerability changed resulting in reduced risk.

5.2.1. Mitigation Action Plan

The Mitigation Action Plan helps prioritize mitigation initiatives according to a benefit cost analysis of the proposed actions and their associated cost. Additionally, the Action Plan provides the framework for how

the proposed actions and initiatives will be implemented and administered by Contra Costa County and each plan participant over the next five (5) years. The parameters (i.e., estimated cost, benefits, duration, and prioritization) that will be used for the prioritization and benefit cost analysis of each mitigation action are outlined in this section

5.2.1.1. Mitigation Action Benefit Cost Review

While the preference is to provide definitive costs (i.e., dollar figures) for each mitigation action, this is not realistic for every mitigation action without project scoping or engineering studies. Therefore, a review of the apparent benefits versus the apparent cost of each project was performed. Parameters were established for assigning subjective ratings (i.e., high, medium, and low) to the costs and benefits of these projects. The estimated cost and benefits parameters are defined in **Table 5-3** and **Table 5-4**, respectively.

Table 5-3. Mitigation Action Estimated Cost Parameters

Rating	Parameter
High	Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (e.g., bonds, grants, and fee increases).
Medium	The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
Low	The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.

Table 5-4. Mitigation Action Benefits Parameters

Rating	Parameter
High	Project will provide an immediate reduction of risk exposure for life and property.
Medium	Project will have a long-term impact on the reduction of risk exposure for life and property, or project will provide an immediate reduction in the risk exposure for property.
Low	Long-term benefits of the project are difficult to quantify in the short term.

5.2.1.2. Mitigation Action Project Duration

While the preference is to provide definitive project completion dates, this is not realistic for all mitigation actions. Therefore, the parameters for the project duration (i.e., estimated completion date) are listed in **Table 5-5**.

Table 5-5. Mitigation Action Project Duration Parameters

Rating	Parameter
Short Term	To be completed in one (1) to five (5) years.
Long Term	To be completed in more than five (5) years.
Ongoing	Currently being funded and implemented under existing programs, and/or is seeking funding and necessary approvals.

5.2.1.3. Mitigation Action Prioritization

Existing Mitigation Actions

The mitigation actions must be prioritized according to the benefit cost analysis of the proposed projects and their associated costs (44 CFR, Section 201.6(c)(3)(iii)). The benefits of proposed actions were weighted against multiple factors as part of the project prioritization process. The benefit cost analysis

was not of the detailed variety required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP) and Building Resilient Infrastructure and Communities (BRIC) Program. A less formal approach was used because some actions may not be implemented for up to 10 years, and associated costs and benefits could change dramatically in that time.

Existing mitigation actions were prioritized based on the parameters outlined in **Table 5-6**.

Table 5-6. Existing Mitigation Action Priority Parameters

Priority	Parameter
High	An action that meets multiple goals (i.e., multiple hazards), has benefits that exceed cost, has funding secured or is an ongoing project and meets eligibility requirements for the Hazard Mitigation Grant Program (HMGP) or Pre-Disaster Mitigation (PDM) grant program. High priority projects can be completed in the short term (one (1) to five (5) years).
Medium	An action that meets goals and objectives, that has benefits that exceed costs, and for which funding has not been secured but that is grant eligible under HMGP, PDM or other grant programs. Project can be completed in the short term once funding is secured. Medium priority projects will become high priority projects once funding is secured.
Low	An action that will mitigate the risk of a hazard, that has benefits that do not exceed the costs or are difficult to quantify, for which funding has not been secured, that is not eligible for HMGP or PDM grant funding, and for which the timeline for completion is long term (one (1) to 10 years). Low priority projects may be eligible for other sources of grant funding from other programs.

New Mitigation Actions

New mitigation actions were evaluated by each plan participant with the following STAPLEE+E method. This method utilizes eight (8) criteria for evaluating a mitigation action – Social, Technical, Administrative, Political, Legal, Economic, Environmental, and Equity and within each of those criteria are additional considerations. **Table 5-7** outlines an explanation of how each of the STAPLEE+E criteria may be applied to the evaluation of each mitigation action.

Table 5-7. STAPLEE+E Method

Criteria		Description
S	Social	Mitigation actions are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the community's social and cultural values. • Will the proposed action adversely affect one (1) segment of the population? • Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?
T	Technical	Mitigation actions are technically most effective if they provide a long-term reduction of losses and have minimal secondary adverse impacts. • How effective is the action in avoiding or reducing future losses? • Will it create more problems than it solves? • Does it solve the problem or only a symptom? • Does the Mitigation strategy address continued compliance with the National Flood Insurance Program (NFIP)?

Criteria		Description
A	Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding. • Does the jurisdiction have the capability (e.g., staff, technical experts, and/or funding) to implement the action, or can it be readily obtained? • Can the community provide the necessary maintenance? • Can it be accomplished in a timely manner?
P	Political	Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support for the action. • Is there political support to implement and maintain this action? • Is there a local champion willing to help see the action to completion? • Is there enough public support to ensure the success of the action? • How can the mitigation objectives be accomplished at the lowest cost to the public?
L	Legal	It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action. • Does the community have the authority to implement the proposed action? • Are the proposed laws, ordinances, and resolutions in place to implement the action? • Are there any potential legal consequences? • Is there any potential community liability? • Is the action likely to be challenged by those who may be negatively affected? • Does the mitigation strategy address continued compliance with the NFIP?
E	Economic	Budget constraints can significantly deter the implementation of mitigation actions. It is important to evaluate whether an action is cost-effective, as determined by a cost benefit review, and possible to fund. • Are there currently sources of funds that can be used to implement the action? • What benefits will the action provide? • Does the cost seem reasonable for the size of the problem and likely benefits? • What burden will be placed on the tax base or local economy to implement this action? • Does the action contribute to other community economic goals such as capital improvements or economic development? • What proposed actions should be considered but be “tabled” for implementation until outside sources of funding are available?

Criteria		Description
E	Environmental	Sustainable mitigation actions that do not have adverse effect on the environment, comply with federal, state, and local environmental regulations, and are consistent with the community's environmental goals, have mitigation benefits while being environmentally sound. • How will this action affect the environment (i.e., land, water, endangered species)? • Will this action comply with local, state, and federal environmental laws and regulations? • Is this action consistent with community environmental goals?
E	Equity	Does not create an opportunity for unequal distribution of resources; racism; affect a particular segment of the population, including communities of color, communities that face discrimination based on sex, sexual orientation or gender identity, individuals with disabilities, individuals who identify with certain religion, individuals with Limited English Proficiency, or rural communities, etc. • Is the action consistent and systematically fair?

New Mitigation Actions Priority

Priorities were assessed by requesting that every new mitigation action submitted by the plan participants be ranked by each of the eight (8) criteria factors (i.e., STAPLEE+E). Each criterion is evaluated on a scale from one (1) to five (5), with one (1) defined as strongly disagree and five (5) as strong agree. Therefore, the highest favorable score would be 40, meaning the action scored five (5) in all eight (8) categories. **Table 5-8** delineates how the STAPLEE+E prioritization score was used to prioritize each mitigation action.

Table 5-8. New Mitigation Action Priority Parameters

Priority	STAPLEE+E Prioritization Score
High	30 – 40 points
Medium	19 – 29 points
Low	8 – 18 points

Mitigation actions with the highest scores represent those mitigation initiatives that represent the highest priority. In addition to the STAPLEE+E Method, the Steering Committee identified those actions that represented the greatest importance and priority to Contra Costa County's plan participants. It should be noted that, although the STAPLEE+E Method provides a standardized process for assigning priority/importance across all participating jurisdictions, there may be additional factors and considerations that elevate the status of a particular mitigation action. This is why input from the Steering Committee is also an important consideration in this process.

5.3 CHANGES IN PRIORITY

A community's mitigation priorities may change over time for a number of reasons. Addressing these changes allows a community to redirect actions that reflect current conditions, including financial and political realities, or changes in conditions or priorities following disaster event. Changes in the priority of a Hazard Mitigation Plan are often dynamic and reflect the evolving understanding of risk, the availability of resources, and the needs of the community. This helps ensure that the Plan remains relevant and

effective in reducing vulnerability to the hazards identified in the Plan by the community. Contra Costa County has identified the following changes in priorities for the 2024 Hazard Mitigation Plan:

- There were no changes to the previous mitigation goals and objectives. However, an additional objective which focuses on identifying and implementing inclusive actions that reduce vulnerability for residents and visitors within Contra Costa County, including the underserved population.
- Projects identified in the 2024 General Plan, as appropriate, were also included in this update of the Hazard Mitigation Plan to promote alignment across County plans and create the possibility for grant eligibility for those projects. The General Plan serves as the basis for planning and infrastructure related decisions made by County staff and decision makers; and it is built around the themes of environmental justice, community health, economic development, and sustainability. The General Plan was undergoing its update simultaneously with this Hazard Mitigation Plan.
- Climate change was added as a new hazard and the effects of climate change in the severity of impacts were discussed for each natural hazard. Contra Costa County and its cities must reduce the amount of greenhouse gases that are emitted into the atmosphere from sources under the jurisdiction, while also adapting to the hazards associated to climate change – wildfires, floods, drought, and sea level rise. These four (4) hazards are profiled in this Plan. The County's Climate Action Plan (CAP) 2024 update is the County's strategic plan to reduce greenhouse gas emissions and to improve resilience to changing climate conditions in the County. The 2024 CAP implements the 2045 General Plan's policy guidance and addresses behaviors, regulations, and investment decisions that directly reduce greenhouse gas emissions or promote climate resilience. This approach supports a holistic view of climate action planning and sustainability which works to reduce Contra Costa County's contribution to climate change by mitigating greenhouse gas emissions while simultaneously preparing for the changes that cannot be avoided through adaptation strategies.
- Envision Contra Costa 2040 is the County's plan to address land use, transportation, housing, climate change, environmental justice, and other important issues over the next 20 years. At the time of this Hazard Mitigation Plan update, the 2045 General Plan and the 2024 Climate Action Plan were undergoing public comment. In an effort to integrate both of these plans into hazard mitigation, the outcomes of the extensive public outreach for the ongoing Envision Contra Costa 2040 process were incorporated into this Plan.
    - The General Plan includes a Safety Element which includes all the hazards that impact the County; Community Profiles (for each unincorporated neighborhood) that identify the community's local hazards; Impacted Communities where the population is exposed to hazards at higher levels than others; and policies and actions.
- There are 13 new plan participants – three (3) municipalities and 10 special districts. The new plan participants include – City of Clayton, City of Oakley, City of Pinole, Mt. View Sanitary District, Reclamation District No. 799, Reclamation District No. 2025, Reclamation District No. 2026, Reclamation District No. 2065, Reclamation District No. 2122, Reclamation District No. 2137, Rodeo-Hercules Fire Protection District, Town of Discovery Bay Community Services District, and West County Wastewater District.
- All mitigation actions from the previous Plan were updated, and a more concerted effort on achieving equitable outcomes for all communities, including underserved communities and socially vulnerable populations, has been implemented.
- There were some notable changes to the hazard risk ranking.

- The new methodology includes 14 factors (versus four (4) in the 2018 update) which align with FEMA's risk assessment criteria. *Refer to Section 4.3 for further details on the 2024 risk assessment methodology*.
- Severe weather hazards were ranked individually and not as a whole category. Heavy rainfall, strong winds/damaging winds, severe thunderstorms, heat wave/extreme heat, and tornado were ranked individually even though these are grouped under severe weather in the hazard profile.
- Riverine/creek flooding and urban/flash flooding were ranked individually even though these are grouped under the flood hazard profile.
- Technological hazards and human-caused hazards were included in the hazard ranking.
- In the 2024 ranking, wildfire is ranked as high risk (ranked medium in the previous ranking) and drought is ranked medium (ranked low in the previous ranking). Although all the hazards under severe weather were ranked as medium risk (except tornado which was ranked as low), heavy rainfall was ranked high. Severe weather was ranked medium in the previous Plan.

CHAPTER 6. PLAN MAINTENANCE

The Disaster Mitigation Act of 2000 requires the monitoring, evaluation and updating of the hazard mitigation plan every five (5) years. This Hazard Mitigation Plan is designed to be a "living" document and therefore will be reviewed and updated within five (5) years from its approval date. The Contra Costa County Hazard Mitigation Steering Committee will provide leadership and guidance throughout the Plan's life cycle (i.e., monitoring, evaluating, and updating). Updates will allow municipal leaders and the public to provide input into the process. The public will be notified of this opportunity via legal public notices. The Plan maintenance process includes a schedule for annual monitoring and evaluation of the programmatic outcomes established in the Plan and for producing a formal Plan revision every five (5) years.

6.1 PLAN UPDATE

The Plan may be reviewed on an annual basis by Contra Costa County OES and reviewed and revised every five (5) years by the Contra Costa County Hazard Mitigation Steering Committee to determine the effectiveness of programs and to reflect changes that may affect mitigation priorities. Contra Costa County OES will be responsible for contacting the Steering Committee members and organizing the review. Members of the Steering Committee will be responsible for monitoring and evaluating the progress of the mitigation strategies in the Plan. Additionally, the goals and actions will be reviewed by the Steering Committee to determine their relevance to changing situations in the County as well as changes in Federal policy, and to ensure they are addressing current and expected conditions. Furthermore, the Steering Committee will also review the hazard risk assessment portion of the Plan to determine if this information should be updated or modified, given any new available data. The organizations responsible for the various action items will report on the status of the projects, the success of various implementation processes, difficulties encountered, success of coordination efforts, and which strategies should be revised or removed.

Contra Costa County OES will be responsible for ensuring Plan updates. Also, Contra Costa County OES and the Steering Committee will notify all stakeholders and plan participants when changes have been made. Every five (5) years, the Plan will be updated and submitted to the State of California Office of Emergency Services and to FEMA Region 9 for review and approval.

6.1.1. Monitoring, Evaluating

To ensure the Contra Costa County Hazard Mitigation Plan continues to provide an appropriate path for risk reduction throughout the County, it is necessary to regularly evaluate and update it. Contra Costa County OES will be responsible for monitoring the status of the Plan and gathering mitigation action status reports from the appropriate parties. The Contra Costa County Hazard Mitigation Steering Committee will convene on an annual basis to determine the progress of the identified mitigation actions. The Steering Committee will also be an active participant in the next Plan update. As this Plan matures, new stakeholders and/or plan participants will be identified and encouraged to join the existing Hazard Mitigation Steering Committee.

Contra Costa County OES is responsible for contacting Steering Committee members and organizing the annual meeting. During each annual meeting, the Steering Committee will be responsible for a brief evaluation of the 2024 Hazard Mitigation Plan and to review the progress on mitigation actions. Each annual meeting must be documented, including the plan evaluation and review of mitigation actions. Mitigation actions have been formatted to facilitate the annual review process. Additional Hazard Mitigation Steering Committee responsibilities include, but are not limited to:

- Annually reviewing each goal and objective to determine its relevance and appropriateness.
- Monitor and evaluate the mitigation strategies in this Plan to ensure the document reflects current hazard analyses, development trends, code changes, and risk analyses and perceptions.
- Ensure the appropriate implementation of annual status reports and regular maintenance of the Plan. The Steering Committee will hear progress reports from the parties responsible for the various implementation actions to monitor progress.
- Create future action plans and mitigation actions. These should be carefully assessed and prioritized utilizing the STAPLEE+E Method outlined in the Mitigation Strategy section of this Plan.
- Ensure the public is invited to comment and involved in mitigation plan updates.
- Ensure that Contra Costa County complies with all applicable Federal statutes and regulations during the periods for which it receives grant funding, in compliance with 44 CFR, Section 201.
- Reassess the Plan in light of any major hazard event. The Steering Committee will convene within 45 days of any major event to review all applicable data and to consider the risk assessment, plan goals, objectives, and action items given the impact of the hazard event.
- Review the Plan in connection with other plans, projects, developments, and other significant initiatives.
- Coordinate with appropriate counties within Contra Costa County and authorities to incorporate regional initiatives that transcend the County boundaries.
- Update the Plan every five (5) years and submit it to the State of California OES and FEMA Region 9 for approval.
- Amend the Plan whenever necessary to reflect changes in state or federal laws and statutes required in 44 CFR, Section 201.

6.1.1.1. Continued Public Engagement

Contra Costa County OES is dedicated to involving the public directly in the review and updates of the Plan. The Steering Committee is responsible for the review and update of the Plan. The public will also have the opportunity to provide input into Plan revisions and updates. Copies of the Plan will be kept by the appropriate County departments, cities, towns, and special districts.

Public meetings will be held when deemed necessary by the Steering Committee. The meetings will provide a forum where the public can express concerns, opinions, or new alternatives that can then be included in the Plan. Contra Costa County OES will be responsible for using the appropriate resources to publicize the public meetings and maintain public involvement. To further facilitate continued public involvement in the planning process, Contra Costa County OES will ensure a copy of the Plan readily available for review and comment by the public. The Plan will also be available on the Contra Costa County website.

6.1.1.2. Implementation and Integration through Existing Plans and Programs

Hazard mitigation practices must be incorporated within existing plans, projects, and programs. Therefore, the involvement of all departments, private non-profits, private industry, and appropriate jurisdictions is necessary in order to find mitigation opportunities within existing or planned projects and programs. To execute this, the Steering Committee will assist and coordinate resources for the mitigation actions and provide strategic outreach to implement mitigation actions that meet the goals and objectives identified in this Plan.

The Contra Costa County Hazard Mitigation Plan is integrated in external plans developed by other local agencies primarily as it relates to the Threat and Hazard Identification Risk Assessment (THIRA). The THIRA is conducted every five (5) years as part of the mitigation planning process. The results of the THIRA detail the risks posed by hazards within Contra Costa County. This information is shared with community partners and local jurisdictions, allowing other planning efforts to be based on the latest hazard information. As a result, local jurisdictions developing comprehensive land use plans integrate the hazard risk information into their efforts.

The Hazard Mitigation Plan is essential to understanding the hazards facing Contra Costa County, the resulting prioritized list of hazards is used across the suite of Contra Costa County and local jurisdictions plans, and community partner organizations, thus creating a shared understanding of the hazards facing the County.

The results of this Plan will be incorporated into ongoing planning efforts throughout the County. Contra Costa County, its municipalities and special districts will update zoning plans and related ordinances, as necessary, and as part of regularly scheduled updates. Each plan participant will be responsible for updating and integrating elements of the Plan into the community's own respective community plans and ordinances.

6.1.1.3. The Five-Year Action Plan

This section outlines the implementation agenda that the Hazard Mitigation Steering Committee, led by Contra Costa County OES, should follow five (5) years after adoption of this Plan, and then every five (5) years thereafter.

The Steering Committee will consider the following action plan for the five (5) year planning cycle. It should be noted that the schedule on **Table 6-1** can be modified as necessary and does not include any meetings and/or activities that would be necessary following a disaster event (e.g., reconvening the Hazard Mitigation Steering Committee within 45 days of a disaster or emergency to determine what mitigation projects should be prioritized during the community recovery). If an emergency meeting of the Hazard Mitigation Steering Committee occurs, this proposed schedule may be altered to fit any new needs.

Table 6-1. Five-Year Action Plan

Year 0	
2024	Update the 2018 Hazard Mitigation Plan and submit it to the State of California OES and FEMA Region 9 for approval.
Year 1	
2025	• Work on mitigation actions. • Contra Costa County OES will stay in contact with its key stakeholders and plan participants to keep track of project status. • Encourage Plan integration efforts.
	• Reconvene the Steering Committee for an annual meeting. • Discuss opportunities for Plan integration with other planning documents. • Discuss recent hazard events. • Update the status of projects. • Host public meetings to re-introduce the Plan to the community, identify additional hazards of concern that should be considered for the next update, if any, and provide update and obtain input on mitigation projects occurring within the community.
Year 2	
2026	• Work on mitigation actions. • Contra Costa County OES will stay in contact with its key stakeholders and plan participants to keep track of project status. • Encourage Plan integration efforts.
	• Reconvene the Steering Committee for an annual meeting. • Discuss opportunities for Plan integration with other planning documents. • Discuss recent hazard events. • Update the status of projects. • Host public meetings to re-introduce the Plan to the community, identify additional hazards of concern that should be considered for the next update, if any, and provide update and obtain input on mitigation projects occurring within the community.

Year 3	
2027	• Work on mitigation actions. • Contra Costa County OES will stay in contact with its key stakeholders and plan participants to keep track of project status. • Encourage Plan integration efforts.
	Apply for hazard mitigation grant funds (e.g., HMGP, BRIC) to update the next iteration of the Hazard Mitigation Plan.
	• Reconvene the Steering Committee for an annual meeting. • Discuss opportunities for Plan integration with other planning documents. • Discuss recent hazard events. • Update the status of projects. • Host public meetings to re-introduce the Plan to the community, identify additional hazards of concern that should be considered for the next update, if any, and provide update and obtain input on mitigation projects occurring within the community.
Year 4	
2028	• Work on mitigation actions. • Contra Costa County OES will stay in contact with its key stakeholders and plan participants to keep track of project status. • Encourage Plan integration efforts.
	Update the 2024 Hazard Mitigation Plan and conduct a series of meetings with stakeholders, plan participants, and the public.
Year 5	
2029	• Update the 2024 Hazard Mitigation Plan and submit it to the State of California OES and FEMA Region 9 for approval. • Repeat.

APPENDIX A. MITIGATION ACTIONS

This Appendix includes the mitigation actions that were developed to address identified risks and vulnerabilities to hazards identified in this Plan. This Plan serves only to recommend mitigation measures based on the potential for risk reduction and available funding. Implementation of mitigation actions is dependent on risk reduction priorities, feasibility, and available funding. It is also dependent on the cooperation and support of the jurisdiction and/or department responsible for each action item.

Contra Costa County agreed upon **47** mitigation actions that apply to the jurisdiction's properties where they have jurisdictional responsibility and authority. One (1) mitigation action was deleted/no longer needed, and eight (8) mitigation action were completed. A summary of the County's mitigation actions status is listed on **Table 6-2**.

Table 6-2. Contra Costa County Mitigation Actions Summary

Status	Mitigation Action Total
Ongoing	13
In Progress/In Work	6
Not Started	2
Delayed/Deferred	1
New	25
TOTAL	**47**
Completed	8
Deleted/No Longer Needed	1

Mitigation Actions per Natural Hazard			
Climate Change	21	Landslide	18
Dam and Levee Failure	17	Sea Level Rise	22
Drought	17	Severe Weather *(Severe Thunderstorms (hail, strong winds, and tornadoes), Heavy Rainfall, Heat Wave)*	20
Earthquake	25	Tsunami	19
Flood	33	Wildfire	26

Mitigation Action	Where appropriate, support retrofitting or relocation of structures in high hazard areas, prioritizing structures that have experienced repetitive losses.				
Action Number	CCC-1	**Year Initiated / Anticipated Year of Initiation**	2011	**Prioritization Score**	Medium
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 1, 4, 7, 9, 12, 14, 15, 17	**Hazard(s) Mitigated**	Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	High	
Potential Funding Source	HMGP, BRIC, FMA		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Integrate the Hazard Mitigation Plan into other County plans, ordinances, and programs that dictate land use decisions in the community, including the County General Plan, County Zoning Ordinance, and County Capital Road Improvement and Preservation Plan.				
Action Number	CCC-2	**Year Initiated / Anticipated Year of Initiation**	2011	**Prioritization Score**	High
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 1, 3, 4, 5, 7, 11, 12, 14, 17, 18	**Hazard(s) Mitigated**	Climate Change, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Department of Conservation and Development		**Supporting Agency / Organization** *(If applicable)*	Contra Costa County Public Works Department	
Additional Participating Jurisdictions *(If applicable)*					
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds, Local Budgeted Funds, Other		If *Other*, you **must** identify a funding source.	Potentially grant funding	
			Please provide further detail on Potential Funding Source.	Staff Time/Department Time	
Implementation Priority	High	**Integration Ideas** *(Optional)*	Included in the General Plan, Appendix B Health & Safety Element Technical Appendix.		

Mitigation Action	Actively support and participate in the implementation, monitoring, maintenance, and updating of this Hazard Mitigation Plan, as outlined, and defined in Volume 1.				
Action Number	CCC-3	**Year Initiated / Anticipated Year of Initiation**	2011	**Prioritization Score**	High
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 3, 8, 16	**Hazard(s) Mitigated**	Climate Change, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Low			
Lead Agency / Organization	Contra Costa County Office of Emergency Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration)	Short Term		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds, HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	Staff Time	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Continue to maintain good standing and compliance under the National Flood Insurance Program (NFIP) through implementation of floodplain management programs that, at a minimum, meet the NFIP requirements. These include: • Enforce the flood damage prevention ordinance. • Participate in floodplain identification and mapping updates. • Provide public assistance/information on floodplain requirements and impacts.				
Action Number	CCC-4	**Year Initiated / Anticipated Year of Initiation**	2011	**Prioritization Score**	High
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 3, 5, 6, 9, 10, 11, 15	**Hazard(s) Mitigated**	Flood	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds, Other		If *Other*, you **must** identify a funding source.	Developer Permit Fees	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Continue to maintain/enhance the County's Community Rating System classification.				
Action Number	CCC-5	**Year Initiated / Anticipated Year of Initiation**	2011	**Prioritization Score**	High
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 3, 4, 5, 7, 9	**Hazard(s) Mitigated**	Flood	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Low			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds, Other		If *Other*, you **must** identify a funding source.	Developer Permit Fees	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Annually provide California State Training Institute (CSTI) “Earthquake” Class to essential County personnel.				
Action Number	CCC-6	**Year Initiated / Anticipated Year of Initiation**	2011	**Prioritization Score**	Medium
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 2, 6, 13	**Hazard(s) Mitigated**	Earthquake	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Contra Costa County Office of Emergency Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Other		If *Other*, you **must** identify a funding source.	EMPG, SHSGP	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Support Mass Care and Shelter drills conducted by the American Red Cross, which involve county employees, non-government agencies, Community Emergency Response Team (CERT) volunteers, and the public.				
Action Number	CCC-7	**Year Initiated / Anticipated Year of Initiation**	2011	**Prioritization Score**	Medium
Goal(s) / Objective(s) Addressed		**Goals:** 1, 3, 5 **Objectives:** 2, 3	**Hazard(s) Mitigated**	Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Contra Costa County Employment & Human Services		**Supporting Agency / Organization** *(If applicable)*	American Red Cross, Contra Costa County Office of Emergency Services	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Continue to participate in annual statewide emergency planning exercises.				
Action Number	CCC-8	**Year Initiated / Anticipated Year of Initiation**	2011	**Prioritization Score**	Medium
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 2, 6, 13	**Hazard(s) Mitigated**	Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Contra Costa County Office of Emergency Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds, Other		If *Other*, you **must** identify a funding source.	UASI, CDPH	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time), Grants	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	FCC P-25 Phase 2 compliance East Bay Regional Communications System (Alameda and Contra Costa County). The system will be a 36-site, two (2) county, P-25 compliant communication system designed to provide fully interoperable communications to all public agencies within Alameda and Contra Costa counties. *Refer to website http://www.ebrcsa.org for complete project description.*				
Action Number	CCC-9	**Year Initiated / Anticipated Year of Initiation**	2012	**Prioritization Score**	N/A
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 5 **Objectives:** 1, 2	**Hazard(s) Mitigated**	Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		Completed	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		N/A			
Lead Agency / Organization	Contra Costa County Joint Powers Authority		**Supporting Agency / Organization** *(If applicable)*	Sheriff's Office Information Technology	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	N/A		**Estimated Cost**	N/A	
Potential Funding Source	N/A		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	N/A	**Integration Ideas** *(Optional)*			

Mitigation Action	Continue to maintain and enhance the existing Countywide Community Warning System (CWS) by identifying and implementing new technology as it becomes available.				
Action Number	CCC-10	**Year Initiated / Anticipated Year of Initiation**	2011	**Prioritization Score**	High
Goal(s) / Objective(s) Addressed		**Goals:** 1, 3, 5 **Objectives:** 2, 3	**Hazard(s) Mitigated**	Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Office of Emergency Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Other		If *Other*, you **must** identify a funding source.	Certified Unified Program Agency (CUPA) Fees	
			Please provide further detail on Potential Funding Source.	CC Health Supplementation uncovered costs due to CUPA fee structure.	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Community Warning System (CWS) will continue to educate and conduct outreach on all registration tools (i.e., cell phones, social media, sirens, etc.).				
Action Number	CCC-11	**Year Initiated / Anticipated Year of Initiation**	2011	**Prioritization Score**	High
Goal(s) / Objective(s) Addressed		**Goals:** 1, 3, 5 **Objectives:** 2, 3	**Hazard(s) Mitigated**	Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Contra Costa County Office of Emergency Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Other		If *Other*, you **must** identify a funding source.	Certified Unified Program Agency (CUPA) Fees	
			Please provide further detail on Potential Funding Source.	CC Health Supplementation uncovered costs due to CUPA fee structure.	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Update and enhance existing flood hazard mapping to better reflect current conditions.				
Action Number	CCC-12	**Year Initiated / Anticipated Year of Initiation**	2011	**Prioritization Score**	Medium
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 3, 6, 12, 16	**Hazard(s) Mitigated**	Flood	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Public Works Department, Contra Costa County Flood Control and Water Conservation District		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Medium	
Potential Funding Source	Other		If *Other*, you **must** identify a funding source.	FEMA/Public Works Floodplain Determination Fees, FEMA Risk MAP Program	
			Please provide further detail on Potential Funding Source.	Developer Permit Fees	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Canal Road Bridge Replacement (Bridge No. 28C0376): The existing bridge is approaching the end of its useful life.				
Action Number	CCC-13	**Year Initiated / Anticipated Year of Initiation**	2017	**Prioritization Score**	N/A
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 1, 7, 15	**Hazard(s) Mitigated**	Earthquake, Flood	
Project Status		Completed	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		N/A			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	N/A		**Estimated Cost**	N/A	
Potential Funding Source	N/A		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	N/A	**Integration Ideas** *(Optional)*			

Mitigation Action	Marsh Creek Road Bridge over Marsh Creek (Bridge No. 28C141): The existing bridge is approaching the end of its useful life.				
Action Number	CCC-14	**Year Initiated / Anticipated Year of Initiation**	2019	**Prioritization Score**	N/A
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 1, 7, 15	**Hazard(s) Mitigated**	Earthquake, Flood	
Project Status		Completed	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		N/A			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	N/A		**Estimated Cost**	N/A	
Potential Funding Source	N/A		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	N/A	**Integration Ideas** *(Optional)*			

Mitigation Action	Byron Highway Bridge Replacement over California Aqueduct (Bridge No. 28C0121): The existing bridge is approaching the end of its useful life.				
Action Number	CCC-15	**Year Initiated / Anticipated Year of Initiation**	2018	**Prioritization Score**	Medium
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 1, 7, 15	**Hazard(s) Mitigated**	Earthquake, Flood	
Project Status		In Progress/In Work	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	DWR, HBP, Gas Tax	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Center Avenue and Pacheco Boulevard Intersection Improvements: Relocate fire station, widen bridge, and construct intersection improvements.				
Action Number	CCC-16	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	Medium
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 1, 7, 15	**Hazard(s) Mitigated**	Earthquake, Flood	
Project Status		Not Started	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	FEMA Hazard Mitigation Grant funding for fire station relocation, Pacheco Area of Benefit Funds, Proposition 111 Gas Tax for road work.	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Boulevard Way at Las Trampas Creek scour repair: Repair Bridge on Boulevard Way crossing Las Trampas Creek. The scouring is needed to maintain the bridge's structural integrity.				
Action Number	CCC-17	**Year Initiated / Anticipated Year of Initiation**	2018	**Prioritization Score**	N/A
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 1, 7, 15	**Hazard(s) Mitigated**	Earthquake, Flood	
Project Status		Completed	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		N/A			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	N/A		**Estimated Cost**	N/A	
Potential Funding Source	N/A		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	N/A	**Integration Ideas** *(Optional)*			

Mitigation Action	Retrofit Marsh Drive Bridge over Walnut Creek (Bridge No. 28C0442): The existing bridge is approaching the end of its useful life.				
Action Number	CCC-18	**Year Initiated / Anticipated Year of Initiation**	2022	**Prioritization Score**	N/A
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 1, 7, 15	**Hazard(s) Mitigated**	Earthquake, Flood	
Project Status		Completed	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		N/A			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	N/A		**Estimated Cost**	N/A	
Potential Funding Source	N/A		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	N/A	**Integration Ideas** *(Optional)*			

Mitigation Action	Marsh Creek Road Bridge over Marsh Creek (Bridge No. 28C143): The existing bridge is approaching the end of its useful life.				
Action Number	CCC-19	**Year Initiated / Anticipated Year of Initiation**	2018	**Prioritization Score**	Medium
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 1, 7, 15	**Hazard(s) Mitigated**	Earthquake, Flood	
Project Status		In Progress/In Work	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Medium	
Potential Funding Source	Local or State Special Taxes		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	HBP, Gas Tax	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*	This project is under construction along with the bridge identified in mitigation action CCC-20. Other bridges to be constructed in 2024.		

Mitigation Action	Marsh Creek Road Bridge over Marsh Creek (Bridge No. 28C145): The existing bridge is approaching the end of its useful life.				
Action Number	CCC-20	**Year Initiated / Anticipated Year of Initiation**	2018	**Prioritization Score**	Medium
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 1, 7, 15	**Hazard(s) Mitigated**	Earthquake, Flood	
Project Status		In Progress/In Work	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Medium	
Potential Funding Source	Local or State Special Taxes		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	HBP, Gas Tax	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*	This project is under construction along with the bridge identified in mitigation action CCC-19. Other bridges to be constructed in 2024.		

Mitigation Action	Del Monte Drive Bridge Preventative Maintenance (Bridge No. 28C0207): The existing bridge is approaching the end of its useful life.				
Action Number	CCC-21	**Year Initiated / Anticipated Year of Initiation**	2021	**Prioritization Score**	Medium
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 1, 7, 15	**Hazard(s) Mitigated**	Earthquake, Flood	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	Medium	
Potential Funding Source	Local or State Special Taxes		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	HBP, Gas Tax	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Pacific Avenue Bridge Replacement (Bridge No. 28C0379): The existing bridge is approaching the end of its useful life				
Action Number	CCC-22	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	Medium
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 1, 7, 15	**Hazard(s) Mitigated**	Earthquake, Flood	
Project Status		Not Started	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	Medium	
Potential Funding Source	Local or State Special Taxes		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	HBP, Gas Tax	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Enhance County Ordinance Code language and enforcement including, but not limited to: • County Zoning Codes to Increase Compliance with SB 1369 Defensible Space. • Other Fire Safe Requirements in the Unincorporated County.				
Action Number	CCC-23	**Year Initiated / Anticipated Year of Initiation**	2011	**Prioritization Score**	High
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 5 **Objectives:** 5, 7, 11, 12	**Hazard(s) Mitigated**	Wildfire	
Project Status		In Progress/In Work	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Department of Conservation and Development		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	Department Funds (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Address deferred maintenance of County owned facilities as identified in the 2007 Contra Costa County Facility Condition Analysis (FCA). The FCA Project included the inspection of 93 buildings totaling over 2,900,000 square feet. Facilities inspected fall into critical infrastructure/key resources categories.				
Action Number	CCC-24	**Year Initiated / Anticipated Year of Initiation**	N/A	**Prioritization Score**	N/A
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 15 **Objectives:** 3, 7, 15	**Hazard(s) Mitigated**	Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		Deleted/No Longer Needed	If *Deleted/No Longer Needed*, provide reason.	The 2022 Contra Costa County Facility Condition Analysis supersedes this 2007 document. A new mitigation action will be completed.	
Benefits *(Loss Avoided)*		N/A			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	N/A		**Estimated Cost**	N/A	
Potential Funding Source	N/A		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	N/A	**Integration Ideas** *(Optional)*			

Mitigation Action	Through publications and social media, better inform residents of comprehensive mitigation strategies for all hazards of concern, including but not limited to: • Elevating appliances above expected flood levels. • Using fire-resistant roofing and defensible space in high wildfire threat and Wildfire Urban Interface (WUI) areas. • Encourage structural retrofitting techniques for older homes. • Using intelligent grading techniques.				
Action Number	CCC-25	**Year Initiated / Anticipated Year of Initiation**	2018	**Prioritization Score**	High
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 5 **Objectives:** 3, 5, 7	**Hazard(s) Mitigated**	Climate Change, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		Ongoing	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Department of Conservation and Development		**Supporting Agency / Organization** *(If applicable)*	Contra Costa County Public Works Department, Contra Costa County Fire Protection District	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration\	Ongoing		**Estimated Cost**\	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	Department Funds (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Construct new Emergency Operations Center (EOC) and obtain Leadership in Energy and Environmental Design (LEED) certification.				
Action Number	CCC-26	**Year Initiated / Anticipated Year of Initiation**	2026	**Prioritization Score**	N/A
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 1, 2, 18	**Hazard(s) Mitigated**	Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		Completed	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		N/A			
Lead Agency / Organization	Contra Costa County Sheriff's Office		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	N/A		**Estimated Cost**	N/A	
Potential Funding Source	N/A		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	N/A	**Integration Ideas** *(Optional)*			

Mitigation Action	Hazardous Materials Emergency Program (HMEP) Adapting to Rising Tides shoreline data overlay hazardous materials rail transportation data to look at the impact that disruption from flooding/sea level rise could or would cause to Contra Costa County.				
Action Number	CCC-27	**Year Initiated / Anticipated Year of Initiation**	2027	**Prioritization Score**	Medium
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 1, 6, 18	**Hazard(s) Mitigated**	Flood	
Project Status		Delayed/Deferred	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa Health (HazMat Division)		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	High	
Potential Funding Source	HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Review and revise, as necessary, General Plan Safety Element policies and maps related to landslide hazards based on information contained in Seismic Hazard Zone (SHZ) Reports prepared by the California Department of Conservation.				
Action Number	CCC-28	**Year Initiated / Anticipated Year of Initiation**	2026	**Prioritization Score**	High
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 5, 6, 7, 12, 14	**Hazard(s) Mitigated**	Landslide	
Project Status		In Progress/In Work	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Department of Conservation and Development		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	Department Funds (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Implement the North Richmond Watershed Connections Project that includes a suite of multiple benefit urban greening projects to improve water quality and enhance the health of San Pablo and Wildcat Creeks, and their watersheds, while expanding the urban forest to reduce heat islands, and provide green infrastructure.				
Action Number	CCC-29	**Year Initiated / Anticipated Year of Initiation**	2018	**Prioritization Score**	N/A
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5 **Objectives:** 1, 3, 10, 14, 17	**Hazard(s) Mitigated**	Flood	
Project Status		Completed	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		N/A			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	N/A		**Estimated Cost**	N/A	
Potential Funding Source	N/A		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	N/A	**Integration Ideas** *(Optional)*			

Mitigation Action	North Richmond stormwater pump Station retrofit.				
Action Number	CCC-30	**Year Initiated / Anticipated Year of Initiation**	2018	**Prioritization Score**	N/A
Goal(s) / Objective(s) Addressed		**Goals:** 2, 3, 4, 5 **Objectives:** 1, 10	**Hazard(s) Mitigated**	Flood	
Project Status		Completed	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		N/A			
Lead Agency / Organization	Contra Costa County Public Works Department, Contra Costa County Flood Control and Water Conservation District		**Supporting Agency / Organization** *(If applicable)*	City of Richmond Public Works Department	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	N/A		**Estimated Cost**	N/A	
Potential Funding Source	N/A		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	N/A	
Implementation Priority	N/A	**Integration Ideas** *(Optional)*			

Mitigation Action	Develop a plan to provide convenient and accessible clean air refuges during times when outdoor air quality is deemed unhealthy. *(2045 General Plan: Health and Safety Element Action HS-A1.6)*				
Action Number	CCC-31	**Year Initiated / Anticipated Year of Initiation**	2024	**Prioritization Score**	40/40
Goal(s) / Objective(s) Addressed		**Goals:** 1	**Hazard(s) Mitigated**	Wildfire	
Project Status		In Progress/In Work	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa Health		**Supporting Agency / Organization** *(If applicable)*	Contra Costa Office of Emergency Services	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, HMGP, BRIC		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Take measures such as applying soil stabilization or installing retaining walls to prevent roadway damage and traffic disruptions from landslides along collector roadways in rural areas in west Contra Costa County.				
Action Number	CCC-32	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	33/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Climate Change, Dam and Levee, Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire,	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds, HMGP, BRIC, FMA		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Address deferred maintenance of County-owned facilities as identified in the 2022 Contra Costa County Facility Condition Analysis (FCA). The FCA project includes inspection of all County-owned and leased building assets. Facilities inspected fall into critical infrastructure/key resources categories.				
Action Number	CCC-33	**Year Initiated / Anticipated Year of Initiation**	2024	**Prioritization Score**	38/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3	**Hazard(s) Mitigated**	Climate Change, Earthquake, Severe Weather	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Long Term		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds, BRIC		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Develop a map of primary pet facilities that can be used in the event of weather and air quality emergencies.				
Action Number	CCC-34	**Year Initiated / Anticipated Year of Initiation**	2024	**Prioritization Score**	36/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 5	**Hazard(s) Mitigated**	Climate Change, Flood, Severe Weather, Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Office of Emergency Services		**Supporting Agency / Organization** *(If applicable)*	Contra Costa County Employment & Human Services	
Additional Participating Jurisdictions *(If applicable)*	Contra Costa Health, GIS				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Develop public education programs to Increase Hazard Education and Risk Awareness. Attend public outreach events and share resources with the cities focusing on equitable distribution of programs especially in non-English speaking communities. Promote usage of State Risk Map.				
Action Number	CCC-35	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	34/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 3, 5	**Hazard(s) Mitigated**	Climate Change, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		High			
Lead Agency / Organization	Contra Costa County Office of Emergency Services		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, HMGP		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Consult with Bay Area Air Quality Management District (BAAQMD) and community stakeholders to amend County Ordinance Code Title 8 (Zoning) to include an Industrial Sensitive Receptor Interface Overlay Zone applied to areas where residential land uses and other sensitive receptors interface or directly about heavy industrial land uses. In the overlay zone, require industrial uses to reduce pollution and employ strategies to mitigate air quality, noise, vibration, odor, light, visual, and safety impacts on nearby sensitive receptors. In addition, require new sensitive receptors to install enhanced ventilation systems and implement other strategies, paid for by neighboring sources of pollution to the extent possible, to protect residents from health and quality of life impacts. (2045 *General Plan: Health and Safety Element Action HS-A1.3)*				
Action Number	CCC-36	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	35/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Department of Conservation and Development		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Partner with community members and regulatory agencies to prepare a community-scale plan for reducing and mitigating air pollutant emissions and industrial hazards, such as pipeline risks, accidents, potential water, or soil contamination), and impacts to sensitive ecological resources for each impacted community, or group of impacted communities, as appropriate. Require future projects to demonstrate consistency with those plans. *(2045 General Plan: Health and Safety Element Action HS-A2.1)*				
Action Number	CCC-37	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	29/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 4, 5	**Hazard(s) Mitigated**	Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Department of Conservation and Development		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, HMGP, BRIC		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

Mitigation Action	Conduct a housing condition survey in Impacted Communities to identify units likely requiring upgrades to provide adequate protection from toxic releases. Based on the survey's findings, target outreach to provide information about weatherization and similar improvement programs. *(2045 General Plan: Health and Safety Element Action HS-A2.3)*				
Action Number	CCC-38	**Year Initiated / Anticipated Year of Initiation**	2030	**Prioritization Score**	35/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3	**Hazard(s) Mitigated**	Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Low			
Lead Agency / Organization	Contra Costa County Department of Conservation and Development		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, HMGP, FMA, BRIC		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Require that any mitigation of air quality impacts occur onsite to the extent feasible to provide the greatest benefit to local residents. For mitigation that relies on offsets, require that the offsets be obtained from sources as near to the project site as possible. If the project site is within or adjacent to an Impacted Community, require offsets/mitigation within that community unless determined as not feasible by the County. *(2045 General Plan: Health and Safety Element Action HS-P1.6)*				
Action Number	CCC-39	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	30/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Low			
Lead Agency / Organization	Contra Costa County Department of Conservation and Development		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Continue to monitor air quality through air quality sensors installed throughout the North Richmond community as part of the Community Air Protection Program (Assembly Bill 617). *(2045 General Plan: North Richmond C.P. Policy 5)*				
Action Number	CCC-40	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	40/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Low			
Lead Agency / Organization	Contra Costa County Department of Conservation and Development		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Review flooding policies and maps in the Contra Costa County General Plan on an annual basis and incorporate best available information regarding 100-, 200-, and 500-year floodplains and projected sea level rise due to climate change. *(2045 General Plan: Health and Safety Element Action HS-A5.1)*				
Action Number	CCC-41	**Year Initiated / Anticipated Year of Initiation**	2024	**Prioritization Score**	40/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Climate Change, Dam and Levee Failure, Flood, Sea Level Rise	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Low			
Lead Agency / Organization	Contra Costa County Public Works Department, Contra Costa County Flood Control and Water Conservation District		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Establish countywide protection priorities for vulnerable communities and their populations identified to be at high risk of displacement from future flooding and sea level rise in the Contra Costa County Vulnerability Assessment or the best available climate science data and use regional funding mechanisms to plan and implement protection measures in these locations or for these populations. *(2045 General Plan: Health and Safety Element Action HS-A5.2)*				
Action Number	CCC-42	**Year Initiated / Anticipated Year of Initiation**	2026	**Prioritization Score**	40/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Climate Change, Drought, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Department of Conservation and Development		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, BRIC, HMGP, FMA		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Amend the Floodplain Management Ordinance to address hazardous material storage. *(2045 General Plan: Health and Safety Element Action HS-A5.3)*				
Action Number	CCC-43	**Year Initiated / Anticipated Year of Initiation**	2024	**Prioritization Score**	40/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Flood	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Low			
Lead Agency / Organization	Contra Costa County Public Works Department, Contra Costa County Flood Control and Water Conservation District		**Supporting Agency / Organization** *(If applicable)*	N/a	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Improve and maintain stormwater infrastructure to prevent flooding in the Pacheco community. *(2045 General Plan: Action Pacheco C.P. Policy 8)*				
Action Number	CCC-44	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	40/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Climate Change, Flood, Sea Level Rise	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Public Works Department, Contra Costa County Flood Control and Water Conservation District		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, BRIC, HMGP, FMA		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority		**Integration Ideas** *(Optional)*			

Mitigation Action	Undertake drainage improvements to reduce local flooding problems in the Vine Hill/Mountain View community. Additionally, to the extent feasible, incorporate "green streets" principles in the design of such projects. *(2045 General Plan: Vine Hill and Mountain View C.P. Action 2)*				
Action Number	CCC-45	**Year Initiated / Anticipated Year of Initiation**	2026	**Prioritization Score**	38/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Climate Change, Flood, Sea Level Rise	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Public Works Department, Contra Costa County Flood Control and Water Conservation District		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds, BRIC, HMGP, FMA		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Coordinate with the San Francisco Bay Conservation and Development Commission (BCDC), cities, and other agencies, organizations, and stakeholders to prepare and adopt a community-driven countywide sea level rise adaptation plan addressing increased flooding and sea level rise that provides unique adaptation options for the entire county shoreline and identifies funding mechanisms for implementation. *(2045 General Plan: Health and Safety Element Action HS-A6.3)*				
Action Number	CCC-46	**Year Initiated / Anticipated Year of Initiation**	2027	**Prioritization Score**	40/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Climate Change, Flood, Sea Level Rise	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Low			
Lead Agency / Organization	Contra Costa County Department of Conservation and Development		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Partner with cities and Contra Costa Transportation Authority (CCTA) to develop and fund a countywide plan to increase the resiliency of roads that will be impacted by sea level rise and tsunamis to ensure emergency responders can get to those in need and that community members, including those that rely on public transit, can continue to reach services. *(2045 General Plan: Health and Safety Element Action HS-A6.5)*				
Action Number	CCC-47	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	40/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Climate Change, Flood, Sea Level Rise, Tsunami	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Low			
Lead Agency / Organization	Contra Costa County Department of Conservation and Development		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, BRIC, HMGP, FMA		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Conduct a study of existing development within designated California Tsunami Hazard Areas to determine evacuation and emergency response needs prior to and during a tsunami event. *(2045 General Plan: Health and Safety Element Action HS-A5.4)*				
Action Number	CCC-48	**Year Initiated / Anticipated Year of Initiation**	2026	**Prioritization Score**	38/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Climate Change, Tsunami	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Public Works Department, Contra Costa County Flood Control and Water Conservation District		**Supporting Agency / Organization** *(If applicable)*	Contra Costa Office of Emergency Services	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds, BRIC, HMGP, FMA		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Develop a feasibility analysis and implementation plan for siting community resilience hubs across the county, with attention to Impacted Communities. Identify opportunities for battery storage projects at County facilities. Establish and maintain community resilience hubs with microgrids, education, training opportunities, and other community-focused resources. County emergency planners help enact this strategy by ensuring emergency response plans include climate change disasters such as wildfires, sea level rise, flooding, extreme heat, and drought. *(Climate Action and Adaptation Plan NI-3)*				
Action Number	CCC-49	**Year Initiated / Anticipated Year of Initiation**	2024	**Prioritization Score**	40/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 5	**Hazard(s) Mitigated**	Climate Change, Severe Weather, Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Low			
Lead Agency / Organization	Contra Costa County Department of Conservation and Development		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Partner with cities and public protection agencies to delineate evacuation routes, identifying their capacity, safety, and viability under different hazard scenarios, as well as emergency vehicle routes for disaster response, and where possible, alternate routes where congestion or road failure might reasonably be expected to occur. Update as new information and technologies become available. *(2045 General Plan: Health and Safety Element Action HS-A13.1)*				
Action Number	CCC-50	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	40/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 4, 5	**Hazard(s) Mitigated**	Climate Change, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa Transportation Authority		**Supporting Agency / Organization** *(If applicable)*	Contra Costa County Office of Emergency Services	
Additional Participating Jurisdictions *(If applicable)*	All Incorporated Areas				
Project Duration	Ongoing		**Estimated Cost**	Medium	
Potential Funding Source	Local Budgeted Funds, BRIC, HMGP, FMA		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Prioritize roadway infrastructure maintenance and improvement, especially repair of collapsed roadways, in the Alhambra Valley, Reliez Valley, and Briones communities. *(2045 General Plan: Alhambra Valley, Reliez Valley & Briones, C.P. Policy 3)*				
Action Number	CCC-51	**Year Initiated / Anticipated Year of Initiation**	2026	**Prioritization Score**	40/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Climate Change, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds, BRIC, HMGP, FMA		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Improve public roadway infrastructure in a way that balances public safety and the needs of users with the desire to maintain Canyon's rural character and privacy. *(2045 General Plan: Canyon C.P. Policy 5)*				
Action Number	CCC-52	**Year Initiated / Anticipated Year of Initiation**	2026	**Prioritization Score**	40/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Climate Change, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds, BRIC, HMGP, FMA		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Develop turnarounds needed by emergency vehicles along Pinehurst Road and Canyon Road. *(2045 General Plan: Canyon C.P. Action 9)*				
Action Number	CCC-53	**Year Initiated / Anticipated Year of Initiation**	2026	**Prioritization Score**	30/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 5	**Hazard(s) Mitigated**	Climate Change, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	High	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Study the feasibility of adding another access road into the Discovery Bay community to improve safety and disaster response. *(2045 General Plan: Discovery Bay C.P. Action 1)*				
Action Number	CCC-54	**Year Initiated / Anticipated Year of Initiation**	2026	**Prioritization Score**	40/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 4, 5	**Hazard(s) Mitigated**	Climate Change, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Proactively address hazards on County-owned land, including removing dead trees, trimming healthy trees, preserving creeks and natural resources, and encourage planting of native trees in the Alamo community. *(2045 General Plan: Alamo and Castle Hill C.P. Action 3)*				
Action Number	CCC-55	**Year Initiated / Anticipated Year of Initiation**	2025	**Prioritization Score**	40/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Climate Change, Dam and Levee Failure, Drought, Earthquake, Flood, Landslide, Sea Level Rise, Severe Weather, Tsunami, Wildfire	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Public Works Department		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Ongoing		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	High	**Integration Ideas** *(Optional)*			

Mitigation Action	Explore financial assistance programs to help residents maintain and upgrade their homes and implement seismic safety improvements in the Kensington community. *(2045 General Plan: Kensington Community Profile Action 3)*				
Action Number	CCC-56	**Year Initiated / Anticipated Year of Initiation**	2026	**Prioritization Score**	29/40
Goal(s) / Objective(s) Addressed		**Goals:** 1, 2, 3, 4, 5	**Hazard(s) Mitigated**	Earthquake	
Project Status		New	If *Deleted/No Longer Needed*, provide reason.	N/A	
Benefits *(Loss Avoided)*		Medium			
Lead Agency / Organization	Contra Costa County Department of Conservation and Development		**Supporting Agency / Organization** *(If applicable)*	N/A	
Additional Participating Jurisdictions *(If applicable)*	N/A				
Project Duration	Short Term		**Estimated Cost**	Low	
Potential Funding Source	Local Budgeted Funds		If *Other*, you **must** identify a funding source.	N/A	
			Please provide further detail on Potential Funding Source.	General Fund (Staff Time)	
Implementation Priority	Medium	**Integration Ideas** *(Optional)*			

APPENDIX B. STAKEHOLDER ENGAGEMENT

Contra Costa County engaged with various stakeholders on multiple occasions, to include the Steering Committee during meetings, workshops, and one on one meetings. These stakeholders assisted in identifying hazards, assessing risks and vulnerability, record critical facilities, and develop and prioritize mitigation actions. In addition to sharing technical data, reports, and studies. Contra Costa County understands the importance of stakeholder engagement and that their contribution strengthens the content and outcomes of this Hazard Mitigation Plan.

B.1. STAKEHOLDER AND JURISDICTION INTRODUCTORY WEBINARS

A series of four (4) Stakeholder and Jurisdiction Introductory webinar were conducted virtually at the beginning stages of the 2024 Contra Costa County Hazard Mitigation Plan update. All potential plan participants and stakeholders (i.e., county and city representatives) were invited to participate in one (1) webinar. The purpose of this webinar was to provide valuable information regarding the FEMA Hazard Mitigation Program directive, and more importantly, demonstrate how participating in this Plan will enable each jurisdiction's eligibility for FEMA's Hazard Mitigation Assistance grant programs. The meeting agenda and sign in sheets for each webinar are below.

Webinar Agenda

Meeting Agenda

Meeting Purpose: Stakeholder and Juriscition Introductory Webinar Series

Dates and Times:
September 25, 2023 | 3:00 PM – 4:00 PM PDT
September 27, 2023 | 2:00 PM – 3:00 PM PDT
October 3, 2023 | 2:00 PM – 3:00 PM PDT
October 4, 2023 | 11:00 AM – 12:00 PM PDT

- **Hazard Mitigation Planning Overview**
- **2023 FEMA Updated to the Hazard Mitigation Process**
- **Hazard Mitigation Planning Process Overview**
- **Jurisdiction/Agency Hazard Summary**
- **Mitigation Strategy**
- **Plan Maintenance and Adoption**
- **Roles and Responsibilities**
- **Project Timeline**

INTEGRATED SOLUTIONS CONSULTING

220 South Buchanan Street Edwardsville, IL 62025
(847) 477-7542 | Ext. 220
inquiry@i-s-consulting.com

September 25, 2024 – Webinar (Session 1) Sign In Sheets

SIGN-IN SHEET: **Hazard Mitigation Plan Update – Stakeholder and Jurisdiction Introductory Webinar**
(September 25, 2023)
GoToWebinar
Contra Costa County, California

Stakeholder and Jurisdiction Introductory Webinar
Date: 9/25/2023 | **Time:** 3:00 PM (PT)

Name	Jurisdiction/Organization	Title	E-mail
Yahiritza D. Álvarez	Integrated Solutions Consulting	Planner	Yahiritza.Alvarez@i-s-consulting.com
Daiko Abe	Integrated Solutions Consulting	Project Manager	Daiko.Abe@i-s-consulting.com
Lori Castillo	Bethel Island Drainage Ad Hoc		lmnscastillo@gmail.com
John Fortner	City of Antioch	Lieutenant	jfortner@ci.antioch.ca.us
Dan Frost	Central Contra Costa Sanitary District	Senior Engineer	dfrost@centralsan.org
Carla Hansen	City of Walnut Creek	Deputy City Manager	hansen@walnut-creek.org
Kristi Jourdan	Office of Communications & Media	Director	kristi.jourdan@contracostatv.org
Cameron Kirkham	Contra Costa County Office of Education	Director of General Services	ckirkham@cccoe.k12.ca.us
Rick Kovar	Contra Costa County Office of Emergency Services	Emergency Services Manager	rkova@so.cccounty.us
Mike Mirmazaheri	Bethel Island Municipal Improvement District and Reclamation District No 799	District Manager	mmirmazaheri@geiconsultants.com
Michael Nisen	Byron Municipal Advisory Council	Council Member	mike@evansbrothers.com
Lee Rosenberg	ISC Subconsultant	Planner	lee.rosenberg@navigatingpreparedness.com
Christy Saxton	Contra Costa County Health - Health, Housing and Homeless Services	Director	Betsy.Cajina@cchealth.org
Lina Velasco	City of Richmond	Director of Community Development	Lina_Velasco@ci.richmond.ca.us
Tyson Zimmerman	Ironhouse Sanitary District	Assistant General Manager	zimmerman@isd.us.com

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September 27, 2023 – Webinar (Session 2) Sign In Sheets

SIGN-IN SHEET: **Hazard Mitigation Plan Update – Stakeholder and Jurisdiction Introductory Webinar**
(September 27, 2023)
GoToWebinar
Contra Costa County, California

Stakeholder and Jurisdiction Introductory Webinar Date: 9/27/2023 | Time: 2:00 PM (PT)			
Name	**Jurisdiction/Organization**	**Title**	**E-mail**
Yahiritza D. Álvarez	Integrated Solutions Consulting	Planner	Yahiritza.Alvarez@i-s-consulting.com
Daiko Abe	Integrated Solutions Consulting	Project Manager	Daiko.Abe@i-s-consulting.com
Trish Beirne	City of Concord	Emergency & Volunteer Services Manager	trish.beirne@cityofconcord.org
Heidi Benenson	East Bay Municipal Utility District	Emergency Preparedness Admin	heidi.benenson@ebmud.com
Amanda Cauble	Central San	Associate Engineer	acauble@centralsan.org
Chris Elliott	Mt. View Sanitary District	District Engineer	chrise@mvsd.org
Seana Field	City of Hercules Community Development	Senior Planner	sfield@ci.hercules.ca.us
Drew Graham	Phillips 66	HSE Manager	Drew.Graham@p66.com
Stephen Griswold	Contra Costa Board of Supervisors (District 3)	District Representative	stephen.griswold@bos.cccounty.us
Lorena Herrera	Contra Costa County Office of Emergency Services	Senior Emergency Planning Coordinator	lherr001@so.cccounty.us
Mark Jelonek	Chevron Refinery	Division Chief	elon@chevron.com
Stephen Kowalewski	Contra Costa County Public Works Department	Chief Deputy Director	steve.kowalewski@pw.cccounty.us
Jocelyn LaRocque	Contra Costa County Public Works	Division Manager/Supervising Civil Engineer	jocelyn.larocque@pw.cccounty.us
Nate McCormack	Town of Danville	Emergency Services Manager	nmccormack@danville.ca.gov
Danielle Navarro	City of Oakley	Assistant City Manager	navarro@ci.oakley.ca.us
Alicia Nuchols	Contra Costa Board of Supervisors (District 3)	Chief of Staff	alicia.nuchols@bos.cccounty.us
Alana Weissman	Animal Services	Lieutenant	alana.weissman@asd.cccounty.us

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October 3, 2023 – Webinar (Session 3) Sign In Sheets

SIGN-IN SHEET: **Hazard Mitigation Plan Update – Stakeholder and Jurisdiction Introductory Webinar**
(October 3, 2023)
GoToWebinar
Contra Costa County, California

Stakeholder and Jurisdiction Introductory Webinar **Date:** 10/3/2023 | **Time:** 2:00 PM (PT)			
Name	**Jurisdiction/Organization**	**Title**	**E-mail**
Yahiritza D. Álvarez	Integrated Solutions Consulting	Planner	Yahiritza.Alvarez@i-s-consulting.com
Daiko Abe	Integrated Solutions Consulting	Project Manager	Daiko.Abe@i-s-consulting.com
David Aranda	Kensington Police Protection and Community Services District	District General Manager	daranda@kppcsd.org
Daniel Barrios	Contra Costa County Department of Conservation and Development	Senior Planner	daniel.barrios@dcd.cccounty.us
Christine Belleci	Diablo Water District	Forward Planning Manager	cbelleci@diablowater.org
Jose Castrejon	El Cerrito Fire Department	Battalion Chief	jcastrejon@ci.el-cerrito.ca.us
Judy Chen	West County Wastewater	Planning Support Manager	jchen@wcwd.org
Maggie Dutton	Contra Costa Water District	Senior Engineer	mdutton@ccwater.com
Timothy Ellsworth	Contra Costa Environmental Health	Environmental Health Specialist	timothy.ellsworth@cchealth.org
Regina Espinoza	Bethel Island Municipal Improvement District	District Manager	respinoza@bimid.com
Brian Helmick	Contra Costa County Fire Protection District	Fire Chief	bhelm@cccfpd.org
Ronald Marley	San Ramon Valley Fire Protection District	Emergency Preparedness Coordinator	rmarley@srvfire.ca.gov
Aaron Osorio	City of Richmond Fire Department	Deputy Chief	aaron_osorio@ci.richmond.ca.us
Beatriz Portillo	Contra Costa County Office of Emergency Services	Senior Emergency Planning Coordinator	bport001@so.cccounty.us
Maureen Toms	Department of Conservation and Development	Deputy Director	maureen.toms@dcd.cccounty.us

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October 4, 2023 – Webinar (Session 4) Sign In Sheets

SIGN-IN SHEET: **Hazard Mitigation Plan Update – Stakeholder and Jurisdiction Introductory Webinar**
(October 4, 2023)
GoToWebinar

Contra Costa County, California

Stakeholder and Jurisdiction Introductory Webinar
Date: 10/4/2023 | **Time:** 11:00 AM (PT)

Name	Jurisdiction/Organization	Title	E-mail
Yahiritza D. Álvarez	Integrated Solutions Consulting	Planner	Yahiritza.Alvarez@i-s-consulting.com
Daiko Abe	Integrated Solutions Consulting	Project Manager	Daiko.Abe@i-s-consulting.com
Gus Amirzehni	Contra Costa County Flood Control District	Division Manager	gus.amirzehni@pw.cccounty.us
Tania Babcock	Tri Delta Transit	Compliance Manager	tbabcock@eccta.org
Lilia Corona	Mt View Sanitary District	General Manager	lcorona@mvsd.org
Uriel Diaz	Tri Delta Transit	Special Projects Analyst	udiaz@eccta.org
Shawn Gruendl	San Ramon Valley Unified School District	EHS Specialist	sgruendl@srvusd.net
Tina Anderson	Reclamation Districts 830, 2025, 2026, 2065, 2122 and 2137	Senior Project Manager	hershey@mbkengineers.com
Shane Hsieh	Public Works Department / City of San Ramon, Dougherty Valley GHAD and Northwest San Ramon GHAD	Senior Civil Engineer	chsieh@sanramon.ca.gov
Beatriz Ibarra	Town of Discovery Bay Community Services District		bibarra@todb.ca.gov
Blake Johnson	Bradford Reclamation District 2059	District Engineer	blake_rd2059@att.net
Jody London	Contra Costa County Department of Conservation and Development, Sustainability	Sustainability Coordinator	Jody.London@dcd.cccounty.us
Carol McCary	VistAbility	AFN Co-Coordinator	cmccrary@vistability.org
Beatriz Portillo	Contra Costa County Office of Emergency Services	Senior Emergency Planning Coordinator	bport001@so.cccounty.us
Nicole Shimizu	Contra Costa County Department of Conservation and Development	Planner	nicole.shimizu@dcd.cccounty.us

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SIGN-IN SHEET: **Hazard Mitigation Plan Update – Stakeholder and Jurisdiction Introductory Webinar**
(October 4, 2023)
GoToWebinar

Stakeholder and Jurisdiction Introductory Webinar
Date: 10/4/2023 | **Time:** 11:00 AM (PT)

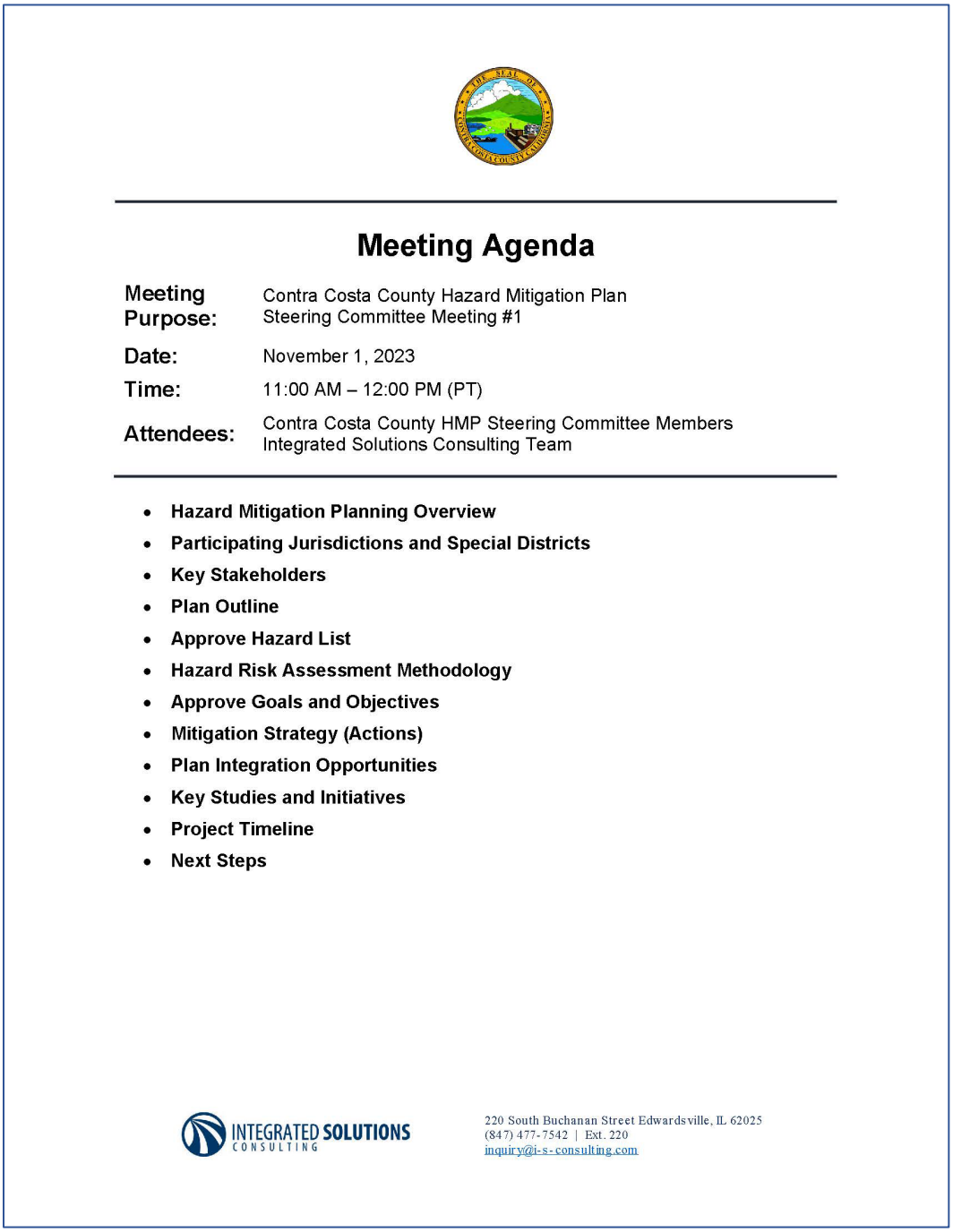
Name	Jurisdiction/Organization	Title	E-mail
David Spath	Kensington Police Protection & Community Services District	Board Member	dspath@kppcsd.org
Cathy Surges-Moscato	City of Lafayette Police Department	Admin Analyst	csurges@ci.lafayette.ca.us
Ben Aldritt	City of Lafayette Police Department	Chief of Police	balld@ci.lafayette.ca.us
John Cornell	City of Lafayette Police Department	Emergency Services Coordinator	jcornell@ci.lafayette.ca.us
Gerald Tamayo	Contra Costa Health	Emergency Preparedness Manager	gerald.tamayo@cchealth.org
Maureen Toms	City of Pinole	Vice Mayor	mtoms@ci.pinole.ca.us
Carolina Walbrun	NOAA/NWS/San Francisco/Monterey Bay Area	Hydrologist	carolina.walbrun@noaa.gov

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B.2. STEERING COMMITTEE MEETING

A total of approximately 16 steering committee members were part of the Hazard Mitigation Plan update process. **Table 1-3** in Section 1.5.2 (Steering Committee) outlines the Steering Committee members by jurisdiction/organization, name, and title of position. The first Steering Committee Meeting for the 2024 Contra Costa County Hazard Mitigation Plan update was conducted on November 1, 2023, and used an agenda to guide the meeting's discussion. The meeting agenda and sign in sheets of the Steering Committee Meeting are below.

Steering Committee Meeting Agenda



Meeting Agenda

Meeting Purpose:	Contra Costa County Hazard Mitigation Plan Steering Committee Meeting #1
Date:	November 1, 2023
Time:	11:00 AM – 12:00 PM (PT)
Attendees:	Contra Costa County HMP Steering Committee Members Integrated Solutions Consulting Team

- **Hazard Mitigation Planning Overview**
- **Participating Jurisdictions and Special Districts**
- **Key Stakeholders**
- **Plan Outline**
- **Approve Hazard List**
- **Hazard Risk Assessment Methodology**
- **Approve Goals and Objectives**
- **Mitigation Strategy (Actions)**
- **Plan Integration Opportunities**
- **Key Studies and Initiatives**
- **Project Timeline**
- **Next Steps**

INTEGRATED SOLUTIONS CONSULTING

220 South Buchanan Street Edwardsville, IL 62025
(847) 477-7542 | Ext. 220
inquiry@i-s-consulting.com

Steering Committee Meeting Sign In Sheet

SIGN-IN SHEET: **Hazard Mitigation Plan Update – Steering Committee Meeting (November 11, 2023)**
Microsoft Teams

Contra Costa County, California

Hazard Mitigation Steering Committee Meeting **Date:** 11/1/2023 | **Time:** 11:00 AM (PT)				
Name	**Organization** (if applicable)	**Title** (if applicable)	**E-mail**	**Phone** (Optional)
Rick Kovar	Contra Costa County Office of Emergency Services	Emergency Services Manager	rkova@so.cccounty.us	(925) 655-0123
Lorena Herrera	Contra Costa County Office of Emergency Services	Senior Emergency Planning Coordinator	Lherr001@so.cccounty.us	(925) 655-0100
Carol McCray	VistAbility	AFN Co-Coordinator	cmccrary@vistability.org	(925) 595-0115
Jody London	Department of Conservation and Development	Sustainability Coordinator	jody.london@dcd.cccounty.us	(925) 434-3250
Jeff Valeros	Contra Costa Public Works	Senior Civil Engineer	jeffrey.valeros@pw.cccounty.us	(925) 313-2031
Gilbert Salinas	Contra Costa Health (DEI)	Chief Equity Officer	gilbert.salinas@cchealth.org	(925) 374-2392
Kristi Jourdan	Contra Costa County Office of Communication and Media	Director	kristi.jourdan@contracostatv.org	(925) 313-1183
Glenn Kimball	Contra Costa County Office of Communication and Media	Community & Media Relations Specialist	glenn.kimball@contracostatv.org	
Lissette Davis	Contra Costa County Office of Communication and Media	Community & Media Relations Specialist	lissette.davis@contracostatv.org	
Daniel Barrios	Department of Conservation and Development	Senior Planner	daniel.barrios@dcd.cccounty.us	(925) 655-2901
Seana Fields	City of Hercules	Senior Planner (Community Development)	sfield@ci.hercules.ca.us	(510) 799-8248
Robyn Cole	California Office of Emergency Services - Coastal Region Response Ops	Emergency Services Coordinator	robyn.cole@caloes.ca.gov	(916) 591-1042
Larry Fong	American Red Cross, Contra Costa Search and Rescue, and CERT	Volunteer	larry.fong@contracostasar.org	(925) 997-4421
Brian Helmick	Contra Costa County Fire Protection District	Deputy Fire Chief	bhelm@cccfpd.org	
Daiko Abe	Integrated Solutions Consulting	Project Manager	Daiko.Abe@i-s-consulting.com	(847) 565-8791
Yahiritza D. Álvarez	Integrated Solutions Consulting	Planner	Yahiritza.Alvarez@i-s-consulting.com	(847) 737-5395 (Ext. 161)
Matt Stanley	Integrated Solutions Consulting	Planner	Matt.Stanley@i-s-consulting.com	(312) 574-3869

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B.3. STAKEHOLDER WORKSHOP

Two (2) Stakeholder Workshops were held in the Contra Costa County Emergency Operation Center on December 4, 2023, and December 6, 2023. The workshops gave each local planning team an opportunity to work with Contra Costa County OES to identify local hazards and areas of concern, review previously identified mitigation actions, develop future mitigation projects, prioritize mitigation projects moving forward and update their jurisdiction's annex of the 2024 Contra Costa County Hazard Mitigation Plan (HMP). The workshop agenda and sign in sheets are below. All participating jurisdictions were able to attend at least one (1) of the workshops.

Stakeholder Workshops Agenda

Contra Costa County, California
2024 Hazard Mitigation Plan Update

Stakeholder Workshop Series

Dates:
December 4 & 6, 2023

Location:
Contra Costa County Emergency Operations Center
1850 Muir Road, Martinez, CA 94553

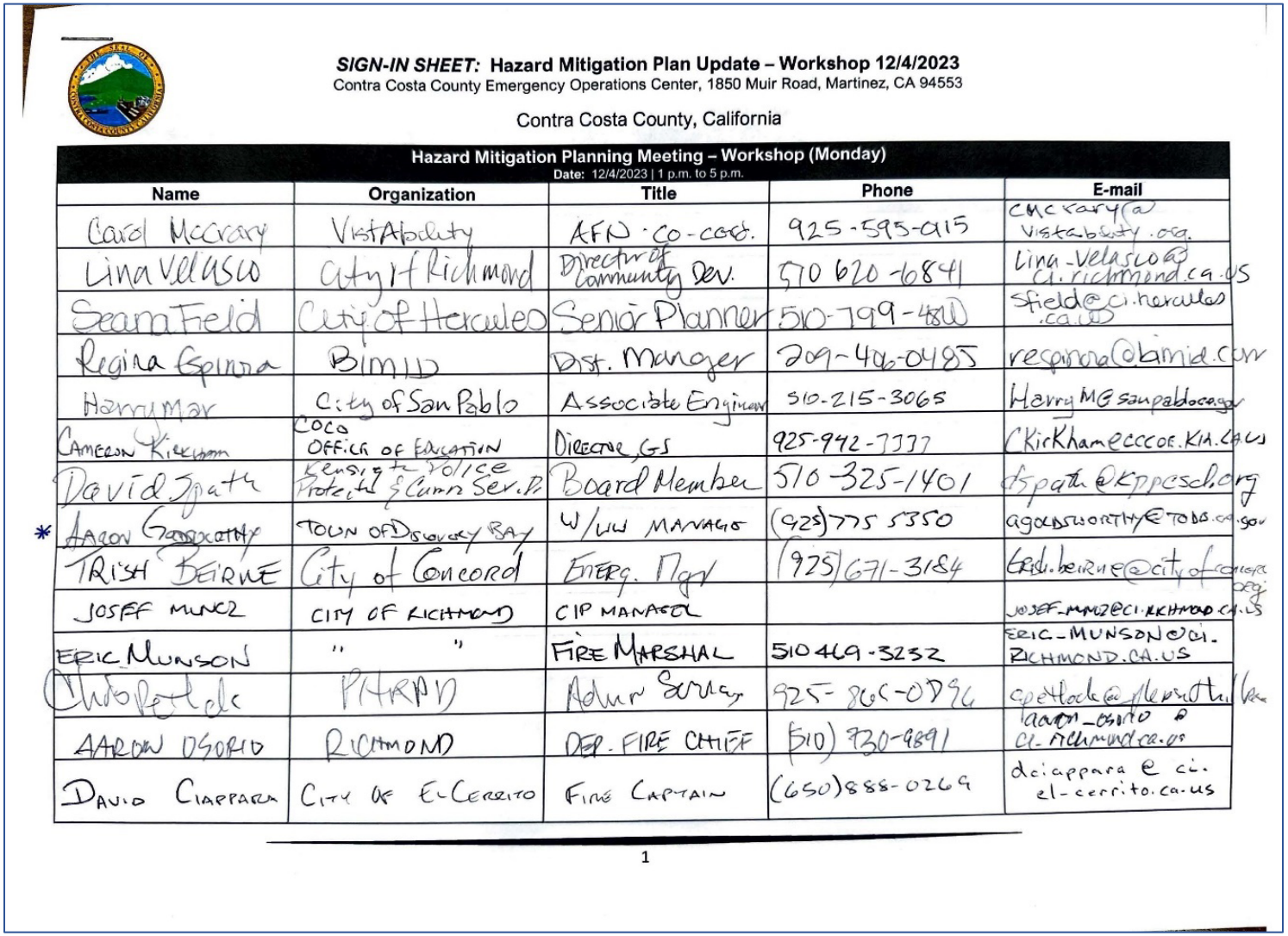
Agenda

- Welcome, Introductions, and Opening Remarks
- Overview of mitigation: Why mitigate?
- How the mitigation plan can benefit my community/district
- Overview of key mitigation plan elements & plan process
- New FEMA guidance that will affect the 2024 update
- Hazard Risk /Risk Assessment Discussion
- Jurisdiction/Agency Hazard Summary
- Mitigation Strategy and Goals Discussion
- Public Survey: Preliminary Findings
- Mitigation Funding Opportunities and Programs
- New and Ongoing Mitigation Actions/Projects
- Capability Assessment
- Plan Participation and Adoption
- Next Steps
- Project schedule and key dates
- Closing Remarks

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December 4, 2023 – Stakeholder Workshop (Session 1) Sign In Sheets

Location: *Contra Costa County EOC – 1850 Muir Road, Martinez, CA 94553*



***SIGN-IN SHEET:* Hazard Mitigation Plan Update – Workshop 12/4/2023**
Contra Costa County Emergency Operations Center, 1850 Muir Road, Martinez, CA 94553

Contra Costa County, California

Hazard Mitigation Planning Meeting – Workshop (Monday)
Date: 12/4/2023 | 1 p.m. to 5 p.m.

Name	Organization	Title	Phone	E-mail
Carol McCrary	VistAbility	AFN Co-Coord.	925-595-915	CMcCrary@vistability.org.
Lina Velasco	City of Richmond	Director of Community Dev.	510 620-6841	Lina-Velasco@ci.richmond.ca.us
Seana Field	City of Hercules	Senior Planner	510-799-4810	sfield@ci.hercules.ca.us
Regina Espinoza	BIMID	Dist. Manager	209-46-0485	respinoza@bimid.com
Harry Mar	City of San Pablo	Associate Engineer	510-215-3065	HarryMG@sanpabloca.gov
Cameron Kirkham	Coco Office of Education	Director, GS	925-942-7777	CKirkham@cccoe.k12.ca.us
David Spath	Kensington Police Protection & Comm Ser. D.	Board Member	510-325-1401	dspath@kppcsd.org
* Aaron Goldsworthy	Town of Discovery Bay	W/WW Manager	(925)775 5350	agoldsworthy@todb.ca.gov
Trish Deirne	City of Concord	Energ. Mgr	(925)671-3184	trish.deirne@city of concord.org
Josef Munoz	City of Richmond	CIP Manager		Josef.munoz@ci.richmond.ca.us
Eric Munson	" "	Fire Marshal	510 469-3232	Eric-Munson@ci.richmond.ca.us
Chris Petlock	PARD	Admin Service	925-807-0976	cpetlock@ci.pleasanton.ca.us
Aaron Osorio	Richmond	Dep. Fire Chief	(510) 930-9891	aaron_osorio@ci.richmondca.gov
David Ciappara	City of El Cerrito	Fire Captain	(650)888-0269	dciappara@ci.el-cerrito.ca.us

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***SIGN-IN SHEET:* Hazard Mitigation Plan Update – Workshop 12/4/2023**
Contra Costa County Emergency Operations Center, 1850 Muir Road, Martinez, CA 94553

Contra Costa County, California

Hazard Mitigation Planning Meeting – Workshop (Monday)
Date: 12/4/2023 | 1 p.m. to 5 p.m.

Name	Organization	Title	Phone	E-mail
MIKE GANCASZ	KENSINGTON POLICE	CHIEF	510-526-41141	MIKEG@KPPCSD.ORG
Mike Alvarez	RD799	General Manager	925-759-8316	dholder@RD799.com
Mike Mirmazaheri	RD799 and Bimid	Dist. Engineer	916-605-8661	mmirmazaheri@geiconsultants.com
Jill Mosley	Contra Costa Water District	Principal Engineer	925-688-8127	jmosley@ccwater.com
Tania Babcock	Eastern Contra Costa Transit Authority Tri Delta Transit	Compliance Mngr	925-754-6622	tbabcock@eccta.org
Dina Breitstein	Town of Discovery Bay	GM	925-634-1131	dbreitstein@todb.ca.gov
Griffen Dempsey	City of San Pablo	Asst. Planner	510 215 3059	griffend@sanpabloca.gov
Daniel Chavarria	City of Richmond	Director Public Works	510.447-0095	daniel_chavarria@ci.richmond.ca.us
Chris Petlock	pleasant hill rec	Admin Services Mgr	925-969-0369	cpetlock@pleasanthillrec.com
Harry Mar	City of San Pablo	Associate Engineer	510-215-3065	HarryM@sanpabloca.gov
Afshan Hamid	Town of Moraga	Planning Dir	925 888 7043	ahamid@moraga.ca.us
Deirdre Castillo	Pleasant Hill	Sr Civil Engr	925 671-5251	dcastillo@pleasanthillca.org
DAVID AVANDA	Kensington Police Protection District	GM	661-300-1231	davanda@kppcsd.org

***SIGN-IN SHEET:* Hazard Mitigation Plan Update – Workshop 12/4/2023**
Contra Costa County Emergency Operations Center, 1850 Muir Road, Martinez, CA 94553

Contra Costa County, California

Hazard Mitigation Planning Meeting – Workshop (Monday)
Date: 12/4/2023 | 1 p.m. to 5 p.m.

Name	Organization	Title	Phone	E-mail
CATHY SURGES-MOSHITO	LAFAYETTE POLICE	ADMIN ANALYST	925-299-3220	CSURGES@CI.LAFAYETTE.CA.US
BEN ALLORITT	LAFAYETTE POLICE	CHIEF	925-299-3221	BALLO@SO.CCCOUNTY.US
NATE MCCORMACK	DANVILLE	EMERGENCY SERVICES MANAGER	925-314-3368	NMCCORMACK@DANVILLE.CA.GOV
DOUG PITTMAN	BRENTWOOD	EMER MGR	415-747-2119	CBSEMC911@GMAIL.COM
CHRIS CASTANCHOA	CITY OF RICHMOND	BUILDING OFFICIAL	510-620-6764	chris_castanchoa@ci.richmond.ca.us
JOHN FORTNER	ANTIOCH PD	LIEUTENANT	925-382-5918	jfortner@antiochca.gov
Mary Morris / Mayorga	Kensington Fire	General Manager	(916)541-0924	mmayorga@KensingtonFire.org
Bradley Harris	City of Richmond	Senior Env Comp	(510)307-8064	Bradley_Harris@ci.richmond.ca.us
Heidi Berenson	EBMUD	Emrgncy Prep Adm.	510-287-0340	Heidi.Berenson@ebmud.com
Tim Simmons	Richmond PD	Asst. Police Chief	(707)652-4555	TSimmons@richmondpd.org
JOE VÁSQUEZ	HERCULES PD	Chief	510-307-5649	jvasquez@HerculesCA.gov
Maggie Dutton	Contra Costa WD	Senior Engineer	925-688-8132	mdutton@ccwater.com
Dana Ayers	Clayton	Community Dev. Director	925-257-0672	danaa@claytonca.gov
JOHN CONTRELL	LAFAYETTE POLICE	EMERGENCY SERVICES	925-490-9926	jcontrell@ci.lafayette.ca.us

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SIGN-IN SHEET: **Hazard Mitigation Plan Update – Workshop 12/4/2023**
Contra Costa County Emergency Operations Center, 1850 Muir Road, Martinez, CA 94553

Hazard Mitigation Planning Meeting – Workshop (Monday)
Date: 12/4/2023 | 1 p.m. to 5 p.m.

Name	Organization	Title	Phone	E-mail
Lance Hurtado	Pleasant Hill Rec & Park	Supt Building Maintenance	925-671-4648	lhurtado@pleasanthillrec.com
Andrea Miller	Richmond	Director of Finance	510-620-6740	andrea_miller@ci.richmond.ca.us
* Jeff Valensi	Public Works (CCC)	Senior Civil Engineer	925-313-2031	jeff.valensi@pw.cccounty.us
Sean Moss	City of El Cerrito	Planning Manager	510-215-4354	smoss@ci.el-cerrito.ca.us
Richard Diaz	City of Richmond	Energy Svcs Mgr.	—	—

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December 6, 2023 – Stakeholder Workshop (Session 2) Sign-In Sheets

Location: *Contra Costa County EOC – 1850 Muir Road, Martinez, CA 94553*

SIGN-IN SHEET: **Hazard Mitigation Plan Update – Workshop 12/6/2023**
Contra Costa County Emergency Operations Center, 1850 Muir Road, Martinez, CA 94553

Contra Costa County, California

Hazard Mitigation Planning Meeting – Workshop (Wednesday)
Date: 12/6/2023 | 8 a.m. to 12 p.m.

Name	Organization	Title	Phone	E-mail
CHRIS ELLIOTT	MT. VIEW SANITARY DISTRICT	DISTRICT ENGINEER	(925) 228-5635	CHRISE@MVSD.ORG
Ryndie Azevedo	City of Walnut Creek	Admin Analyst I	925 943 5899 x2189	razevedo@walnut-creek.org
Jiaqi Chen	West County Wastewater	PESS Mgr	510 622 7000	jchen@wcwd.org
Bruce Sower	Walnut Creek Police	Exec. Lt.	(925) 765-7500	jsower@walnutcreekpd.com
Troy Faulk	City of Oakley	Recreation Mgr.	(303) 888-0694	faulk@ci.oakley.ca.us
Daniele Navarro	City of Oakley	Assist City Mgr	(925) 625-7162	navarro@ci.oakley.ca.us
Tyson Zimmerman	Ironhouse San Dist.	Asst General Mgr	(925) 809-3011	zimmerman@isd.us.com
Tyson Zimmerman	RD 830	Trustee	(925) 809-3011	zimmerman@isd.us.com
Reed Al-Zaher	City of Martinez	Eng. Tech	(405) 762-2588	ral-zaher@cityofmartinez.org
Frank Kong	city of Walnut creek	CBO	(925) 943 5828	Kong@Walnut-creek.org
Aaron Winer	West County Wastewater	Director of Water Quality	(510) 817-9586	awiner@wcwd.org

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SIGN-IN SHEET: **Hazard Mitigation Plan Update – Workshop 12/6/2023**
Contra Costa County Emergency Operations Center, 1850 Muir Road, Martinez, CA 94553

Contra Costa County, California

Hazard Mitigation Planning Meeting – Workshop (Wednesday)
Date: 12/6/2023 | 8 a.m. to 12 p.m.

Name	Organization	Title	Phone	E-mail
Ron Marley	SRVFPD	Emer. Prep. Coord		RMarley@SRV.FIRE.ca.gov
Sandra Leyba	Diablo Water District	Forward Planning Analyst	925 848-0357	sleyba@diablowater.org
Wayne Weaver	Diablo Water	Mgr Const.	925-766-8387	WWeaver@diablowater.org
Stacey Ambrose	MUSD	Deputy Gen Mgr	925-260-2848	sambrose@musd.org
Michael Moncrief	MBK Engineers 8/30/2023/2024/2025/2026/2122/2057	District Engineer	916 761 1281	moncrief@mbkengineers.com
Julia Halsne	MUSD	VP, Board	925 209-8620	jhalsne@mvsd.org
Dan Frost	Central San	Sr. Engineer	925-383-1022	dfrost@centralsan.org
Ken Strelo	Oakley	Planning Manager	925 625 7036	kstrelo@ci.oakley.ca.us
Michael Thompson	Brentwood	Lieutenant	925-584-0984	MThompson@brentwood.ca.gov
Melissa Hickok	Clerk Rec Elections	Exec Sec.	9253357850	Melissa.hickok@cr.cccounty.us
Micki Cronin	City of Orinda	SR Man Analyst	925 253-4227	mcronin@cityoforinda.org
D. Buckley	"	P.D. Lt.	925 [illegible] 9305	dbuckley@cityofpittsburg.ca.gov
David Lowrisson	City of Pittsburg	Planning Manager	510 724-9842	DLowrisson@ci.pittsburg.ca.us
TED LEACH	CCCFPD	FIRE INSPECTOR II	(925) 941-3300 x 1539	tleach@cccfpd.org
ALISTAIR FORTSON	TOWN OF MORAGA	ASST PLN 1	925 888 7042	afortson@moraga.ca.us

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Contra Costa County, California

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Name	Organization	Title	Phone	E-mail
Luis Romero	Diablo Water District	Lead	(925) 575-4190	LRomero@Diablowater.org
Christine Belleci	Diablo Water District	Forward Planning Mgr.	925-848-1224	cbelleci@diablowater.org
Lilia Corona	Mt. View SD	General Mgr	(925) 228-5635	lcoron@mvsd.org
Doug Alessio	City of Orinda	Admin Svs Director	925-253-4224	Dalessio@cityoforinda.org
Kevin Rohani	City of Oakley	PW Director	925-625-7003	rohani@ci.oakley.ca.us
DAVID BIGGS	CITY OF ORINDA	City Manager	925 253 4222	dbiggs@cityoforinda.org
Kenneth Murphy	city of Brentwood	Building Official	925-516-5702	Kmurphy@brentwoodca.gov
Todd Zavazza	Delta Diablo	Safety Mgr.	925 382 4604	tzavazza@deltadiablo.org
Scott Christie	City of Orinda	PW Dir	925-253-4219	schristie@cityoforinda.org
Michelle Cordis	CCC Flood Control Dist	Sr. Civil Eng	925-285-2677	michelle.cordis@pw.cccounty.us
Carla Hansen	City of Walnut Creek	Deputy CM	925 943-5899	hansen@walnut-creek
James Duff	City of Orinda	Outreach Coord	925-253-4225	jduff@cityoforinda.org
Shawn Gruendl	San Ramon Valley USD	EMS specialist	925-518-5200	sgruendl@srvusd.net
Rebecca Ramirez	Rodeo-Hercules Fire Protect. Dist.	Fire Chief	530 979-0346	rramirez@rhfd.org

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Name	Organization	Title	Phone	E-mail
Joe Enke	City of Martinez	PW Director	925-372-3562	jenke@cityofmartinez.org
Abdul Mixon	San Ramon Valley School	Executive Director Bus Ops	707 761-2867	amixon@srvusd.net
Michelle Rinehart	Con Fire	County Coord.	925 440 5831	mrine@cccfpd.org
Ch. Bachman	Fire Ch.	Con Fire	" "	" "
Rich Payne	City WC	PW Manager	925-765-6326	payne@walnutcreek.org
Celina Palmer	City of Orinda	Associate Planner	(925) 253-4212	cpalmer@cityoforinda.org
Amanda Cauble	CCCSD	Assoc Engr	925 229 7363	Acauble@centralsan.org

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Name	Organization	Title	Phone	E-mail
Scott Biocic	Mt View Sanitary Dist.	Wastewater Dept Mgr.	925-228-5635	sbiocic@mvsd.org
Josh McMurray	City of Oakley	City Manager	925 625 7025	mcmurray@ci.oakley ca.us
Ian Barnes	Fehr & Peers	Consultant	925-357-3388	i.barnes@fehrandpeers.com
Shanett Sieh	City of San Ramon	Senior Civil Engineer	925-733-5410	chsieh@sanramon.ca.gov
Maureen Toms	CC County	Deputy Dir	925-655-2895	maureen.toms@dcd.cccounty.us

Photos Stakeholder Workshops





B.4. MULTI-AGENCY COORDINATION MEETING

The Hazard Mitigation Plan update was presented and discussed during the Contral Costa County Operational Area Multi-Agency Coordination (MAC) meeting, which occurs monthly, on November 1, 2023. **Table B-1** lists the MAC members by jurisdiction/organization, name, and title.

Table B-1. Multi-Agency Coordination (MAC) Members List

Name	Department	Title
Aaron Osorio	City of Richmond Fire Department	Battalion Chief
Adam Springer	Contra Costa County Health Services - Hazardous Material	Acting Assistant Director
Adeline Ford	PBF Energy LLC Refinery	Water Environmental Engineer
A.J. "Tony" Semenza	Community Awareness and Emergency Response	Executive Director
Alana Weissman	Contra Costa County Animal Services Department	Lieutenant
Aaron McAlister	Contra Costa County Fire Protection District	Deputy Fire Chief
Anthony Morales	Contra Costa County Water District	
Anthony Morefield	City of Antioch Police Department	Interim Chief
Angelina Camacho	Lone Tree Post Acute Skilled Nursing Facility	
Ann Elliot	Contra Costa County Human Resources Department	Director of Human Resources
Allan Shields	Contra Costa County Office of the Sheriff- Danville Police Department	Chief of Police- Lieutenant
Aimee Vitug-Hom	VistAbility	Program Director
Jessica Azevedo	City of Walnut Creek	Permit Center Supervisor
Ben Alldritt	Contra Costa County Office of the Sheriff- Lafayette Police Department	Chief
Baraka Carter	CAL Fire	Deputy Chief of Operations - Santa Clara Unit
Steven Beall	Rodeo Sanitary District	District Manager
Bear Heartly	Contra Costa County Department of Information Technology	GIS Manager
Brian Helmick	Contra Costa County Fire Protection District	Fire Chief
Brian Hill	Pleasant Hill Police Department	Police Chief
Bill Reid	County Veterans Service Office	Department Head
Agency Contact	Bethel Island Municipal Improvement District	General Manager
Ben Keizer	Contra Costa County Health Services	EMS
Blake Johnson	Bradford Reclamation District 2059	District Engineer
Blanca Gutierrez	Contra Costa Crisis Center- 211	211 Resource Manager
Brian Leonard	City of Pleasant Hill Police Department	Lieutenant - Support Services
Brian Musser	Byron School District	Maintenance and Operations Lead

Name	Department	Title
Bob Ferronato	California Department of Transportation	Maintenance Manager 1
Beatriz Portillo	Contra Costa County Office of the Sheriff OES	Emergency Planning Coordinator
Brad Mustard	Caltrans	District 4 Hazmat Manager
EMS Branch		
Brandon Lum	California Office of Emergency Services	Maritime Intelligence
Brian Balbas	Contra Costa County Department of Public Works	Director
Brian Garcia	National Oceanic and Atmospheric Administration	Warning Coordination Meteorologist
Briana Taylor	American Red Cross	Board Member
Brooke Converse	Contra Costa County Library	Public Information Officer
Brian Sliger	Contra Costa County Office of the Sheriff	Lieutenant - Courts
Claudia Ramirez	The Society of St. Vincent de Paul of Contra Costa County	Executive Director
Carolyn Halstenson	Contra Costa County Department of Public Works	Purchasing
Caryn Thornburg	Tenet Health	Director Plant Operations
Cliff Buxton	City of San Ramon	Emergency Management Analyst
Alexandra McMullen	Contra Costa County Hazardous Materials Programs	Clerical Supervisor
Chau Vo	Contra Costa County Health Services	
Christy Saxton	Contra Costa County Health Services	Director of Health, Housing and Homeless Services
Christine Koehne	San Ramon Valley Unified School District	Special Needs Liason/ Educational Services
Carol McCrary	VistAbility	Director of Operations
	United Way Bay Area General Contact	
Brian Craig	Rodeo-Hercules Fire Department	Fire Chief
Connie Sanders	Contra Costa County Office of the Sheriff	Lieutenant - Watch Commander
Colby LaPlace	Solano County Environmental Health	Sr. Hazardous Materials Specialist
Constance Slessinger	Contra Costa County Employment & Human Services Department	Manager, Procurement & Fleet
Caitlin Sly	Meals on Wheels	Executive Director
Chris Wynkoop	City of Pinole Fire Department	Fire Chief
Cora Young	Contra Costa County Employment & Human Services Department	Emergency and Safety Coordinator
Dally Aleman	Contra Costa County Department of Public Works	Purchasing
Dan Peddycord	Contra Costa County Health Services	Chief Climate & Health Policy Officer
Dante Nomellini Jr.	Central Delta Water Agency	

Name	Department	Title
David Brockbandk	Contra Costa County Department of Conservation and Development	Principal Planner
David Cook	East Bay Municipal Utility District	Manager of Security and Emergency Preparedness
David Despain	Caltrans (Department of Transportation)	Maintenance Manager II
David Woodard	East Bay Municipal Utility District	Manager, Regulatory Compliance
Danielle Bell	San Ramon Valley Fire Protection District	Community Risk Reduction Educator / CERT Coordinator
David Biggs	City of Orinda	City Manager
Dave Christensen	Milestone California-Based Investment Company	Co-Founder and Managing Principle
Denton Carlson	City of San Ramon	Captain - Virtual SRPD
Dean Colombo	Crockett-Carquinez Fire Department	Fire Chief
Debi Cooper	Contra Costa County Clerk-Recorder	Clerk-Recorder and Registrar of Voters
Debra Strawther	Delta View Post Acute Care Skilled Nursing Facility	
Desbele Gebre	Contra Costa County Department of Public Works	Senior Buyer
David Hall	Contra Costa County Office of the Sheriff	Captain - Training
Mike Alvarez	Reclamation District	District Manager
Michael Butier	California Department of Social Services - Disaster Services Branch	State FAST Coordinator
Diane Maltester	Contra Costa Interfaith Coalition & Council	Chair
Daniel Mcnamara	San Ramon Valley Fire Protection District	SRM Battalion Chief
David Nielson	Contra Costa County Office of the Sheriff	Communications
	Contra Costa County Health Services	
Doug Pittman	City of Martinez	Emergency Management Analyst
Doug Pittman	City of San Pablo Police Department	Emergency Services Manager
Deanne Pearn	Contra Costa Crisis Center - Hope Solutions	Executive Director
David Peters	Dublin San Ramon Services District	Safety Officer
Dennis Rein	Moraga-Orinda Fire District	Public Information Officer
David Shroer	City of Brentwood Police Department	Police Lieutenant
Dave Winnacker	Moraga Orinda Fire	Fire Chief
Dylan Radke	Contra Costa County Council	
Emelia Gabriele	Contra Costa County Employment & Human Services Department	Director of Administration Services
Mark Jelonek	Chevron Refinery	Division Chief of Emergency Response/Planning/Training
Eric McQuoid	Contra Costa County Office of the Sherriff OES	Captain

Name	Department	Title
Enid Mendoz	Contra Costa County CAO	Senior Deputy CAO
Eric Presser	MOTCO Military Ocean Terminal Concord	Emergency Manager
Erika Jenssen	Contra Costa County Health Services	Deputy Director
Erinn Riley	Contra Costa County Office of the Sheriff	911 County Coordinator/Dispatch Supervisor
Rev. Will McGarvey	Interfaith Council of Contra Costa County	Executive director
Kevin Finn	Central Contra Costa Transit Authority	Procurement
Garrett Thomsen	California Office of Emergency Services	Coastal Region Response
Geoffrey Martin	Contra Costa Health Services - Emergency Medical Services	Pre-Hospital Care Coordinator
Gred Kogler	City of Pleasant Hill Police Department	Captain
Glen Kimball	Contra Costa County TV	Community and Media Relations Specialist
Greg Baer	Contra Costa County Department of Public Works	Director of Airports
Glorian Sasser	Moraga-Orinda Fire District	Administrative Services Director
	Food Bank of Contra Costa and Solano	
Major Gwyn Jones	Concord Corps. - The Salvation Army	Commanding Officer
Huma Abbasi	Chevron	Chief Medical Officer
Heather Hackett	Futures-Explored	
Heidi Benenson	East Bay Municipal Utility District	Emergency Preparedness and Business Continuity Administrator
Nate Hershey	MBK Engineers - Reclamation Districts 830, 2025, 2026, 2137	District Engineer
Hannah Michaelson	The Care Parent Network	Program Director
Ilana Israel-Samuels	San Ramon Valley Unified School District	Public Information Officer
Jonas Aguiar	San Ramon Valley Fire Protection District	Battalion Chief
James Lambert	The Permanente Medical Group	Service Line Director
Jane Andriotti	Contra Costa County Animal Services Department	Captain / Field Services Unit
Brian Janowiak	BMK Engineers	Supervising Engineer
Jason Crapo	Contra Costa County Department of Conservation and Development	Deputy Director (Building Division)
James Barnhill	Crockett Community Services District	Sanitary Department Manager
Joe Bingaman	City of Pinole Public Works	Manager
Jennifer Cannon	Contra Costa County Office of the Sheriff-Community Warning System	Emergency Planning Coordinator-CWS
Jose Castrejon	City of El Cerrito Fire Department	Battalion/Training Chief, Fire Operations

Name	Department	Title
Julie Cavallero	Contra Costa County Office of the Sheriff-Community Warning System	Community Warning System Manager
John Cornell	City of Lafayette Police Department	Police Services Assistant
Jeff Krieger	City of Concord Police Department	Lieutenant
Jennifer Hopkins	Contra Costa County Department of Information Technology	Assistant Chief Information Officer
Jeremy Hough	John Muir Health	Director
Jeremy Rogers	City of Pinole	Community Services Director
John Fortner	City of Antioch Police Department	Lieutenant
Jeff Gove	Bay Area Air Quality Management District	Director of Compliance and Enforcement
James Ferris	P66 Rodeo Refinery	Fire Chief
James Matzorkis	Port of Richmond	Executive Director
Jeff Isaacs	Moraga-Orinda Fire District	Fire Marshal
James Larot	Contra Costa Water District	Operations Control Administrator
John Kan Lee	Regional Center of the East Bay	Emergency Coordinator Specialist
Jimmy Lee	Contra Costa County Office of the Sheriff	Public Information Officer
J.B Morris	Food Bank of Contra Costa and Solano	Logistics Manager
Joanne.Chiu	Contra Costa County Department of Conservation and Development	Senior Planner, East Contra Costa County Habitat Conservancy
Jocelyn LaRocque	Contra Costa County Department of Public Works	Division Manager
Jocelyn Stortz	Contra Costa County Environmental Health	Director of Environmental Health
Jody London	Contra Costa County Department of Conservation and Development	Sustainability Coordinator
Joe Yee	Contra Costa County Department of Public Works	Deputy Director
John Cunningham	Contra Costa County Department of Conservation and Development	Transportation Planner
John F. Jones	CocoKids	Executive Director
John Wiggins	Contra Costa County Environmental Health	Supervising Environmental Health Specialist
Joseph Bateman	Valero Energy Corporation	Operations Supervisor
Joe Piro	Contra Costa Water District	Response Project Manager
	Independent Living Resources	
Josph Vasquez	Hercules Police Department	Chief
Karl Fischer	Contra Costa County Health Services	Community and Media Relations Specialist
Kelly Batson	United Way Bay Area	Senior Administrator

Name	Department	Title
Kelly Kalfsbeek	Contra Costa County Department of Public Works	Community and Media Relations Coordinator
Katie Haun	Athoc/Blackberry	Account Relations Manager
Kim McCarl	Contra Costa County Health Services	Communications Officer
Kevin Janes	City of El Cerrito Fire Department	Battalion Chief
Kristi Jourdan	Contra Costa County Office of Communications and Media	Director, Office of Communications and Media
Kristian Lucas	Contra Costa County Health Services	Assistant Director of Environmental Health
Lara DeLaney	Contra Costa County CAO	Senior Deputy County Administrator
Lavonna Martin	Contra Costa County Health Services	Deputy Director of Health Services
Lesley Garcia	Contra Costa Crisis Center - 211 Contra Costa	Director of Programs
Lewis Broshard	Contra Costa County Fire Protection District	Fire Chief
Lon Goestch	Contra Costa County Fire Protection District	Assistant Fire Chief - C Shift
Lorena Herrera	Contra Costa County Office of the Sherriff OES	Senior Emergency Planning Coordinator
Lissette Davis	Contra Costa County Office of Communications and Media	Community and Relations Specialist
Liz Dietz	Red Cross	Disaster Health Services Manager / Disability Integration Regional Lead
Lucas Lambert	Moraga-Orinda Fire District	Battalion - Chief
Lynn Mackey	Contra Costa Office of Education	County Superintendent of Schools
Leslie Monroy	Contra Costa County Office of the Sheriff-Community Warning System	Emergency Planning Coordinator-CWS
Les Putnam	Pacific Gas & Electric	Public Safety Specialist
Lucy Zhou	City of Richmond	Port Marketing/ Operations Manager
Lulis Lopez	Contra Costa County Treasurer-Tax Collector	Contra Costa County Auditor Controllers Office
Mark Whitlock	BI Safety Committee	
Manly Moulton	City of Richmond Fire Department	Battalion Chief
Marc Shorr	Contra Costa County Department of Information Technology	Chief Information Officer
Marianne Iversen	Down Syndrome Connection of the Bay Area	Director of Teen and Adult Services
Marshall Bennett	Contra Costa County Health Services - Emergency Services	Director of Emergency Medical Services
Mathais Wakefield	California Department of Social Services	
Matt Kaufmann	Contra Costa County Health Services	Deputy Director
Matthew Slattengren	Contra Costa County Agriculture / Weights and Measures	Ag Commissioner/Weights and Measures Director

Name	Department	Title
Maureen Toms	Contra Costa County Department of Conservation and Development	Deputy Director, Policy Planning
Matt Avery	City of Pinole Police Department	Public Information Officer Lieutenant
Megan Benveniste	Contra Costa County Office of the Sherriff OES	Clerk
Michael Casten	Contra Costa County Office of the Sheriff	Undersheriff
Joshua McMurray	City of Oakley	City Manager
Micki Cronin	City of Orinda	Sr. Management Analyst
Rebecca Melvin	City of Walnut Creek	Office Specialist - Risk Management, Emergency Management, City Attorney's Office
Maria Lupita Mendoza	Sutter Delta Medical Center	Safety Officer
Michael Brill	BART Police Department	Manager of Emergency Preparedness
Michael Callanan	Contra Costa County Health Services	CORE Outreach Coordinator
Michael Dossey	Contra Costa County Health Services - Hazardous Material	Accidental Release Prevention Engineer
Michael Miller	Martinez Refining Company Fire Department	Fire Chief/Safety Supervisor
Michael Tognolini	East Bay Municipal Utility District	Director of Water and Natural Resources
Michelle Heckle	University of San Francisco	Division Commander - Homeland Security Emergency Management
Michael Hendley	Capitol Corridor Joint Powers Authority	Transportation Services Manager
Scott Mitchell	County Connection	Chief Operating Officer
Mark Johnson	Contra Costa County Office of the Sheriff	Lieutenant
Melissa Klawuhn	Contra Costa County Office of the Sherrif	Assistant Sheriff
Monica Nino	Contra Costa County Clerk Administrators Office	Chief Officer
Morgan March	DOIT County GIS	GIS Technician
Mike Quesada	Contra Costa County Fire Protection District	A Shift Duty Officer
Mark Bennett	Martinez Refinery	Safety Supervisor
Meera Sreenivasan	Contra Costa Health Services	Deputy Health Officer / Communicable Disease Controller
Monica Stoeffl	California Resiliency Alliance	Executive Director
Marla Stuart	Contra Costa County Department Employment & Human Services Department	Director
NWS - SF Bay Area	National Weather Service	Meteorologist
Miki Tsubota	Contra Costa Water District	Director of Public Works
Nancy Navarro	PBF Energy	Security Manager

Name	Department	Title
Natalie Manier	American Red Cross	Disaster Program Manager
Danielle Navarro	City of Oakley	Assistant City Manager
Neil Baranik	Solvay	Process Engineer
Nicole Benty	CAL Fire Diablo Battalion	Battalion Chief
Nicole Heath	Contra Costa County Health Services	Acting Director of Hazardous Materials Programs
Nate McCormack	Town of Danville	Emergency Services Manager
Noah Brownlow	City of Richmond Fire Department	Battalion Chief
Nanette Wellman	Contra Costa County District Attorney	DA Manager of Law Offices
Ori Tzvieli	Contra Costa County Health Services	Health Officer/Public Health Director
Patti Tran	California Department of Social Services	Mass Care and Shelter Coordinator
Paul Keith	El Cerrito Police Department	Chief
Patrick Salmaid	City of Martinez Police Department	Lieutenant
Pace Stokes	Alameda County Sheriff's Office of Emergency Services	Captain
Jeanet Lara	Moraga Public Works	Senior Administrative Assistant
Rebecca Ramirez	Rodeo-Hercules Fire Protection District	Fire Chief
Ryndie Azevedo	City of Walnut Creek Risk Management	Administrative Analyst 1
Regina Espinoza	Bethel Island Municipal Improvement District	District Manager
Rich McEachin	City of Clayton	Police Chief
Rick Kovar	Contra Costa County Office of the Sherriff OES	Emergency Services Manager
Ron Marley	San Ramon Valley Fire Protection District	Emergency Preparedness Coordinator
Ramsay Mashy	California Autism Foundation	Director of Quality Assurance and Community Services
Rob Thompson	Westcat Public Transportation Services	General Manager
Robbie Morris	Corteva Agriscience	ER&S Specialist/Fire Chief
	Independent Living Resources	
Ronald Maria	California State Lands Commission	Assistant Chief Marine Environmental Protection
Bret Prebula	City of Clayton	Interim City Manager
Ronda Boler	Contra Costa County Treasurer-Tax Collector	Executive Secretary to the Treasurer - Tax Collector
Ron Halog	ILRSCC (Independent Living Resources Solano and Contra Costa County	Emergency Preparedness Coordinator
Ryan Sullivan	City of Orinda	Police Chief
Russ Norris	City of Concord Police Department	Sergeant

Name	Department	Title
Russell Milburn	Contra Costa County Department of Public Works Airport Division	Assistant Director of Airports - Operations
Russell Watts	Contra Costa County Treasurer	Treasurer-Tax Collector
Ruth Adams	Contra Costa County Health Services	Branch Coordinator
Ruth Raisner	Contra Costa County Health Services	Medical Countermeasures Coordinator
Steve Albanese	City of Pittsburg Police Department	Captain
Salma Sadiq	Contra Costa County Human Resources Department	Employee Benefits Analyst
Scott Joseph	Chevron Refinery	Fire Fighter
Steve Devine	City of Martinez	Senior Management Analyst
Shanon Winston	Contra Costa County Risk Management	Safety Services Specialist
Shasa Curl	City of Richmond	City Manager
Shirell Naidu	California Department of Social Services	Emergency Services Coordinator / Regional Mass Care Coordinator for Region II
Shawn Knapp	Moraga Public Works	Director of Public Works, Town Engineer
Sefanit Mekuria	Contra Costa County Health Services	Deputy Health Director
Sonnet Rodriguez	Reclamation District 800 (Byron Tract)	District Manager
Stan Massie	American Red Cross	Leadership Council Chair
Stephen W. Griswold III	Office of Supervisor Diane Burgis	District Representative
Stephen Terrin	Metropolitan Transportation Commission	Emergency Coordinator
Steve Burdo	Contra Costa County Animal Services Department	Public Information Office
Public Information Officer	Contra Costa County Fire Protection District	Public Information Officer
Susan Vasquez	City of Antioch	Principal Executive Assistant City Manager’s Office
Terrence Cotcher	East Bay Regional Park District	Lieutenant of Police
Ted Asregadoo	Contra Costa District Attorney's Office	Public Information Officer
Tish Gallegos	Employment & Human Services Department	Community Relations/Media Division Manager / PIO
Tim Jenson	Contra Costa County Department of Public Works	Assistant Public Works Director
Timothy Ellsworth	Contra Costa County Health Services	Environmental Health Specialist
Tim Ewell	Contra Costa County CAO	Chief Assistant County Administrator
Tim Herbert	City of Brentwood Police Department	Captain
Todd Fitsimmons	Contra Costa County Department of Conservation and Development	Senior Planner
Trish Beirne	City of Concord	Emergency & Volunteer Services Manager

Name	Department	Title
Uriel Diaz	Tri Delta Transit	Special Projects Analyst/ Emergency Operations Center Manager
Warren Lai	Contra Costa County Department of Public Works	Deputy Director
Zuna Baker Portillo	City of Pittsburg	Environmental Health and Safety Officer
Lilia Corona	Mountain View Sanitary District	General Manager
Lance Littlejohn	Contra Costa County VOAD	VOAD Lead
Cole Robyn	California Office of Emergency Services	Emergency Services Coordinator

B.5. WHOLE COMMUNITY

Contra Costa County provided key stakeholders an opportunity to be involved in the planning process. This included, but was not limited to, sharing information and input to inform the Plan's content; assist with targeted outreach and engagement, especially for the underserved communities; and review and feedback on the Plan during the plan comment period. Stakeholders are individuals or groups that a mitigation action or policy affects and involving them in the planning process helps obtain support for the Plan and identify barriers to carry out hazard mitigation.

The following stakeholder types were provided an opportunity to be part of the planning process.

- Local and regional agencies involved in hazard mitigation activities (e.g., public works, emergency management, local floodplain administration and GIS departments).
- Agencies that have the authority to regulate development (e.g., zoning, planning, community and economic development departments, building officials, planning, commissions and other elected officials).
- Neighboring communities (e.g., adjacent local governments, including special districts and tribes, that are affected by similar hazard events. They also may share a mitigation action or project that crosses jurisdictional boundaries).
- Businesses, academia, and other private interests (e.g., private utilities, chambers of commerce, dam owners, local or regional educational centers within the jurisdiction, or major employers that sustain community lifelines).
- Nonprofit organizations, including community-based organizations that work directly with and/or provide support to underserved communities and socially vulnerable populations (e.g., faith-based organizations, disability agencies or non-governmental organizations, rural support agencies, health and social services departments, housing agencies and housing advocacy groups.

The stakeholders that were provided an opportunity to participate in the planning process, including review and feedback of the draft Plan, for the Contra Costa County Hazard Mitigation Plan are listed below in no particular order.

Local and Regional Agencies	
Alameda County Sheriff's OES	Contra Costa County Mosquito and Vector Control District
Bay Area Air Quality Management District	Contra Costa County Office of Communication and Media
Cal OES	Contra Costa County Office of Education
CalFire	Contra Costa County Office of Restorative Equity and Social Justice
California Department of Parks and Recreation	Contra Costa County Office of the Sheriff
California Department of Social Services	Contra Costa County Probation
California Department of Transportation (Caltrans)	Contra Costa County Risk Management

Local and Regional Agencies	
California Department of Water Resources	Contra Costa County Transportation Authority
California Highway Patrol	Contra Costa County Treasurer-Tax Collector
California State Lands Commission	Contra Costa County Veteran Services Office
Capitol Corridor Joint Powers Authority	Contra Costa County Volunteer Organizations Aiding in Disaster
Central Delta Water Agency	Contra Costa County Water District
Contra Costa County Administrator's Office	Contra Costa Regional Medical Center
Contra Costa County Airport	Dublin San Ramon Services District
Contra Costa County Animal Services Department	East Bay Municipal Utility District
Contra Costa County Auditor – Controller	East Bay Regional Park District
Contra Costa County Clerk-Recorder	Golden Gate, Bridge, Highway and Transportation District
Contra Costa County Counsel	Metropolitan Transportation Commission
Contra Costa County Department of Agriculture	Military Ocean Terminal Concord
Contra Costa County Department of Conservation and Development	National Oceanic and Atmospheric Association
Contra Costa County Department of Information Technology	National Weather Service
Contra Costa County Department of Public Works	Rodeo Sanitary District
Contra Costa County District Attorney's Office	State Water Resources Control Board
Contra Costa County Employment & Human Services Department	Tri Delta Transit
Contra Costa County Health Services	West Contra Costa Transit Authority
Contra Costa County Human Resources Department	WestCAT
Contra Costa County Library	

Agencies that have the Authority to Regulate Development	
Contra Costa County Department of Conservation Development	Contra Costa Local Agency Formation Commission

Neighboring Communities	
Alameda County	Bouldin Island Reclamation District
City of Antioch	Reclamation District No. 2059 (Bradford Island)
City of Concord	Byron-Bethany Irrigation District
City of Pittsburg	Crockett Community Services District
Marin County	Crockett-Carquinez Fire Department

Neighboring Communities	
Sacramento County	Moraga-Orinda Fire District
San Joaquin County	Reclamation District No. 800 (Byron Tract)
Solano County	
Yolo County	

Nonprofit Organizations	
American Red Cross	Futures Explored
California Autism Foundation	Independent Living Resources – Solano and Contra Costa Counties
California Resiliency Alliance	Inter-Tribal Council of California
Care Parent Network	La Familia Counseling
CARESTAR Foundation	Loaves and Fishes – Contra Costa County
Carlton Senior Living	Meals on Wheels
CocoKids	Monument Crisis Center
Community Awareness and Emergency Response	Regional Center of the East Bay
Concord Corps. – The Salvation Army	Richmond Community Foundation
Contra Costa County Crisis Center - 211	Society of St. Vincent de Paul of Contra Costa County
Contra Costa County Crisis Center – Hope Solutions	United Way Bay Area
Interfaith Council of Contra Costa County	VistAbility
Down Syndrome Connection of the Bay Area	

Businesses, Academia, and Other Private Organizations	
AC Transit	Global Medical Response
Amtrak	John Muir Behavioral Health
AtHoc/Blackberry	Kaiser Permanente Hospital
Bloomfield Cherries	Lone Tree Post Acute Skilled Nursing Facility
BMK Engineers	Marathon Petroleum
BNSF Railway	Martinez Refinery Company/PBF Energy
Brenden Theater	Milestone California-Based Investment Company
Byron School District	MV Transportation
California State University	Pacific Gas & Electric
Canyon Elementary School **	Philips 66 Rodeo Refinery
Chevron Refinery	Shell Oil Company

Businesses, Academia, and Other Private Organizations	
Contra Costa County Community College District	Sutter Delta Medical Center
Contra Costa Event Park – Contra Costa County Fair	Tenet Health
Corteva	University of San Francisco
County Connection Transportation and Link Paratransit Services	Valero Energy Corporation
Delta View Post Acute Care Skilled Nursing Facility	Vituity
EcoServices	
Food Bank of Contra Costa and Solano	

APPENDIX C. PUBLIC ENGAGEMENT

The mitigation planning process promotes awareness of hazard risks and continues the conversation about the community's safety and resilience. A hazard mitigation plan generates additional community support when it accurately reflects the values and priorities of the community which will lead to successfully implementing the mitigation actions and projects identified in this Plan.

Federal regulations for mitigation plan approval require that stakeholders and the general public are given opportunities to be involved in the plan's development and update process. Input from community members can strengthen the content and outcomes of the hazard mitigation plan. Furthermore, the plan must state continued public engagement as the Plan is carried out during its lifetime.

A public outreach strategy outlines what the community intends to achieve throughout the outreach efforts. Additionally, it identifies who to involve in the process, and how and when to effectively engage the community. Every plan participant can employ a slightly tailored engagement strategy that suits their community's demographics, including the underserved population, and needs in addition to the lead jurisdiction's engagement strategy.

Contra Costa County stakeholders and the public were given a number of opportunities to be involved throughout the planning process. Opportunities were provided via a public survey, in-person and virtual public meetings, and public engagement activities to review the Plan draft (i.e., public comment period).

Contra Costa County and its plan participants ensured that the stakeholder and public engagement was meaningful and productive. Additionally, the County coordinated social media, website, and news media efforts that participating jurisdictions were able to leverage within their respective outreach activities throughout the planning process. Examples of how Contra Costa County successfully used different types of outreach methods, as outlined in FEMA's Local Mitigation Planning Handbook, are listed in **Table C-1**.

Table C-1. Contra Costa County Outreach Methods

Method	Purpose	Description
Community Events	Inform	Host a booth at a fair or other event where the community will gather. Use the booth to teach residents about preparing for natural hazards. Share materials on related topics with visitors. Consider games, giveaways or other incentives as ways to engage at the event.
Interviews	Consult	Host a series of structured discussions. They could be telephone or face-to-face interviews with leaders and representatives from each of the county's communities, school districts, and the public. This could help to identify hazards of concern and potential mitigation measures.
News Media	Inform	Work with local media outlets, including television, radio and print media partners. They can prepare stories that promote broad public involvement.

Method	Purpose	Description
Public Meetings	Inform, Involve	Through a participating jurisdiction's Corporate Communications and Marketing Office, email newsletters soliciting input on draft plan documents and public meeting attendance. Distribution lists could include government agencies, businesses, and civic organizations. Send public meeting details to all city and county employees. Also, post them to the community's online public events calendar. Add them to live tickers that scroll across the bottom of the local government access television channel as well. Share live coverage of public input meetings and let residents share their questions or comments by email.
Presentation to Governing Bodies	Inform	Share the status of the plan with the board of county commissioners or similar governing body. These meetings should be public, and an announcement of the plan agenda item should be included in the announcement of the public meeting.
Questionnaires/ Surveys	Consult	Use a survey to get information from people who could not attend the public meetings. Post the survey to your community's social media account(s). Ask local officials to give out copies of the survey. Have copies available for residents at municipal offices. Those offices can also post an electronic version on their websites. Where applicable, create questionnaires/surveys in multiple languages.
Roundtables/Forums	Collaborate	Sponsor a public forum to get ideas from residents on how to reduce the risk of natural hazards. This could be the main event for teaching the public. It is also a chance to let the public add to the plan's action items. The resulting ideas may inform the jurisdiction's planning team about risks, strengths, weaknesses and opportunities.
Social Media	Inform, Involve	Make a mitigation plan Facebook page, Twitter account, or Instagram account. The page or account can include small video clips of community leaders talking about the need for mitigation planning. The page or account can also link to your questionnaire/survey. Use the page or account to hold raffles or giveaways. This will help to support participation. For example, you may post that "All those who participate and share feedback through this page or account will be entered into a drawing."
Area-Specific Meetings	Involve	Host small, area-specific meetings twice each year. You can hold them at public libraries and other public venues. These meetings give you a chance to share reading materials. They can educate residents on actions they can take to mitigate natural hazards, save lives and prevent property damage. These meetings can also gather input on making the mitigation process more effective.

Method	Purpose	Description
Website	Involve, Consult	You can use a website to promote the mitigation plan by sharing: • What hazard mitigation planning is. • A list of who is involved in the local planning process. • How the plan update process works. • Information about future stakeholder meetings and chances for public involvement. You can share contact information for questions or comments. Downloads available from the site could include copies of the existing

Outreach Purpose Definitions:

Inform: *To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.*
Consult: *To obtain public feedback on analysis, alternatives and/or decisions.*
Involve: *To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.*
Collaborate: *To partner with the public in each aspect of the decision, including the development of alternatives and the identification of the preferred solution.*
Empower: *To place final decision making in the hands of the public.*

Public engagement participation and supporting documentation for <u>each</u> plan participant can be found in their respective annexes.

How Public Input was Incorporated into the Plan

Information and feedback gained through the public survey, public meetings, and public comment period provided valuable data to validate and confirm the risk assessment findings and potential mitigation strategies. Specifically, feedback from the public offered during the public meetings offered greater insights into the public's concerns regarding specific hazards and their impacts. The public also offered specific initiatives they felt would create greater resiliency for the County and its residents.

Survey results helped validate the hazards included in the Plan, the hazard ranking process, and areas where the County and jurisdictions could further improve outreach and education efforts. Open-ended responses, specifically regarding their experience with damages from past hazards, helped to validate hazard-specific impact data in *Chapter 4 (Hazard Identification and Risk Assessment)*. These, and related findings, helped the Core Planning Team and local planning teams determine meaningful mitigation projects.

C.1. PUBLIC MEETINGS

Contra Costa County OES hosted three (3) public meetings throughout the County on December 4, 2023, December 5, 2023, and December 6, 2023. Two (2) public meetings were conducted in hybrid format with the public having the option to attend in person or virtually (i.e., Zoom, live stream). These meetings allowed the County to introduce the Plan update, identify additional hazards of concern that should be included, if any, and to provide input for the various mitigation measures intended to eliminate or reduce the negative impact to those hazards. Language translation assistance in Spanish was available in all public meetings.

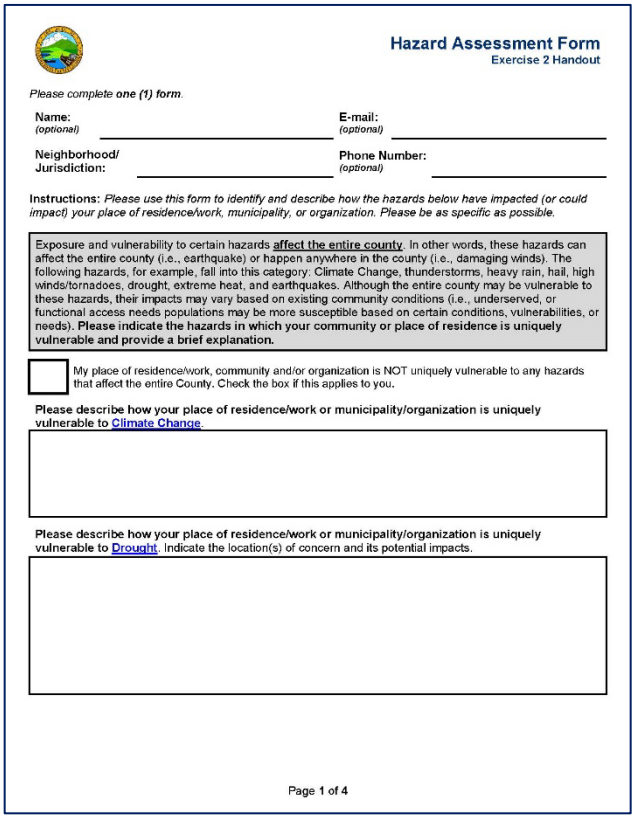
During the Public Meetings, forms were provided to each participant to identify and describe how the identified hazards for Contra Costa County have impacted (or could impact) their place of residence and/or work, municipality, or organization. Additionally, participants were asked to provide mitigation actions/ideas and to identify additional hazards of concern. Although highly encouraged, these forms were voluntary and confidential.

Public Meeting Calendar

December 2023		
Date	**Monday, December 4th**	**Tuesday, December 5th**
Event Name	Public Meeting #1	Public Meeting #2
Location	Contra Costa County Auditorium 1850 Muir Road, Martinez, CA 94553	San Pablo Community Center 2450 Road 20, San Pablo, CA 94806
Outreach Method	Public Meetings, Roundtable/Forums	Public Meetings, Roundtable/Forums
Outreach Purpose	Inform, Involve, Collaborate	Inform, Involve, Collaborate
Targeted Population	Countywide (Access and Functional Needs, Age, Ethnicity, High Poverty, Limited Access to a Vehicle, Limited English Proficiency)	Countywide (Access and Functional Needs, Age, Ethnicity, High Poverty, Limited Access to a Vehicle, Limited English Proficiency)
Accommodations Provided	After Hours, Spanish Speaking Available, Virtual Options	After Hours, Spanish Speaking Available, Virtual Options
Date	**Wednesday, December 6th**	
Event Name	Public Meeting #3	
Location	Oakley City Council Chambers 3231 Main Street Oakley, CA 94561	
Outreach Method	Public Meetings, Roundtable/Forums	
Outreach Purpose	Inform, Involve, Collaborate	
Targeted Population	Countywide (Access and Functional Needs, Age, Ethnicity, High Poverty, Limited Access to a Vehicle, Limited English Proficiency)	
Accommodations Provided	After Hours, Spanish Speaking Available	

The public meeting forms samples, agendas, sign in sheets are below.

Hazard Assessment Form



Hazard Assessment Form
Exercise 2 Handout

*Please complete **one (1) form**.*

Name: *(optional)* _____ **E-mail:** *(optional)* _____

Neighborhood/ Jurisdiction: _____ **Phone Number:** *(optional)* _____

Instructions: *Please use this form to identify and describe how the hazards below have impacted (or could impact) your place of residence/work, municipality, or organization. Please be as specific as possible.*

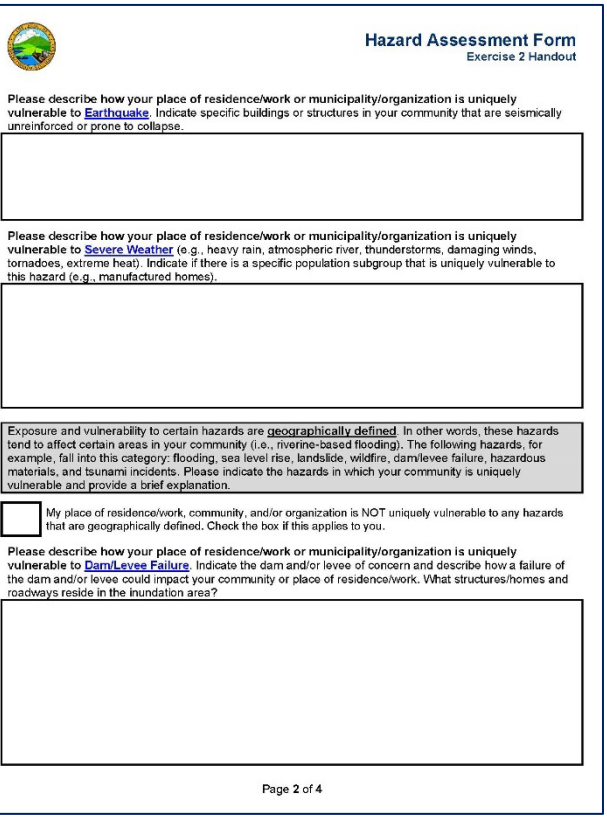
Exposure and vulnerability to certain hazards affect the entire county. In other words, these hazards can affect the entire county (i.e., earthquake) or happen anywhere in the county (i.e., damaging winds). The following hazards, for example, fall into this category: Climate Change, thunderstorms, heavy rain, hail, high winds/tornadoes, drought, extreme heat, and earthquakes. Although the entire county may be vulnerable to these hazards, their impacts may vary based on existing community conditions (i.e., underserved, or functional access needs populations may be more susceptible based on certain conditions, vulnerabilities, or needs). **Please indicate the hazards in which your community or place of residence is uniquely vulnerable and provide a brief explanation.**

☐ My place of residence/work, community and/or organization is NOT uniquely vulnerable to any hazards that affect the entire County. Check the box if this applies to you.

Please describe how your place of residence/work or municipality/organization is uniquely vulnerable to Climate Change.

Please describe how your place of residence/work or municipality/organization is uniquely vulnerable to Drought. Indicate the location(s) of concern and its potential impacts.

Page 1 of 4



Hazard Assessment Form
Exercise 2 Handout

Please describe how your place of residence/work or municipality/organization is uniquely vulnerable to Earthquake. Indicate specific buildings or structures in your community that are seismically unreinforced or prone to collapse.

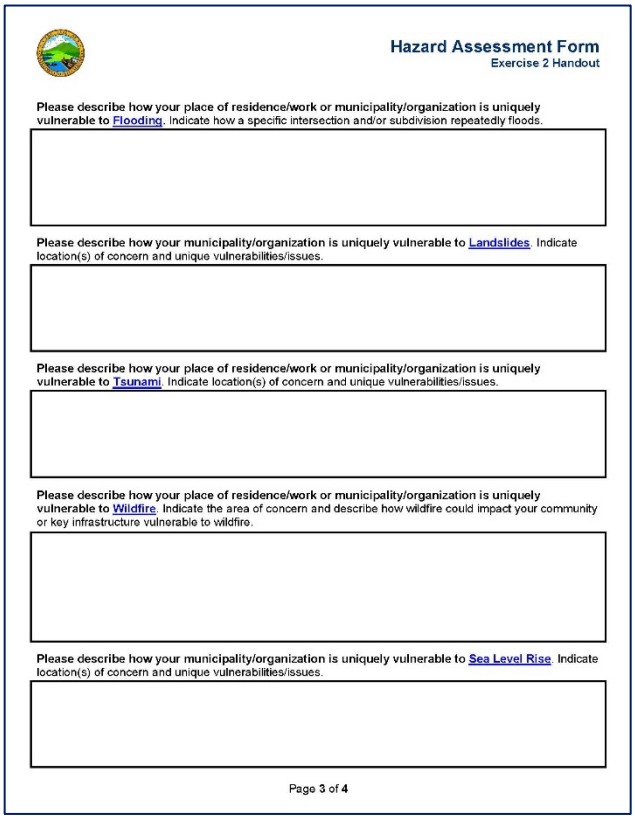
Please describe how your place of residence/work or municipality/organization is uniquely vulnerable to Severe Weather (e.g., heavy rain, atmospheric river, thunderstorms, damaging winds, tornadoes, extreme heat). Indicate if there is a specific population subgroup that is uniquely vulnerable to this hazard (e.g., manufactured homes).

Exposure and vulnerability to certain hazards are geographically defined. In other words, these hazards tend to affect certain areas in your community (i.e., riverine-based flooding). The following hazards, for example, fall into this category: flooding, sea level rise, landslide, wildfire, dam/levee failure, hazardous materials, and tsunami incidents. Please indicate the hazards in which your community is uniquely vulnerable and provide a brief explanation.

☐ My place of residence/work, community, and/or organization is NOT uniquely vulnerable to any hazards that are geographically defined. Check the box if this applies to you.

Please describe how your place of residence/work or municipality/organization is uniquely vulnerable to Dam/Levee Failure. Indicate the dam and/or levee of concern and describe how a failure of the dam and/or levee could impact your community or place of residence/work. What structures/homes and roadways reside in the inundation area?

Page 2 of 4



Hazard Assessment Form
Exercise 2 Handout

Please describe how your place of residence/work or municipality/organization is uniquely vulnerable to Flooding. Indicate how a specific intersection and/or subdivision repeatedly floods.

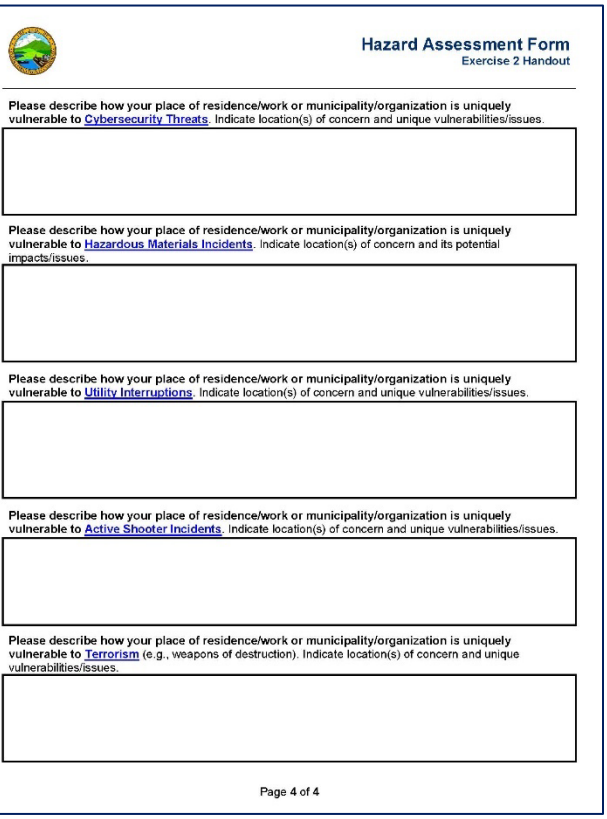
Please describe how your municipality/organization is uniquely vulnerable to Landslides. Indicate location(s) of concern and unique vulnerabilities/issues.

Please describe how your place of residence/work or municipality/organization is uniquely vulnerable to Tsunami. Indicate location(s) of concern and unique vulnerabilities/issues.

Please describe how your place of residence/work or municipality/organization is uniquely vulnerable to Wildfire. Indicate the area of concern and describe how wildfire could impact your community or key infrastructure vulnerable to wildfire.

Please describe how your municipality/organization is uniquely vulnerable to Sea Level Rise. Indicate location(s) of concern and unique vulnerabilities/issues.

Page 3 of 4



Hazard Assessment Form
Exercise 2 Handout

Please describe how your place of residence/work or municipality/organization is uniquely vulnerable to Cybersecurity Threats. Indicate location(s) of concern and unique vulnerabilities/issues.

Please describe how your place of residence/work or municipality/organization is uniquely vulnerable to Hazardous Materials Incidents. Indicate location(s) of concern and its potential impacts/issues.

Please describe how your place of residence/work or municipality/organization is uniquely vulnerable to Utility Interruptions. Indicate location(s) of concern and unique vulnerabilities/issues.

Please describe how your place of residence/work or municipality/organization is uniquely vulnerable to Active Shooter Incidents. Indicate location(s) of concern and unique vulnerabilities/issues.

Please describe how your place of residence/work or municipality/organization is uniquely vulnerable to Terrorism (e.g., weapons of destruction). Indicate location(s) of concern and unique vulnerabilities/issues.

Page 4 of 4

New Mitigation Action Forms

New Mitigation Action
Exercise 3 Handout

*Please complete **one (1) form for <u>each</u> proposed mitigation action/idea** with as much detail as possible.*

Name: *(optional)* _____ **E-mail:** *(optional)* _____

Neighborhood/ Jurisdiction: _____ **Phone Number:** *(optional)* _____

New Mitigation Action/Idea (Proposed Solution to a Risk or Concern)

Please describe.

Benefit *(Problem this Mitigation Action/Idea will address)*

Please describe the benefits this mitigation action/idea will offer to your community and/or organization.

Mitigation Hazards

*Place an **X** by the hazard this action/idea will mitigate. Please select **<u>all that apply</u>**.*

X	***Example**: Sample Hazard*		Sea Level Rise		Utility Interruptions
	Dam and Levee Failure		Severe Weather *(Heavy Rain, Atmospheric River, Thunderstorms, Damaging Winds, Tornadoes, Extreme Heat)*		Active Shooter Incidents
	Drought		Tsunami		Terrorism *(Weapons of Mass Destruction)*
	Earthquake		Wildfire		Cybersecurity Threats
	Flood		Climate Change		Addresses All Hazards
	Landslide		Hazardous Materials Incidents		Other Hazard(s) (Please indicate)

Page **1** of **1**

December 4, 2023 – Public Meeting #1

Contra Costa County, California
2024 Hazard Mitigation Plan Update
Public Meeting

Date:
Monday, December 4, 2023

Time:
6:30 PM – 7:30 PM

Location:
Contra Costa County Auditorium
1850 Muir Road, Martinez, CA 94553

Live Stream: https://www.contracosta.ca.gov/60/Hazard-Mitigation-Planning-Public-Meetin

Agenda

Welcome, Introductions, and Opening Remarks

Hazard Mitigation Overview

Hazard Mitigation Benefits

Hazard Mitigation Planning Overview

Public Survey Results

Hazard List Summary

Hazard Risk Assessment (Exercise 1)

Hazard Assessment Form (Exercise 2)

Mitigation Goals

Mitigation Actions/Ideas (Exercise 3)

Closing Remarks

1

SIGN-IN SHEET: **Hazard Mitigation Plan Update – Public Meeting 12/4/2023**
Contra Costa County Auditorium, 1850 Muir Road, Martinez, CA 94553

Contra Costa County, California

Hazard Mitigation Planning Meeting – Public Meeting
Date: 12/4/2023

Name	**Organization** (if applicable)	**Title** (if applicable)	**Phone** (Optional)	**E-mail** (Optional)
DAVID DYCHE	MARTINEZ AREA CERT	Administrator	9258185457	ddyche@outlook.com
Lynette Bjorgan	CERT	Events	9259633504	Lynettebjorgan@sbcglobal.net
David Aranda	RPPCSD	G.M	661-300-1231	daranda@rppcsd.org
Brian Lindsey	Martine CERT	Operations	925-890-8698	brianc@hotmail.com
NATE MCCORMICK	DANVILLE	EMEE. SCRUBE'S MGR		
Colby LaPlace	Pinole	Solano County	510-409-7091	claplace@pinole.ca.gov
Ginger Ogden	MARTINEZ Cert		925-963-7369	gingerogden@gmail.com
Victoria Murphy	CERT / MT2		(925)586-6502	
Jill Ray	BOS DIST 2			
Keary Flagg	CCSO	Specialist		
Jimmy Lee	CCSO	PIO		
Maurice Lewis	CCSO	Deputy		
Jen Cannon	CCSO	Emergency Planning coordinator		
Rick Kwarr	CCSO	Emergency Services Manager		

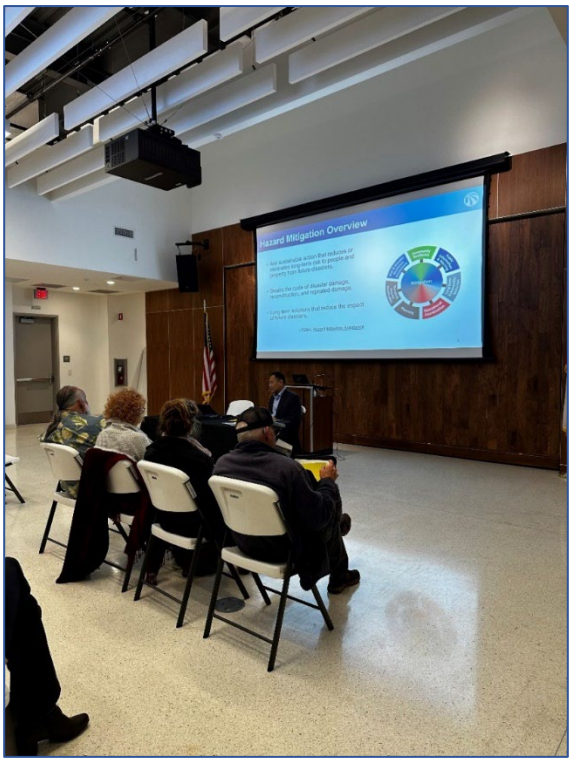
1

SIGN-IN SHEET: **Hazard Mitigation Plan Update – Public Meeting 12/4/2023**
Contra Costa County Auditorium, 1850 Muir Road, Martinez, CA 94553

Hazard Mitigation Planning Meeting – Public Meeting Date: 12/4/2023				
Name	**Organization** (if applicable)	**Title** (if applicable)	**Phone** (Optional)	**E-mail** (Optional)
Lorena Herrera	CCSO	Senior EPC		
Beatriz Portillo	CCSO	SEPC		

2





December 5, 2023 – Public Meeting #2

Contra Costa County, California
2024 Hazard Mitigation Plan Update
Public Meeting

Date:
Tuesday, December 5, 2023

Time:
6:30 PM – 7:30 PM

Location:

In Person
San Pablo Community Center
2450 Road 20, San Pablo, CA 94806

OR

Virtual (via Zoom)
https://cccounty-us.zoom.us/j/88236660673

Agenda

Welcome, Introductions, and Opening Remarks

Hazard Mitigation Overview

Hazard Mitigation Benefits

Hazard Mitigation Planning Overview

Public Survey Results

Hazard List Summary

Hazard Risk Assessment (Exercise 1)

Hazard Assessment Form (Exercise 2)

Mitigation Goals

Mitigation Actions/Ideas (Exercise 3)

Closing Remarks

1

SIGN-IN SHEET: **Hazard Mitigation Plan Update – Public Meeting 12/5/2023**
San Pablo Community Center, 2450 Road 20, San Pablo, CA 94806

Contra Costa County, California

Hazard Mitigation Planning Meeting – Public Meeting
Date: 12/5/2023

Name	**Organization** (if applicable)	**Title** (if applicable)	**Phone** (Optional)	**E-mail** (Optional)
Seana Field	City of Hercules	Senior Planner	510-799-8248	sfiddeci.hercules.ca.us
Leslie Manry	CCCOES CWS	emergency planning	925-655-0102	lmanry01@sccccaumyes
Cynthia Robinson				

December 6, 2023 – Public Meeting

Contra Costa County, California
2024 Hazard Mitigation Plan Update
Public Meeting

Date:
Wednesday, December 6, 2023

Time:
6:30 PM – 7:30 PM

Location:
Oakley City Council Chambers
3231 Main Street Oakley, CA 94561

Agenda

Welcome, Introductions, and Opening Remarks

Hazard Mitigation Overview

Hazard Mitigation Benefits

Hazard Mitigation Planning Overview

Public Survey Results

Hazard List Summary

Hazard Risk Assessment (Exercise 1)

Hazard Assessment Form (Exercise 2)

Mitigation Goals

Mitigation Actions/Ideas (Exercise 3)

Closing Remarks

1

SIGN-IN SHEET: **Hazard Mitigation Plan Update – Public Meeting 12/6/2023**
Oakley City Council Chambers, 3231 Main Street Oakley, CA 94561

Contra Costa County, California

Hazard Mitigation Planning Meeting – Public Meeting
Date: 12/6/2023

Name	**Organization** (if applicable)	**Title** (if applicable)	**Phone** (Optional)	**E-mail** (Optional)
Mark Whitlock	BI. MAC		925-351-3759	Makebethelislandsafe @yahoo.com
Jean Weis	BIMID Island Emergency Safety Committee	Volunteer member	925-727-2544	Weismarine@gmail.com
Phillip Kammerer	B.I. MAC	CHAIR	925-826-6580	PHILIP KAMMERER PEOPLEPC.COM
CHAR JACQUEZ	C.C. SHERIFF	LT.	925-499-2873	cjacq@so.cccounty.us
Mike Nisen	Byron MAC	Councilmember	925-525-0502	Mike@evansbrothers.com
Shannon Shaw	City of Oakley	Council Member	760 801 0787	Shaw@Ci.oakley.ca.us
Danielle Navarro	City of Oakley	Assistant City Manager	925-625-7162	navarro@ci.oakley.ca.us
Josh McMurray	City of Oakley	City Manager	925-625-7025	mcmurray@ci.oakley.ca.us
Jimmy Ramsey				
Lisa Vierra	BIMID	Director	925 382 5249	KirKlisa@gmail.com
Susanna Thompson	CCCFPD	Commissioner	925 408-9399	Sthompsonccfpd@gmail
Mike Nisen				mike@evansbrothers.com

1



Figure C-1 Social Media Posts Samples



Contra Costa County
@CCCounty

.@CCCounty residents and businesses can help the County update its emergency preparedness plans by participating in Hazard Mitigation Planning Public Meetings. Here is more information: bit.ly/3RlJuu7

PUBLIC MEETING ANNOUNCEMENT

LEARN ABOUT THE DISASTERS THAT COULD IMPACT CONTRA COSTA COUNTY

Contra Costa County Office of Emergency Services (OES) wants to know how it can better prepare you for disasters.

The meeting will provide the public an opportunity to review the potential hazards that could occur within the County, and will request input for the various mitigation measures intended to eliminate or reduce the negative impact of those hazards. Language translation assistance in Spanish will be provided. Come join us in one (1) of the sessions listed below.

Hazard Mitigation Planning Public Meetings Schedule *You only need to attend one (1) meeting.*	
Session 1	Monday, December 4, 2023 6:30 PM – 7:30 PM Contra Costa County Auditorium 1850 Muir Road, Martinez, CA 94553
Session 2	Tuesday, December 5, 2023 6:30 PM – 7:30 PM San Pablo Community Center 2450 Road 20, San Pablo, CA 94806
Session 3	Wednesday, December 6, 2023 6:30 PM – 7:30 PM Oakley City Council Chambers 3231 Main Street, Oakley, CA 94561

For questions, please contact the Contra Costa County OES via phone at (925) 655-0100 or e-mail at oes-staff@so.cccounty.us.

ALT



Contra Costa County
@CCCounty

.@CCCounty residentes y las empresas pueden ayudar al condado a actualizar sus planes de preparación para emergencias participando en reuniones públicas de planificación de mitigación de riesgos. Aquí hay más información: bit.ly/3RlJuu7

Translate post

ANUNCIO DE REUNIÓN PÚBLICA

INFORMACIÓN SOBRE LOS DESASTRES QUE PODRÍAN AFECTAR AL CONDADO DE CONTRA COSTA

La Oficina de Servicios de Emergencia del Condado de Contra Costa quiere saber como puede prepararlo/a mejor a usted en situaciones de emergencia para asegurar la protección de la vida y propiedad de los ciudadanos.

Este evento le dará al público la oportunidad de aprender sobre los posibles desastres que podrían ocurrir en el Condado de Contra Costa, y discutir maneras para eliminar o reducir el impacto de estos desastres. Participe en una (1) de las sesiones enumeradas a continuación.

Reuniones Públicas para la Planificación de Mitigación de Peligros *Solo necesita asistir a una (1) reunión.*	
Sesión 1	Lunes, 4 de diciembre del 2023 6:30 PM – 7:30 PM Auditorio del Condado de Contra Costa 1850 Muir Road, Martinez, CA 94553
Sesión 2	Martes, 5 de diciembre del 2023 6:30 PM – 7:30 PM Centro Comunitario de San Pablo 2450 Road 20, San Pablo, CA 94806
Sesión 3	Miércoles, 6 de diciembre del 2023 6:30 PM – 7:30 PM Cámaras del Consejo Municipal de Oakley 3231 Main Street, Oakley, CA 94561

Si tiene preguntas, comuníquese con la Oficina de Servicios de Emergencia del Condado de Contra Costa por teléfono a (925) 655-0100 o correo electrónico a oes-staff@so.cccounty.us.

ALT

nextdoor

Sign in

Contra Costa County **is on Nextdoor, the neighborhood hub.**

Sign up for Nextdoor

California / Contra Costa County / Contra Costa County Public Agencies / Contra Costa County



Contra Costa County

Welcome to Contra Costa County's Official Nextdoor page. Serve. Innovate. Improve the quality of life for residents. For information about County programs and services, visit https://linktr.ee/contracostacounty.

contracosta.ca.gov

More info...

Subscribe

Activity

Contra Costa County residents and businesses can help the County update its emergency preparedness plans by participating in Hazard Mitigation Planning Public Meetings scheduled sessions and a voluntary online questionnaire.

Community & Media Relations Specialist Lissette Davis from Contra Costa County · 29 Nov



Hazard Mitigation Planning Public Meetings Schedule Sessions:

Session 1 Monday, December 4, 2023
6:30 PM – 7:30 PM
Contra Costa County Auditorium
1850 Muir Road, Martinez, CA 94553

Session 2 Tuesday, December 5, 2023
6:30 PM – 8:30 PM
San Pablo Community Center
2450 Road 20, San Pablo, CA 94806

Session 3 Wednesday, December 6, 2023
6:30 PM – 8:30 PM
Oakley City Council Chambers
3231 Main Street, Oakley, CA 94561

Those who live or work in Contra Costa County are encouraged to share their experiences, knowledge, and concerns about local hazards by participating in the brief questionnaire. The survey is available in English and Spanish. To complete the questionnaire, please go to: https://survey.alchemer.com/s3/7511228/2...

The questionnaire will remain open until January 30, 2024.

Click here for more information:https://www.contracosta.ca.gov/DocumentCenter/View/80803/

Residentes del Condado de Contra Costa están Invitados a Participar en el Estudio de Preparación Comunitaria

Los residentes y las empresas del Condado de Contra Costa pueden ayudar al Condado a actualizar sus planes de preparación para emergencias participando en una de las siguientes Sesiones de Programación de Reuniones Públicas de Planificación de Mitigación de Riesgos:

Sesión 1 Lunes, 4 de diciembre de 20236:30 p. m. – 7:30 p. m.
Auditorio del Condado de Contra Costa 1850 Muir Road, Martinez, CA 94553

Sesión 2 Martes, 5 de diciembre de 20236:30 p. m. – 7:30 p. m.
Centro Comunitario San Pablo 2450 Road 20, San Pablo, CA 94806

Sesión 3 Miércoles, 6 de diciembre de 20236:30 p. m. – 7:30 p. m.
Cámaras del Concejo Municipal de Oakley 3231 Main Street, Oakley, CA 94561

También puede participar en un cuestionario voluntario en línea. Los comentarios de la encuesta confidencial de 10 minutos permitirán a la Oficina de Servicios de Emergencia del Condado de Contra Costa servir mejor a los residentes y negocios antes, durante y después de una emergencia o desastre.La encuesta será confidencial y deberá tomar 10 minutos para completar. Los resultados permitirán a la Oficina de Servicios de Emergencia del Condado de Contra Costa servirle mejor antes, durante y después de una emergencia o desastre.

"Sus comentarios nos ayudarán a mejorar nuestros esfuerzos de preparación y respuesta ante emergencias," dijo el presidente de la Junta, John Gioia, supervisor del Distrito 1. "La seguridad de nuestra comunidad es una de nuestras prioridades más importantes."

Las personas que viven o trabajan en el Condado de Contra Costa se les anima a compartir sus experiencias, conocimientos y preocupaciones sobre los riesgos locales participando en el breve cuestionario. El cuestionario está disponible en inglés y español. Para completarlo, por favor visite: https://survey.alchemer.com/s3/7531453/2...

El cuestionario permanecerá abierto hasta el 30 de enero del 2024.

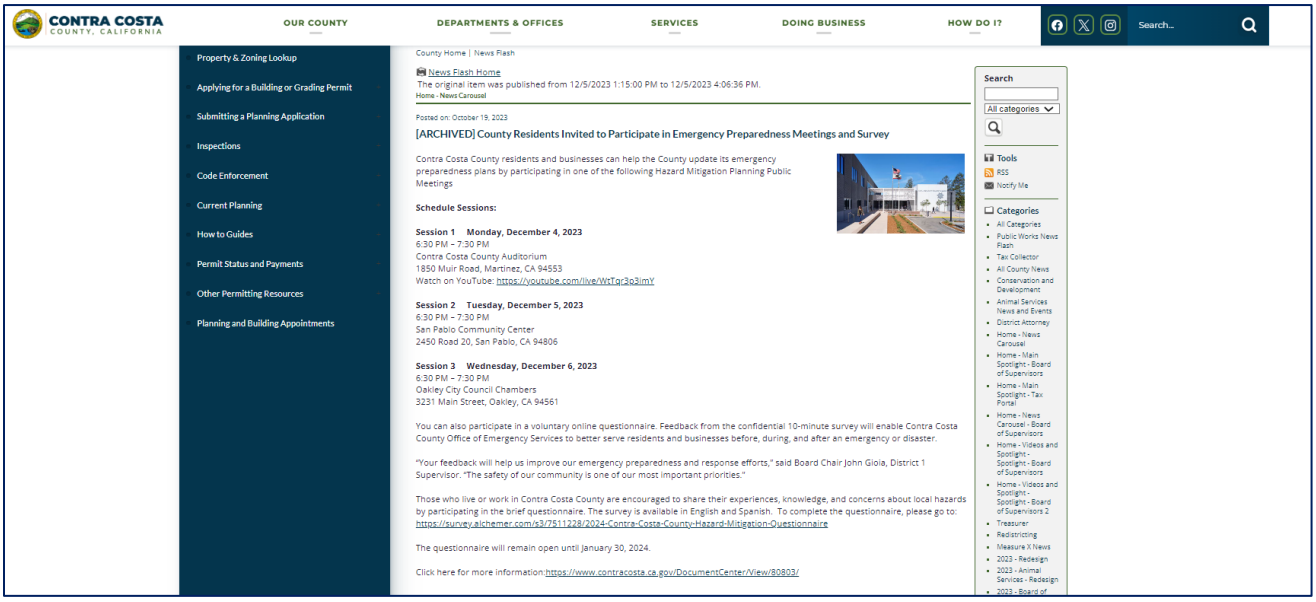
Haga clic aquí para más información: https://www.contracosta.ca.gov/DocumentC...

2024 Contra Costa County Hazard Mitigation Que...
2024 Contra Costa County Hazard Mitigation Questionnaire.
SURVEY.ALCHEMER.COM

Edited 5 Dec · Posted Nov 29, 2023 · Subscribers of Contra Costa County in General

THANK | 53 REPLY | 14

Figure C-2 Contra Costa County Website





C.2. PUBLIC SURVEY

The 2024 Contra Costa County Hazard Mitigation Questionnaire (i.e., Public Survey) was available in English, Spanish, Traditional Chinese, Simplified Chinese, and Tagalog. The English and Spanish survey opened on October 19, 2023. While the Traditional Chinese, Simplified Chinese, and Tagalog open on November 15, 2023. The Survey was distributed and promoted through a variety of methods such as social media (e.g., Facebook, Instagram, Twitter), press releases to the County and 19 city Public Information Officers (PIOs), County Board of Supervisors, and the Bay Area media outlets (e.g., Kron4 and NBC Bay Area). Community organizations and plan participants were critical in connecting county and city residents with the Survey, and Contra Costa County OES used their broad-based distribution lists of community stakeholders to disseminate the Survey to residents and employees. Ultimately, respondents for this Survey were selected from among those who volunteered to participate. No special weighting was done to reflect the demographic composition of the County.

As part of this Survey, Steering Committee members, community representatives, and members of the public were asked to rate each of the hazards in terms of perceived risk. Furthermore, they were asked to rate "mitigation importance" for each of the identified hazards in the Plan. The information gathered from this survey was used to inform the hazard risk prioritization process, and to ensure the Plan adequately addressed the public's' concerns and priorities.

The Survey had a total of 32 questions of multiple choice and open-ended questions. In total 1,895 respondents participated in the five (5) surveys. To ensure all data could be accurately correlated, only the completed (in its entirety) survey was used in this report. In some situations, the respondent chose not to answer one (1) or more questions which is why some discrepancies exist in the total number of responses per question. **Table C-1** provides a breakdown of the Survey responses for each language.

Table C-2. Survey Response Summary

Survey Status	Total				
	English	Spanish	Tagalog	Traditional Chinese	Simplified Chinese
Completed	1,365	18	2	1	1
Partial	476	21	0	1	0
Disqualified*	9	0	0	0	0
TOTAL	**1,850**	**39**	**2**	**2**	**1**

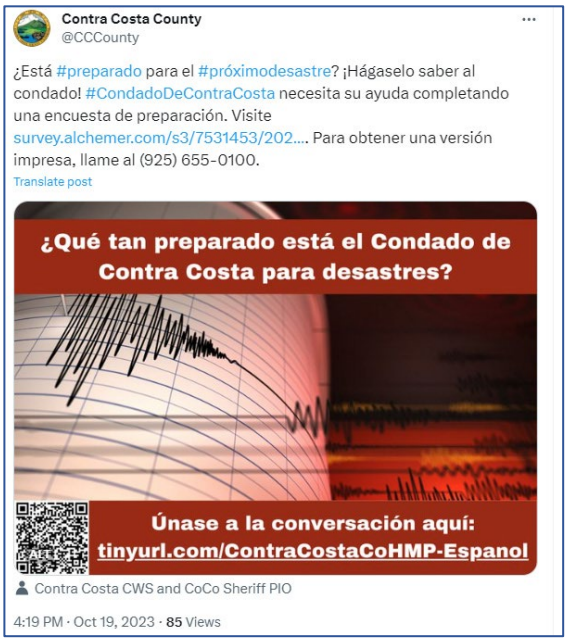
**A survey response is Disqualified when the respondent selects "No, I do not live or work in Contra Costa County." for question 1.*

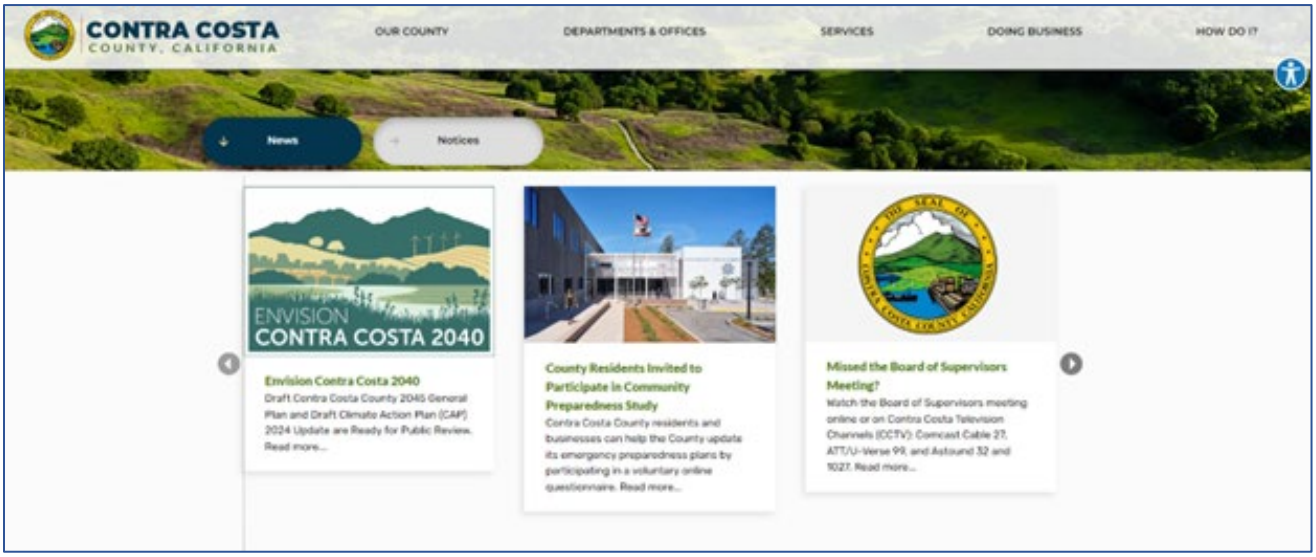
Figure C-3 Social Media and Website Posts Samples

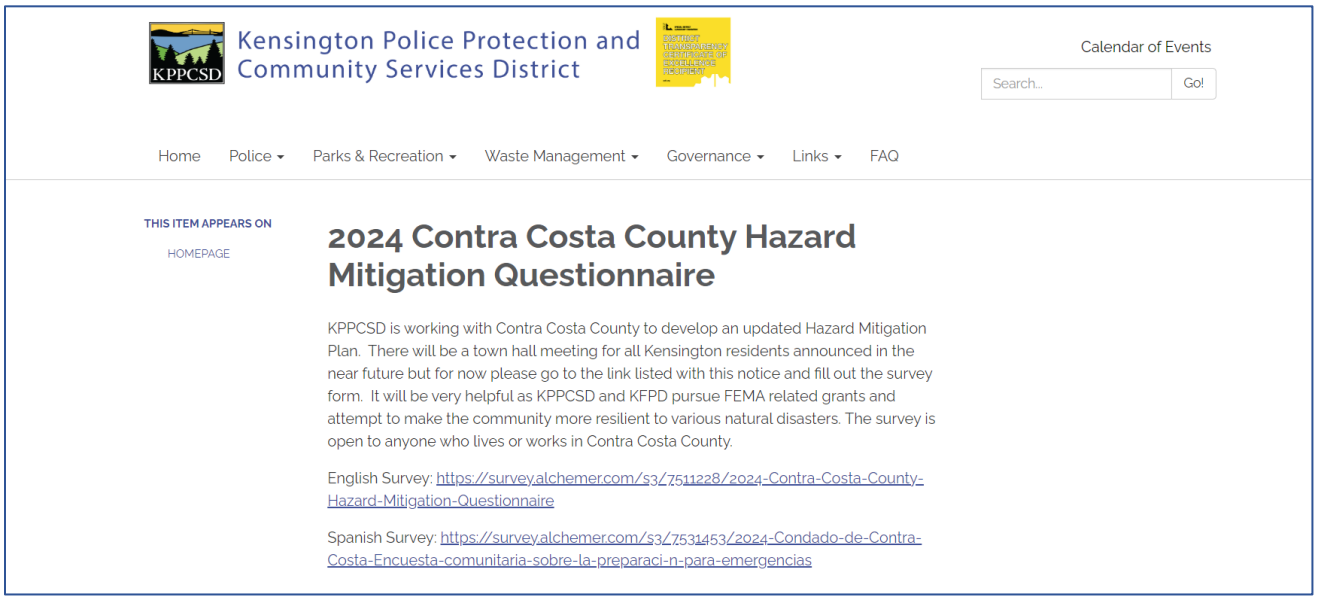





Contra Costa County @CCCounty · 34m
Are you #prepared for the next disaster? Let the County know! @CCCounty needs your help by completing a preparedness survey. Go to survey.alchemer.com/s3/7511228/202.... Call (925) 655-0100 to request a hard copy.
How prepared is Contra Costa County for disasters?
Join the conversation here:
tinyurl.com/ContraCostaCoHMP
Contra Costa CWS and CoCo Sheriff PIO


Contra Costa County
@CCCounty
¿Está #preparado para el #próximodesastre? ¡Hágaselo saber al condado! #CondadoDeContraCosta necesita su ayuda completando una encuesta de preparación. Visite survey.alchemer.com/s3/7531453/202.... Para obtener una versión impresa, llame al (925) 655-0100.
Translate post
¿Qué tan preparado está el Condado de Contra Costa para desastres?
Únase a la conversación aquí:
tinyurl.com/ContraCostaCoHMP-Espanol
Contra Costa CWS and CoCo Sheriff PIO
4:19 PM · Oct 19, 2023 · 85 Views


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Envision Contra Costa 2040
Draft Contra Costa County 2045 General Plan and Draft Climate Action Plan (CAP) 2024 Update are Ready for Public Review. Read more...
County Residents Invited to Participate in Community Preparedness Study
Contra Costa County residents and businesses can help the County update its emergency preparedness plans by participating in a voluntary online questionnaire. Read more...
Missed the Board of Supervisors Meeting?
Watch the Board of Supervisors meeting online or on Contra Costa Television Channels (CCTV): Comcast Cable 27, ATT/U-Verse 99, and Astound 32 and 1027. Read more...



Kensington Police Protection and Community Services District

Calendar of Events

Search... Go!

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THIS ITEM APPEARS ON

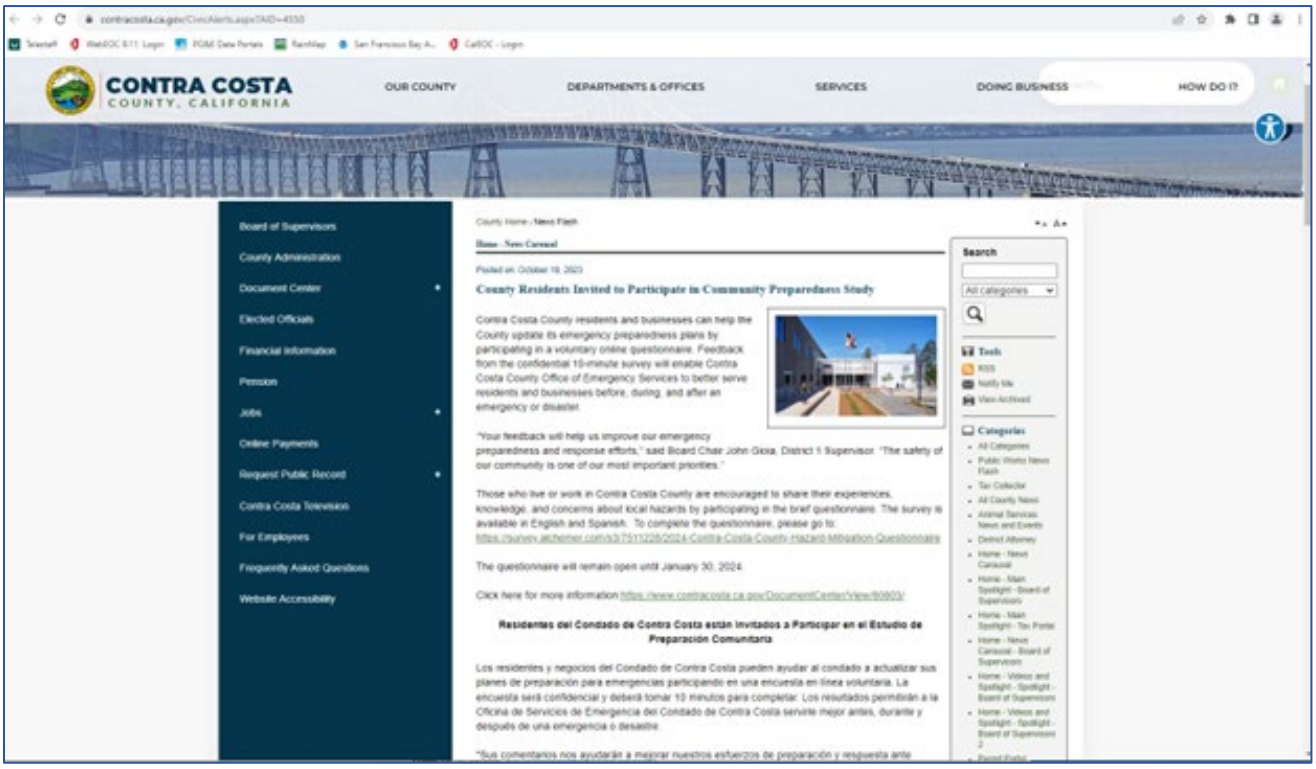
HOMEPAGE

2024 Contra Costa County Hazard Mitigation Questionnaire

KPPCSD is working with Contra Costa County to develop an updated Hazard Mitigation Plan. There will be a town hall meeting for all Kensington residents announced in the near future but for now please go to the link listed with this notice and fill out the survey form. It will be very helpful as KPPCSD and KFPD pursue FEMA related grants and attempt to make the community more resilient to various natural disasters. The survey is open to anyone who lives or works in Contra Costa County.

English Survey: https://survey.alchemer.com/s3/7511228/2024-Contra-Costa-County-Hazard-Mitigation-Questionnaire

Spanish Survey: https://survey.alchemer.com/s3/7531453/2024-Condado-de-Contra-Costa-Encuesta-comunitaria-sobre-la-preparaci-n-para-emergencias



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Elected Officials
Financial Information
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For Employees
Frequently Asked Questions
Website Accessibility

County Residents Invited to Participate in Community Preparedness Study

Contra Costa County residents and businesses can help the County update its emergency preparedness plans by participating in a voluntary online questionnaire. Feedback from the confidential 10-minute survey will enable Contra Costa County Office of Emergency Services to better serve residents and businesses before, during, and after an emergency or disaster.

"Your feedback will help us improve our emergency preparedness and response efforts," said Board Chair John Gioia, District 1 Supervisor. "The safety of our community is one of our most important priorities."

Those who live or work in Contra Costa County are encouraged to share their experiences, knowledge, and concerns about local hazards by participating in the brief questionnaire. The survey is available in English and Spanish. To complete the questionnaire, please go to: https://survey.alchemer.com/s3/7511228/2024-Contra-Costa-County-Hazard-Mitigation-Questionnaire

The questionnaire will remain open until January 30, 2024.

Click here for more information https://www.contracosta.ca.gov/DocumentCenter/View/80803/

Residentes del Condado de Contra Costa están invitados a Participar en el Estudio de Preparación Comunitaria

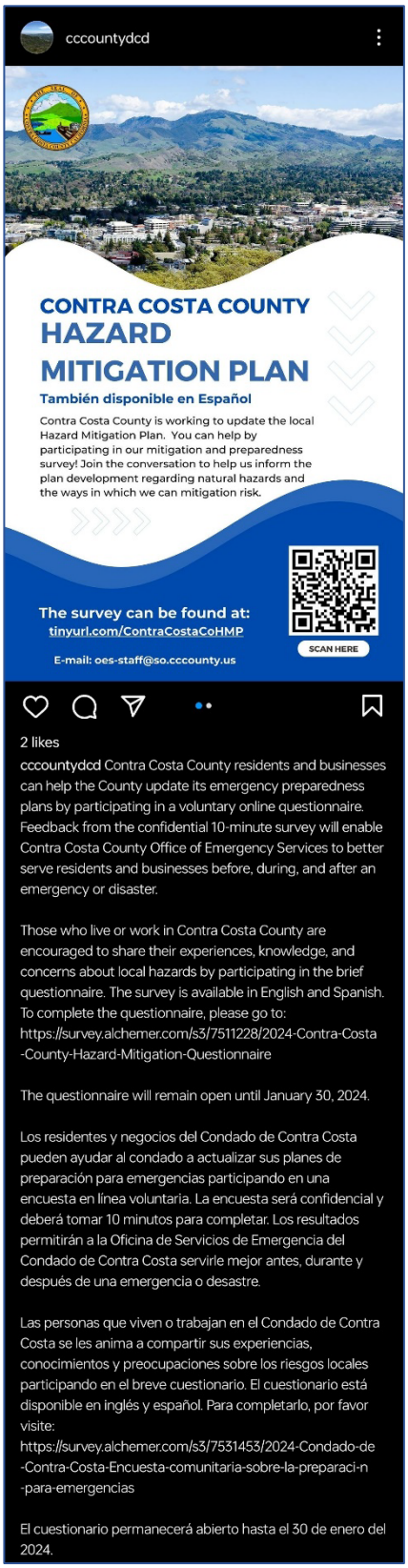
Los residentes y negocios del Condado de Contra Costa pueden ayudar al condado a actualizar sus planes de preparación para emergencias participando en una encuesta en línea voluntaria. La encuesta será confidencial y deberá tomar 10 minutos para completar. Los resultados permitirán a la Oficina de Servicios de Emergencia del Condado de Contra Costa servirle mejor antes, durante y después de una emergencia o desastre.

Search

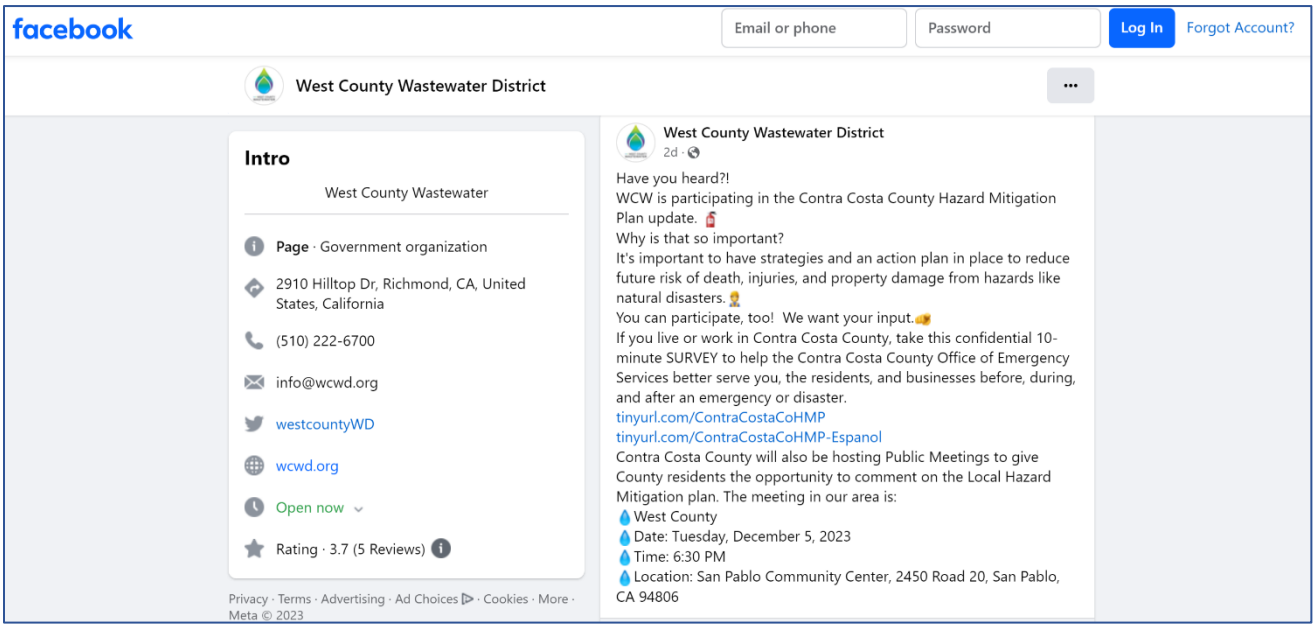
Tools

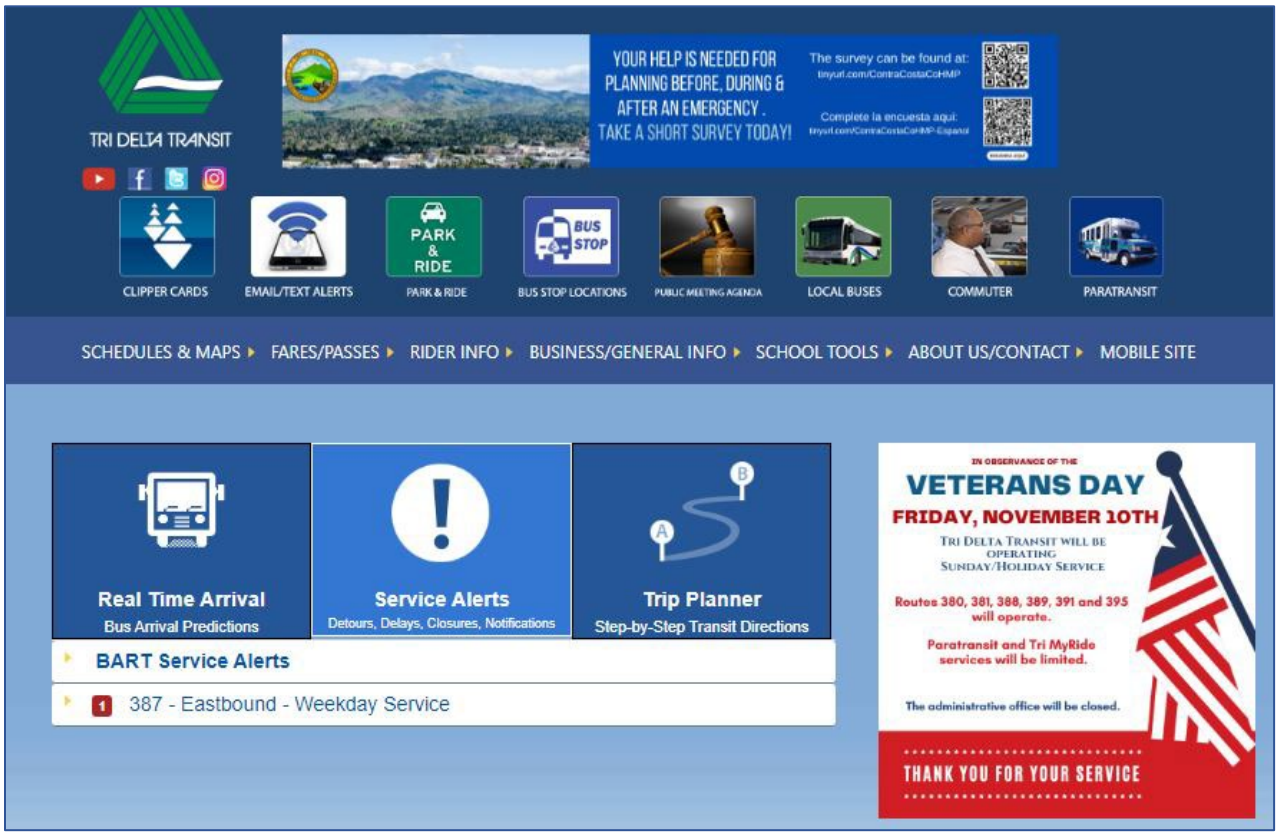
Categories


cityofbrentwood
CONTRA COSTA COUNTY
HAZARD
MITIGATION PLAN
También disponible en Español
Contra Costa County is working to update the local Hazard Mitigation Plan. You can help by participating in our mitigation and preparedness survey! Join the conversation to help us inform the plan development regarding natural hazards and the ways in which we can mitigation risk.
The survey can be found at:
tinyurl.com/ContraCostaCoHMP
E-mail: oes-staff@so.cccounty.us
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cityofbrentwood Contra Costa County is working to update the local Hazard Mitigation Plan. You can help by participating in the mitigation and preparedness survey! Join the conversation at https://tinyurl.com/ContraCostaCoHMP
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CONTRA COSTA COUNTY
HAZARD
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Contra Costa County is working to update the local Hazard Mitigation Plan. You can help by participating in our mitigation and preparedness survey! Join the conversation to help us inform the plan development regarding natural hazards and the ways in which we can mitigation risk.
The survey can be found at:
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E-mail: oes-staff@so.cccounty.us
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cccountydcd Contra Costa County residents and businesses can help the County update its emergency preparedness plans by participating in a voluntary online questionnaire. Feedback from the confidential 10-minute survey will enable Contra Costa County Office of Emergency Services to better serve residents and businesses before, during, and after an emergency or disaster.
Those who live or work in Contra Costa County are encouraged to share their experiences, knowledge, and concerns about local hazards by participating in the brief questionnaire. The survey is available in English and Spanish. To complete the questionnaire, please go to: https://survey.alchemer.com/s3/7511228/2024-Contra-Costa-County-Hazard-Mitigation-Questionnaire
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Las personas que viven o trabajan en el Condado de Contra Costa se les anima a compartir sus experiencias, conocimientos y preocupaciones sobre los riesgos locales participando en el breve cuestionario. El cuestionario está disponible en inglés y español. Para completarlo, por favor visite: https://survey.alchemer.com/s3/7531453/2024-Condado-de-Contra-Costa-Encuesta-comunitaria-sobre-la-preparaci-n-para-emergencias
El cuestionario permanecerá abierto hasta el 30 de enero del 2024.


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Intro
West County Wastewater
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info@wcwd.org
westcountyWD
wcwd.org
Open now
Rating · 3.7 (5 Reviews)
West County Wastewater District
2d ·
Have you heard?!
WCW is participating in the Contra Costa County Hazard Mitigation Plan update.
Why is that so important?
It's important to have strategies and an action plan in place to reduce future risk of death, injuries, and property damage from hazards like natural disasters.
You can participate, too! We want your input.
If you live or work in Contra Costa County, take this confidential 10-minute SURVEY to help the Contra Costa County Office of Emergency Services better serve you, the residents, and businesses before, during, and after an emergency or disaster.
tinyurl.com/ContraCostaCoHMP
tinyurl.com/ContraCostaCoHMP-Espanol
Contra Costa County will also be hosting Public Meetings to give County residents the opportunity to comment on the Local Hazard Mitigation plan. The meeting in our area is:
West County
Date: Tuesday, December 5, 2023
Time: 6:30 PM
Location: San Pablo Community Center, 2450 Road 20, San Pablo, CA 94806
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TRI DELTA TRANSIT
YOUR HELP IS NEEDED FOR PLANNING BEFORE, DURING & AFTER AN EMERGENCY. TAKE A SHORT SURVEY TODAY!
The survey can be found at:
tinyurl.com/ContraCostaCoHMP
Complete la encuesta aquí:
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PARK & RIDE
BUS STOP LOCATIONS
PUBLIC MEETING AGENDA
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PARATRANSIT
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Real Time Arrival
Bus Arrival Predictions
Service Alerts
Detours, Delays, Closures, Notifications
Trip Planner
Step-by-Step Transit Directions
BART Service Alerts
387 - Eastbound - Weekday Service
IN OBSERVANCE OF THE
VETERANS DAY
FRIDAY, NOVEMBER 10TH
TRI DELTA TRANSIT WILL BE OPERATING SUNDAY/HOLIDAY SERVICE
Routes 380, 381, 388, 389, 391 and 395 will operate.
Paratransit and Tri MyRide services will be limited.
The administrative office will be closed.
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Contra Costa County
Community and Media Relations Specialist Glenn Kimball • Just now

Are you prepared for the next disaster? Let the County know! Contra Costa County residents and businesses can help the County update its emergency preparedness plans by participating in a voluntary online questionnaire. Feedback from the confidential 10-minute survey will enable the Contra Costa County Office of Emergency Services to better serve residents and businesses before, during, and after an emergency or disaster.

The survey is available in English and Spanish. To complete the questionnaire, please go to:

English Survey: https://survey.alchemer.com/s3/7511228/2024-Contra-Costa-County-Hazard-Mitigation-Questionnaire
Spanish Survey: https://survey.alchemer.com/s3/7531453/2024-Condado-de-Contra-Costa-Encuesta-comunitaria-sobre-la-preparaci-n-para-emergencias

The survey will remain open until January 12, 2023. For a hard copy version of the survey, please contact the Contra Costa County Office of Emergency Services via phone at (925) 655-0100 or e-mail at oes-staff@so.cccounty.us.

¿Está preparado/a para el próximo desastre? ¡Déjele saber al condado! Los residentes y negocios del Condado de Contra Costa pueden ayudar al condado a actualizar sus planes de preparación para emergencias participando en una encuesta en línea voluntario. La encuesta será confidencial y deberá tomar 10 minutos para completar. Los resultados permitirán a la Oficina de Servicios de Emergencia del Condado de Contra Costa servirle mejor antes, durante y después de una emergencia o desastre.

El cuestionario está disponible en inglés y español. Para completarlo, por favor visite:

Cuestionario en Ingles: https://survey.alchemer.com/s3/7511228/2024-Contra-Costa-County-Hazard-Mitigation-Questionnaire
Cuestionario en Español: https://survey.alchemer.com/s3/7531453/2024-Condado-de-Contra-Costa-Encuesta-comunitaria-sobre-la-preparaci-n-para-emergencias

La encuesta estará abierta hasta el 12 de enero, 2023. Para obtener una versión impresa de la encuesta, por favor contacte a la Oficina de Servicios de Emergencia del Condado de Contra Costa por teléfono a (925) 655-0100 o correo electrónico a oes-staff@so.cccounty.us.

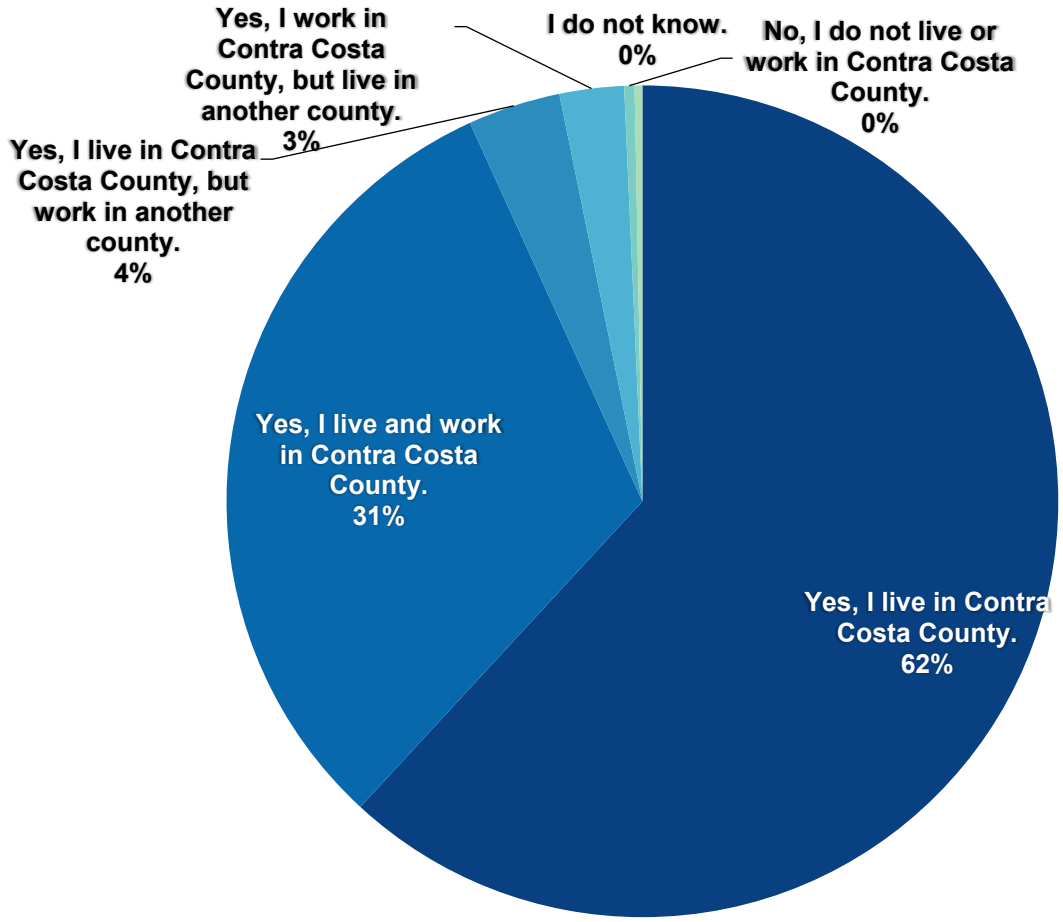




Survey Results

NOTE: *This is the redacted version of the Survey. Open-ended responses from the public were NOT included in this version to ensure confidentiality and privacy.*

Question 1: Do you live and/or work in Contra Costa County? Please select the best answer that applies to your current situation.

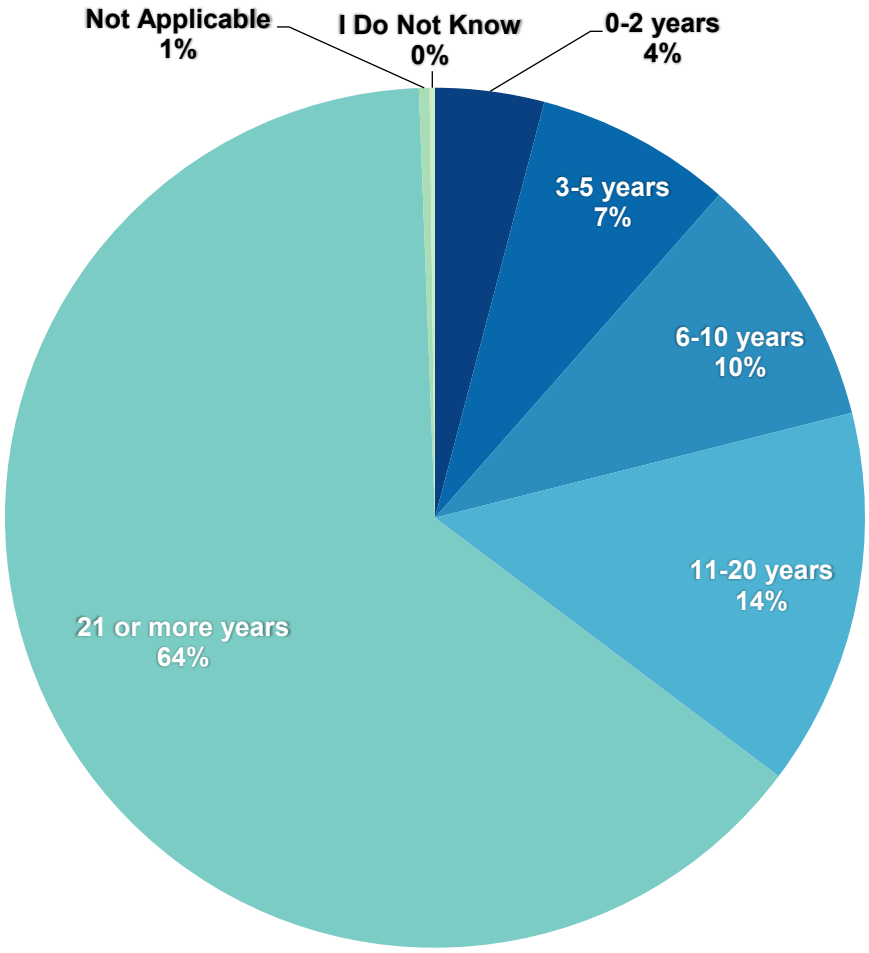


Value	Percent	Total Responses
Yes, I live in Contra Costa County.	61.8%	1,091
Yes, I live and work in Contra Costa County.	31.3%	553
Yes, I live in Contra Costa County, but work in another county.	3.6%	64
Yes, I work in Contra Costa County, but live in another county.	2.5%	45
No, I do not live or work in Contra Costa County.	0.4%	7
I do not know	0.3%	6
	TOTAL	**1,766**

Spanish Survey Results

Value	Percent	Total Responses
Yes, I live in Contra Costa County.	54.5%	18
Yes, I live and work in Contra Costa County.	36.4%	12
Yes, I live in Contra Costa County, but work in another county.	6.1%	2
Yes, I work in Contra Costa County, but live in another county.	3.0%	1
No, I do not live or work in Contra Costa County.	54.5%	18
I do not know	36.4%	12
	TOTAL	**33**

Question 2: Approximately how many years have you lived in Contra Costa County?

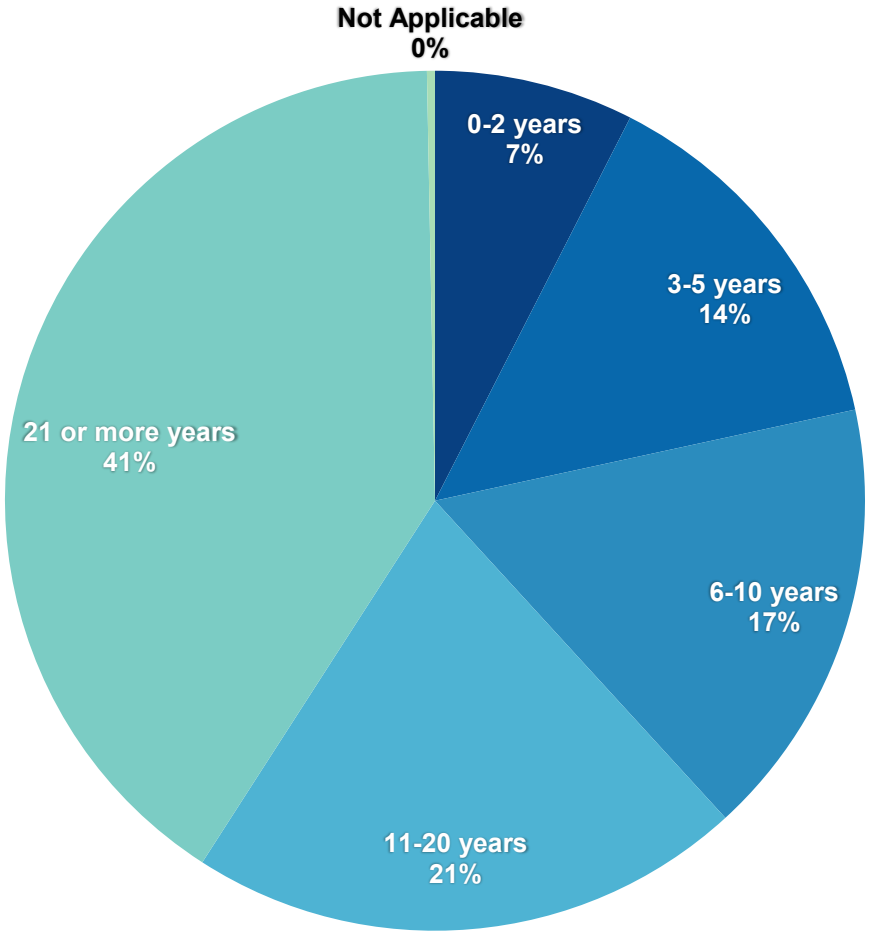


Value	Percent	Total Responses
0-2 years	4.1%	68
3-5 years	7.4%	124
6-10 years	9.6%	161
11-20 years	14.2%	239
21 or more years	64.2%	1,078
Not Applicable	0.4%	6
I do not know	0.2%	3
	TOTAL	**166**

Spanish Survey Results

Value	Percent	Total Responses
0-2 years	10.7%	3
3-5 years	7.1%	2
6-10 years	17.9%	5
11-20 years	17.9%	5
21 or more years	46.4%	13
	TOTAL	**28**

Question 3: Approximately how many years have you worked in Contra Costa County?



Value	Percent	Total Responses
0-2 years	7.5%	44
3-5 years	14.1%	83
6-10 years	16.6%	98
11-20 years	20.9%	123
21 or more years	40.6%	239
Not Applicable	0.3%	2
I do not know	7.5%	44
	TOTAL	**589**

Spanish Survey Results

Value	Percent	Total Responses
0-2 years	18.2%	2
3-5 years	27.3%	3
6-10 years	9.1%	1
11-20 years	27.3%	3
21 or more years	18.2%	2
	TOTAL	**11**

Question 4: Please indicate which community in Contra Costa County you live in.

Community	Percent	Total Responses
Acalanes Ridge	0.1%	1
Alamo	1.5%	23
Alhambra Valley	0.1%	2
Antioch	5.2%	80
Bay Point	0.9%	14
Bayview	0.1%	1
Bethel Island/Sandmound Slough	5.0%	76
Blackhawk	0.4%	6
Brentwood	3.7%	57
Briones	0.1%	1
Byron	0.4%	6
Camino Tassajara	0.1%	2
Castle Hill	0.2%	3
Clayton	1.0%	16
Clyde	0.1%	1
Concord	8.0%	123
Contra Costa Centre	0.5%	7
Crockett	0.4%	6
Town of Danville	3.7%	57
Diablo	0.1%	1
Discovery Bay	1.3%	20
East Richmond Heights	0.6%	9
El Cerrito	2.5%	38
El Sobrante	3.5%	54
Hercules	1.6%	24
Kensington	0.9%	14
Knightsen	0.1%	1
Lafayette	2.7%	41
Martinez	14.4%	220
Town of Moraga	2.9%	45
Mountain View	0.2%	3
North Richmond	0.1%	1

Community	Percent	Total Responses
Oakley	4.4%	67
Orinda	3.5%	54
Pacheco	0.3%	5
Pinole	2.0%	31
Pittsburg	2.7%	41
Pleasant Hill	2.7%	42
Richmond	5.9%	90
Rodeo	0.8%	12
Rollingwood	0.1%	2
San Pablo	0.9%	14
San Ramon	3.1%	47
Saranap/Parkmead	0.1%	2
Tara Hills	0.1%	2
Vine Hill	0.1%	1
Walnut Creek	10.8%	165
	TOTAL	**1,528**

Spanish Survey Results

Community	Percent	Total Responses
Antioch	13.8%	4
Brentwood	10.3%	3
Concord	6.9%	2
Hercules	6.9%	2
Martinez	10.3%	3
Oakley	3.4%	1
Richmond	34.5%	10
San Pablo	6.9%	2
San Ramon	6.9%	2
	TOTAL	**29**

Question 5: Please indicate which community in Contra Costa County you work in.

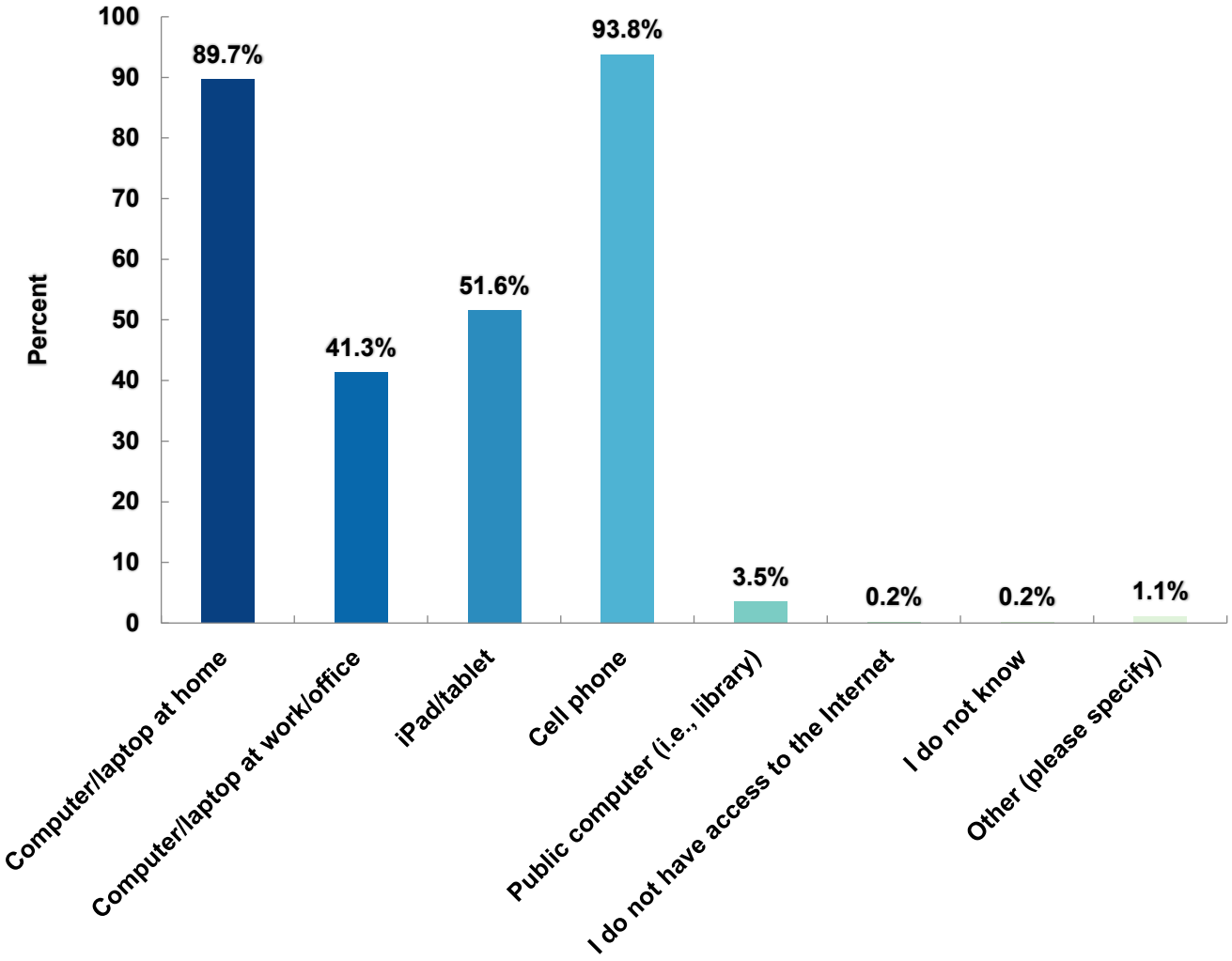
Community	Percent	Total Responses
Alamo	0.7%	4
Antioch	8.9%	51
Bay Point	0.3%	2
Bethel Island/Sandmound Slough	1.2%	7
Blackhawk	0.3%	2
Brentwood	3.5%	20
Castle Hill	0.2%	1
Clayton	0.5%	3
Concord	11.3%	65
Contra Costa Centre	0.5%	3
Crockett	0.3%	2
Town of Danville	1.7%	10
Discovery Bay	0.3%	2
El Cerrito	1.4%	8
El Sobrante	0.9%	5
Hercules	1.4%	8
Kensington	0.3%	2
Lafayette	1.6%	9
Martinez	23.7%	136
Town of Moraga	3.0%	17
Mountain View	0.3%	2
North Richmond	0.2%	1
Oakley	3.7%	21
Orinda	1.6%	9
Pacheco	0.5%	3
Pinole	1.7%	10
Pittsburg	1.2%	7
Pleasant Hill	8.0%	46
Richmond	7.1%	41
Rodeo	0.3%	2
Rollingwood	0.2%	1

Community	Percent	Total Responses
San Pablo	0.5%	3
San Ramon	1.9%	11
Walnut Creek	10.5%	60
	TOTAL	**574**

Spanish Survey Results

Community	Percent	Total Responses
Brentwood	18.2%	2
Hercules	9.1%	1
Martinez	18.2%	2
Pittsburg	9.1%	1
Pleasant Hill	9.1%	1
Richmond	27.3%	3
San Ramon	9.1%	1
	TOTAL	**11**

Question 6: Please indicate what type of device(s) you use to access the internet. Select ALL that apply.

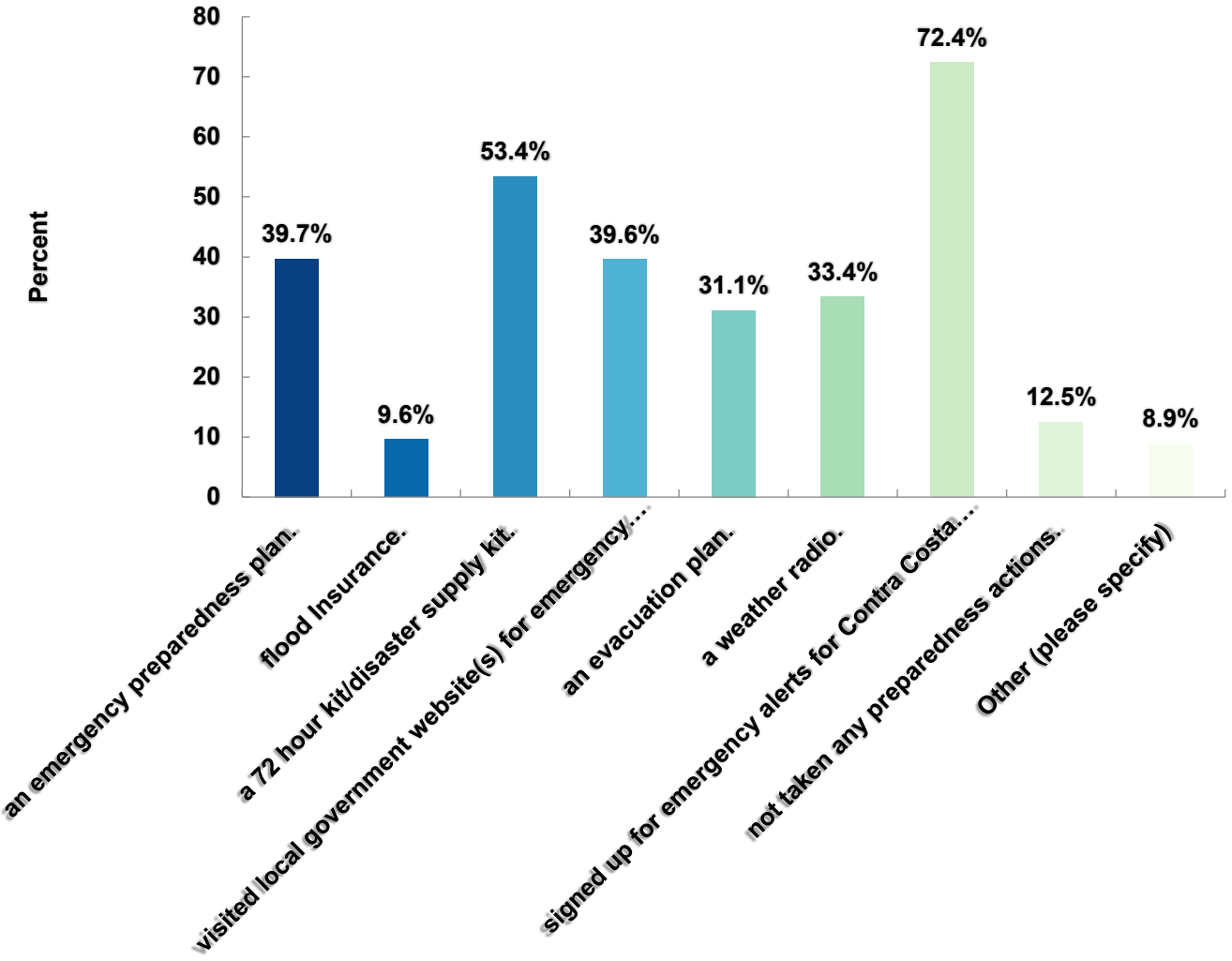


Value	Percent	Total Responses
Computer/laptop at home	89.7%	1,357
Computer/laptop at work/office	41.3%	625
iPad/tablet	51.6%	781
Cellphone	93.8%	1,419
Public computer (e.g., library)	3.5%	53
I do not have access to the Internet	0.2%	3
I do not know	0.2%	3
Other	1.1%	17

Spanish Survey Results

Value	Percent	Total Responses
Computer/laptop at home	75.0%	18
Computer/laptop at work/office	50.0%	12
iPad/tablet	45.8%	11
Cellphone	95.8%	23
Public computer (e.g., library)	0.0%	0
I do not have access to the Internet	0.0%	0
I do not know	0.0%	0
Other	4.2%	1

Question 7: Please indicate those activities you have done to prepare for emergencies and disasters. Please select ALL that apply. I have…

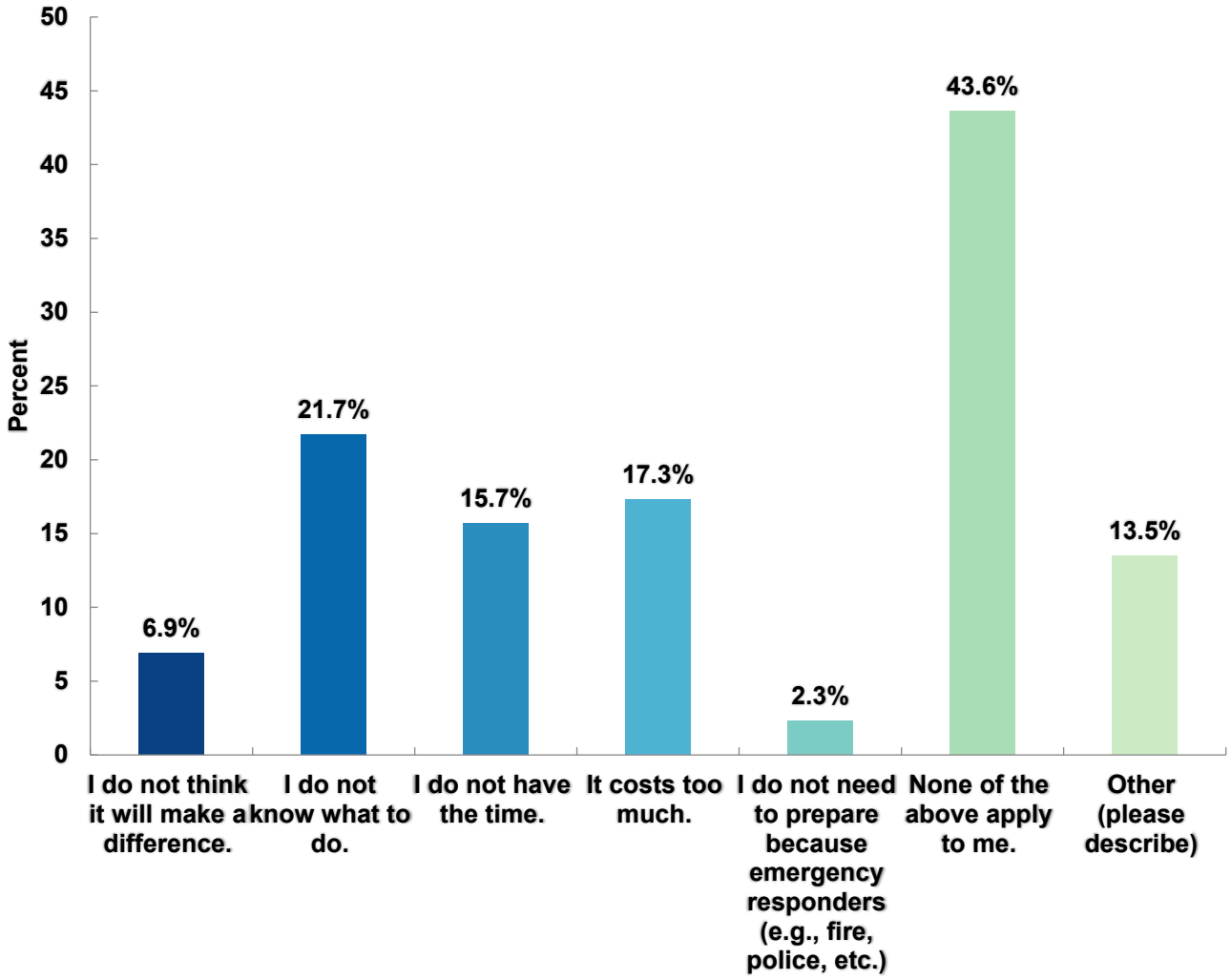


Value	Percent	Total Responses
an emergency preparedness plan.	39.7%	600
flood Insurance.	9.6%	145
a 72 hour kit/disaster supply kit.	53.4%	807
visited local government website(s) for emergency preparedness information.	39.6%	598
an evacuation plan.	31.1%	469
a weather radio.	33.4%	505
signed up for emergency alerts for your local emergency management office (e.g., Harris County).	72.4%	1,093
not taken any preparedness actions.	12.5%	189
Other	8.9%	135

Spanish Survey Results

Value	Percent	Total Responses
an emergency preparedness plan.	29.2%	7
flood Insurance.	4.2%	1
a 72 hour kit/disaster supply kit.	45.8%	11
visited local government website(s) for emergency preparedness information.	25.0%	6
an evacuation plan.	37.5%	9
a weather radio.	0.0%	0
signed up for emergency alerts for your local emergency management office (e.g., Harris County).	50.0%	12
not taken any preparedness actions.	25.0%	6
Other	12.5%	3

Question 8: Have any of the reasons below prevented you from pursuing additional preparedness activities? Please select ALL that apply.

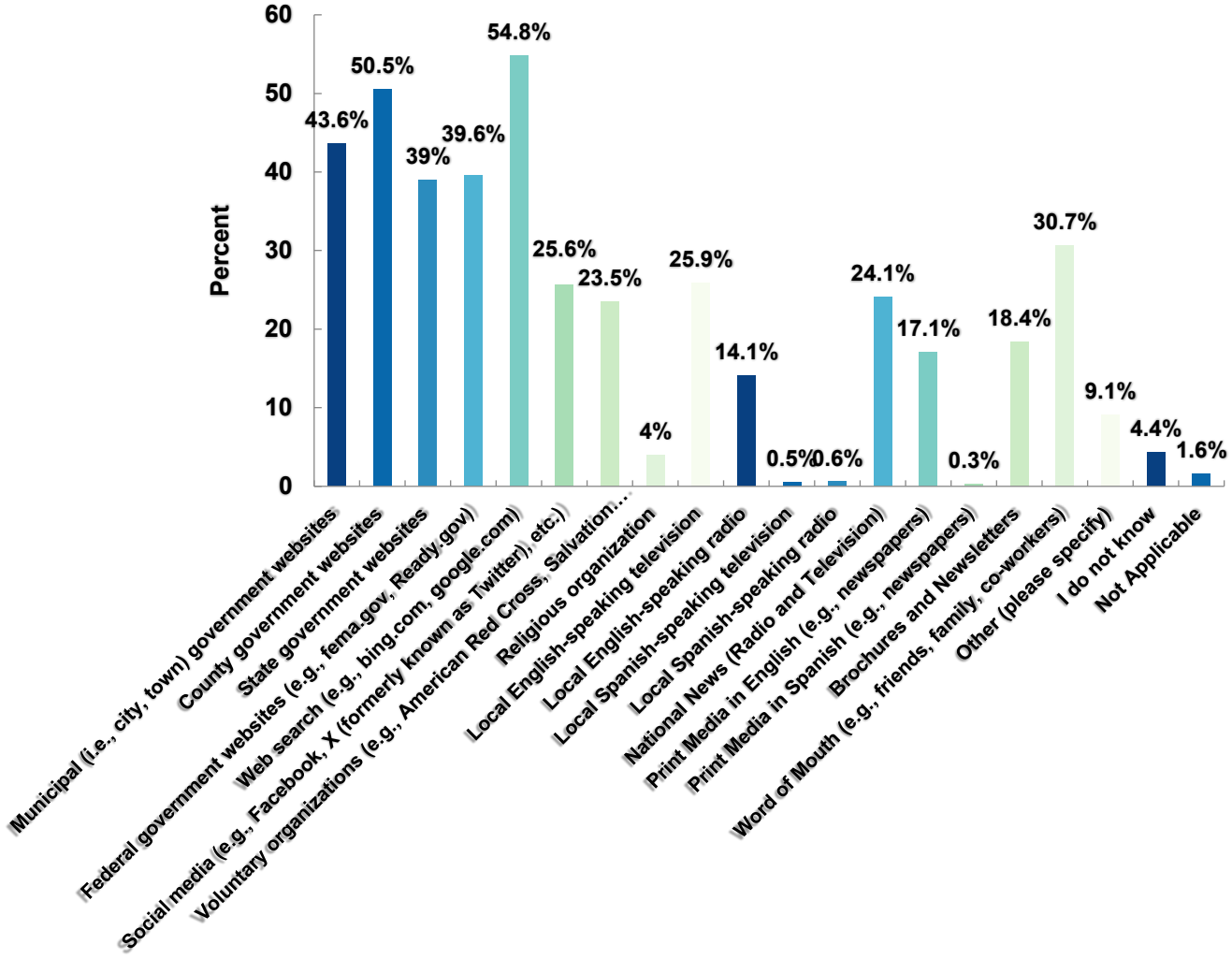


Value	Percent	Total Responses
I do not think it will make a difference.	6.9%	100
I do not know what to do.	21.7%	316
I do not have the time.	15.7%	229
It costs too much.	17.3%	252
I do not need to prepare because emergency responders (e.g., fire, police, etc.) will help me during an emergency.	2.3%	33
None of the above apply to me.	43.6%	634
Other	13.5%	196

Spanish Survey Results

Value	Percent	Total Responses
I do not think it will make a difference.	0.0%	0
I do not know what to do.	34.8%	8
I do not have the time.	34.8%	8
It costs too much.	21.7%	5
I do not need to prepare because emergency responders (e.g., fire, police, etc.) will help me during an emergency.	4.3%	1
None of the above apply to me.	13.0%	3
Other	8.7%	2

Question 9: Please indicate where you go to obtain emergency and disaster preparedness related information? Please select ALL that apply.



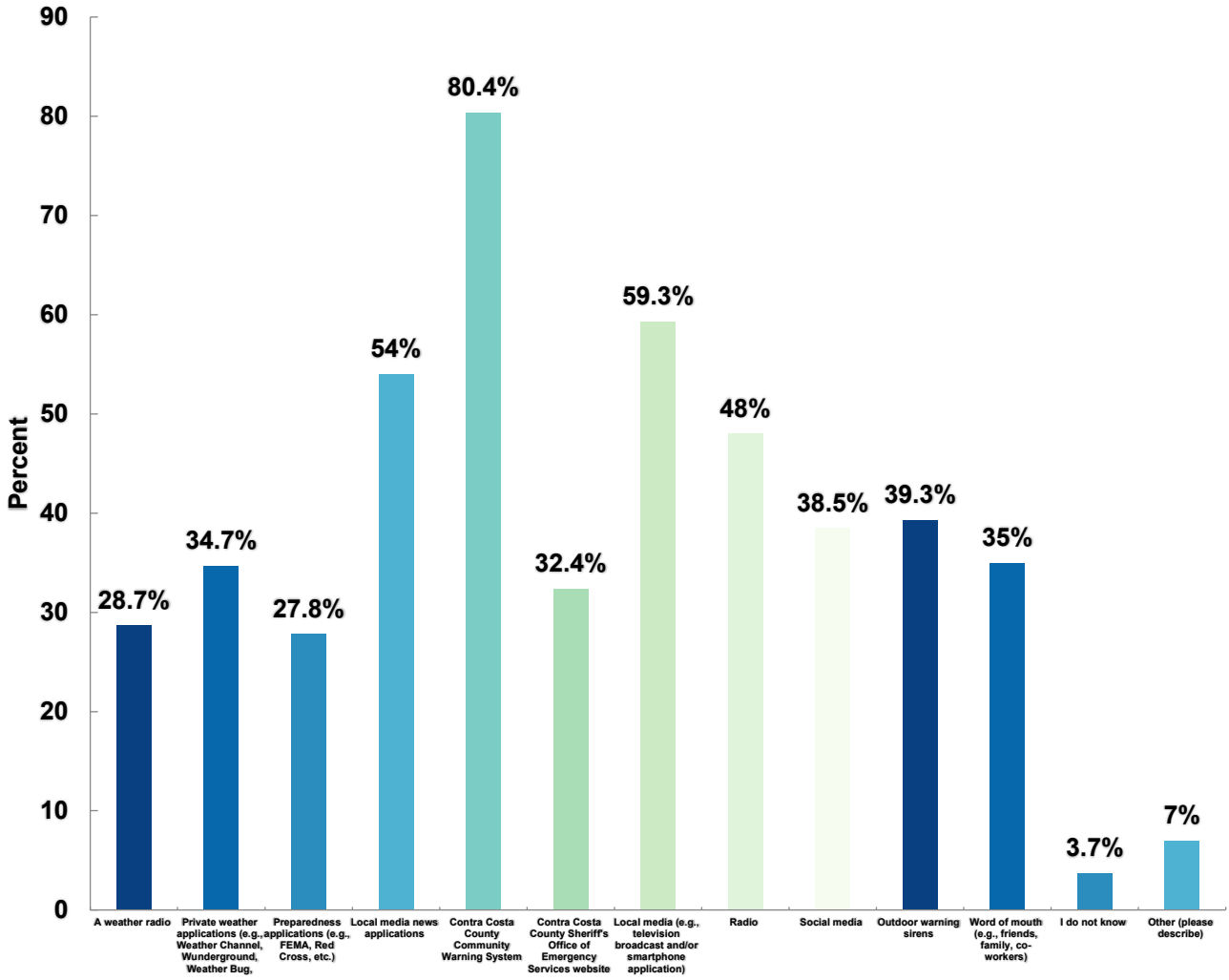
Value	Percent	Total Responses
Municipal (i.e., city, town) government websites	43.6%	657
County government websites	50.5%	761
State government websites	39.0%	587
Federal government websites (e.g., fema.gov, Ready.gov)	39.6%	596
Web search (e.g., bing.com, google.com)	54.8%	826
Social media (e.g., Facebook, X (formerly known as Twitter), etc.)	25.6%	385
Voluntary organizations (e.g., American Red Cross, Salvation Army, etc.)	23.5%	354
Religious organization	4.0%	60

Value	Percent	Total Responses
Local English-speaking television	25.9%	390
Local English-speaking radio	14.1%	212
Local Spanish-speaking television	0.5%	8
Local Spanish-speaking radio	0.6%	9
National News (Radio and Television)	24.1%	363
Print Media in English (e.g., newspapers)	17.1%	257
Print Media in Spanish (e.g., newspapers)	0.3%	5
Brochures and Newsletters	18.4%	277
Word of Mouth (e.g., friends, family, co-workers)	30.7%	462
Other (please specify)	9.1%	137
I do not know	4.4%	67

Spanish Survey Results

Value	Percent	Total Responses
Municipal (i.e., city, town) government websites	37.5%	9
County government websites	41.7%	10
State government websites	25.0%	6
Federal government websites (e.g., fema.gov, Ready.gov)	25.0%	6
Web search (e.g., bing.com, google.com)	45.8%	11
Social media (e.g., Facebook, X (formerly known as Twitter), etc.)	29.2%	7
Contra Costa County Community Warning System	37.5%	9
Voluntary organizations (e.g., American Red Cross, Salvation Army, etc.)	25.0%	6
Religious organization	4.2%	1
Local English-speaking television	33.3%	8
Local English-speaking radio	16.7%	4
Local Spanish-speaking television	29.2%	7
Local Spanish-speaking radio	20.8%	5
National News (Radio and Television)	33.3%	8
Print Media (e.g., newspapers)	16.7%	4
Word of Mouth (e.g., friends, family, co-workers)	33.3%	8
Other (please specify)	8.3%	2
I do not know	4.2%	1

Question 10: Please indicate how you expect to receive alerts and information during an emergency. Please select ALL that apply.



Value	Percent	Total Responses
A weather radio	28.7%	432
Private weather applications (e.g., Weather Channel, Wunderground, Weather Bug, AccuWeather, etc.)	34.7%	521
Preparedness applications (e.g., FEMA, Red Cross, etc.)	27.8%	418
Local media news applications	54.0%	812
Contra Costa County Community Warning System	80.4%	1,208
Contra Costa County Sheriff's Office of Emergency Services website	32.4%	487
Local media (e.g., television broadcast and/or smartphone application)	59.3%	891
Radio	48.0%	721

Value	Percent	Total Responses
Social media	38.5%	579
Outdoor warning sirens	39.3%	590
Word of mouth (e.g., friends, family, co-workers)	35.0%	526
I do not know	3.7%	56
Other	7.0%	105

Spanish Survey Results

Value	Percent	Total Responses
A weather radio	12.5%	3
Private weather applications (e.g., Weather Channel, Wunderground, Weather Bug, AccuWeather, etc.)	54.2%	13
Preparedness applications (e.g., FEMA, Red Cross, etc.)	29.2%	7
Local media news applications	45.8%	11
Contra Costa County Community Warning System	62.5%	15
Contra Costa County Sheriff's Office of Emergency Services website	45.8%	11
Local media (e.g., television broadcast and/or smartphone application)	41.7%	10
Radio	37.5%	9
Social media	45.8%	11
Outdoor warning sirens	37.5%	9
Word of mouth (e.g., friends, family, co-workers)	41.7%	10
Other	4.2%	1

Question 11: Would you agree or disagree with the following statements?

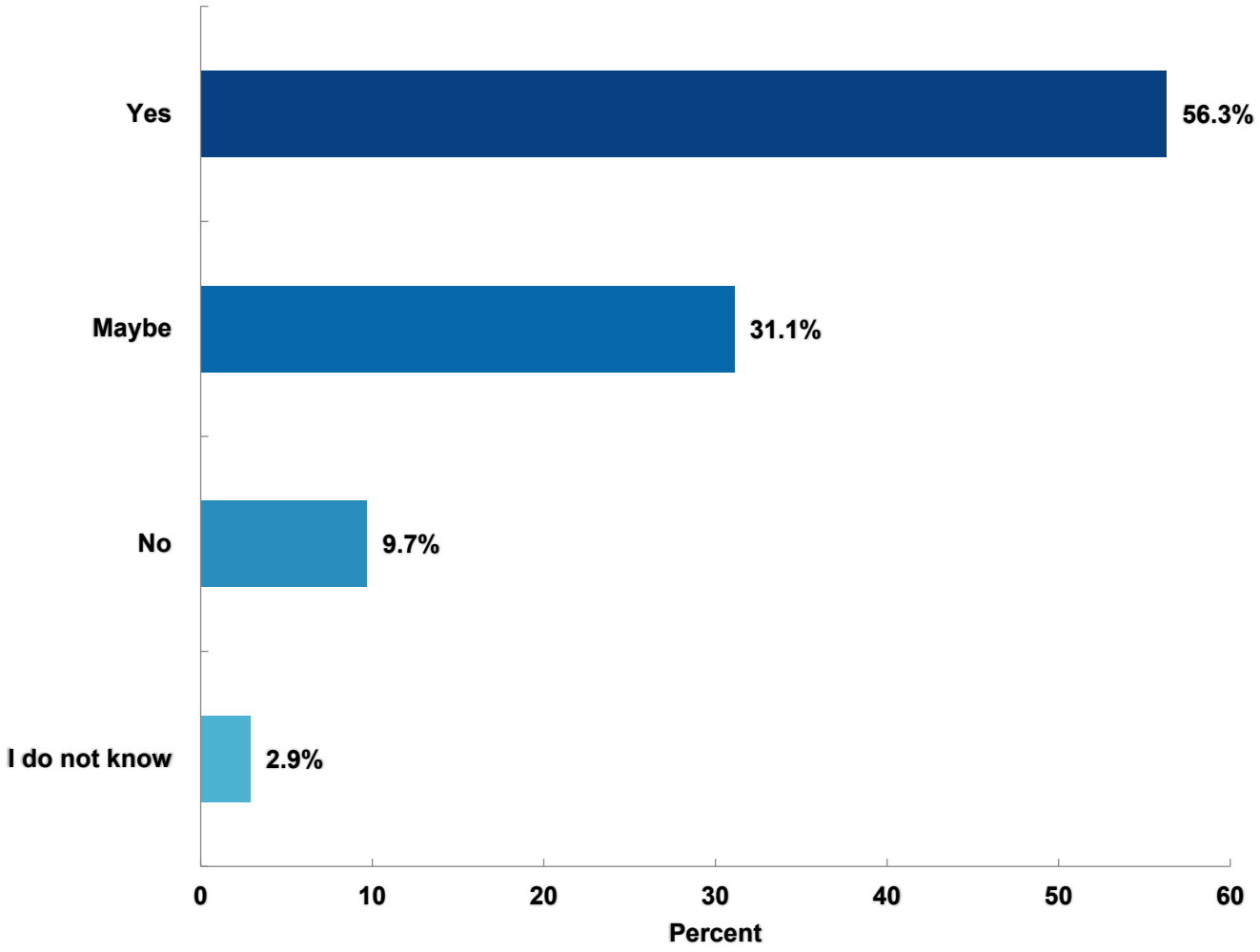
Value	Strongly Disagree		Disagree		Neither Agree or Disagree		Agree		Strongly Agree		I Do Not Know		Total Responses
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	
Contra Costa County is providing the services necessary to prepare me for a disaster.	111	7.4%	182	12.1%	501	33.4%	379	25.3%	97	6.5%	228	15.2%	1,498
I am familiar with Contra Costa County's website and can easily obtain information about emergencies and disasters.	112	7.5%	328	22.0%	398	26.6%	416	27.8%	118	7.9%	122	8.2%	1,494
During times of emergency, information is provided in a language or format I can understand.	52	3.5%	26	1.7%	160	10.7%	570	38.2%	569	38.1%	117	7.8%	1,494
I can easily obtain emergency information in times of crisis.	70	4.7%	154	10.3%	405	27.2%	491	32.9%	128	8.6%	243	16.3%	1,491

Spanish Survey Results

Value	Strongly Disagree		Disagree		Neither Agree or Disagree		Agree		Strongly Agree		I Do Not Know		Total Responses
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	
Contra Costa County is providing the services necessary to prepare me for a disaster.	1	4.2%	6	25.0%	10	41.7%	3	12.5%	2	8.3%	2	8.3%	24
I am familiar with Contra Costa County's website and can easily obtain information about emergencies and disasters.	1	4.2%	8	33.3%	4	16.7%	6	25.0%	1	4.2%	4	16.7%	24
During times of emergency, information is provided in a language or format I can understand.	3	12.5%	2	8.3%	4	16.7%	8	33.3%	5	20.8%	2	8.3%	24
I can easily obtain emergency information in times of crisis.	2	8.3%	6	25.0%	6	25.0%	6	25.0%	1	4.2%	3	12.5%	24

Question 12: Please indicate how Contra Costa County can better assist you in preparing for emergencies and disasters (e.g., provide preparedness materials in my language). REDACTED

Question 13: If a disaster (i.e., earthquake, wildfire) impacted Contra Costa County, knocking out electricity and running water, would your household be able to manage on its own for at least three (3) days?



Value	Percent	Total Responses
Yes	56.3%	848
Maybe	31.1%	469
No	9.7%	146
I do not know	2.9%	43
	Total	**1,506**

Spanish Survey Results

Value	Percent	Total Responses
Yes	33.3%	8
Maybe	16.7%	4
No	41.7%	10
I do not know	8.3%	2
	Total	**24**

Question 14: Do you believe that Contra Costa County might ever be threatened by the following hazards? Please rate what hazards present the greatest risk.

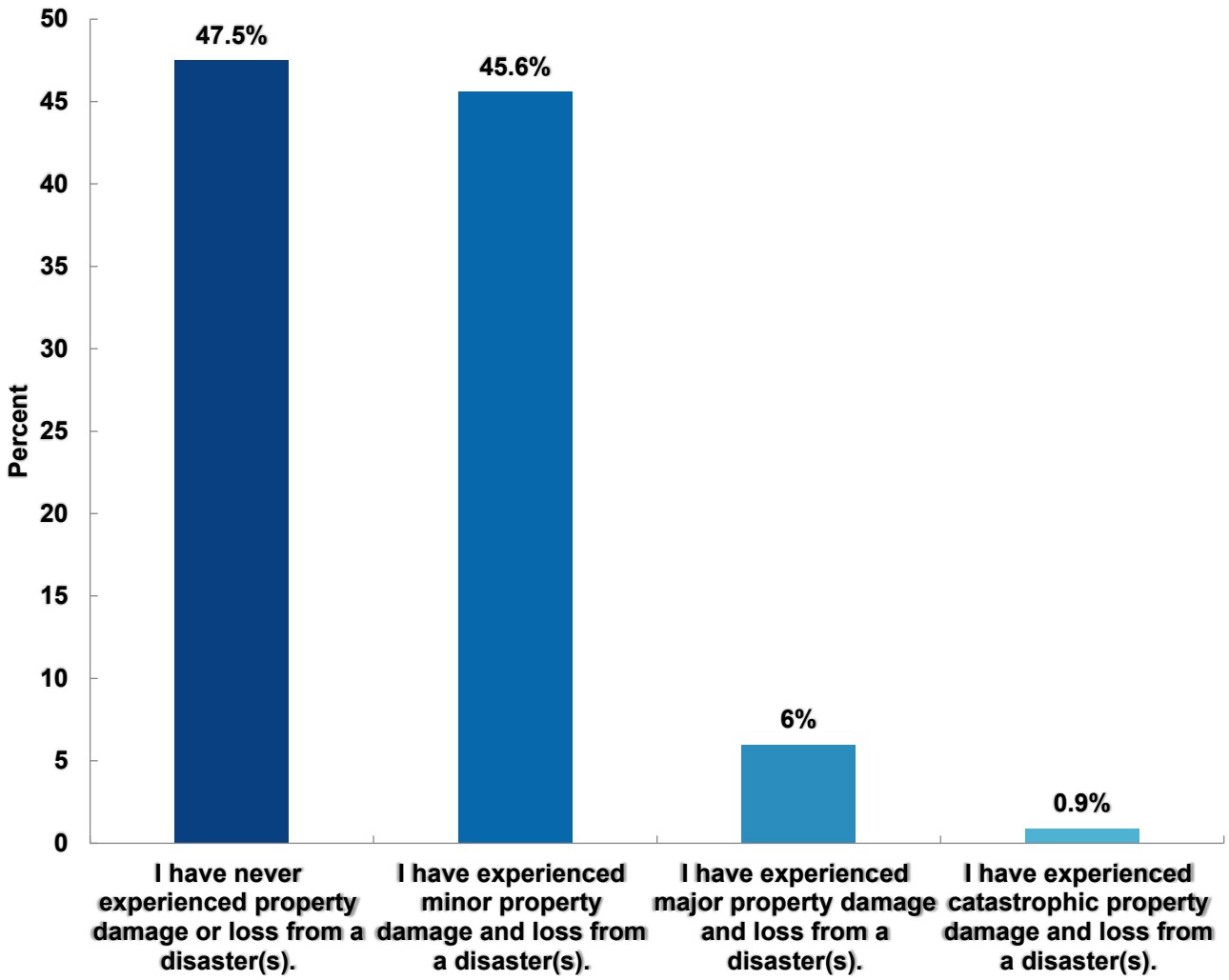
Low Risk: Low impact on threat to life and property damage.
Medium Risk: Medium impact on threat to life and property damage.
High Risk: High impact on threat to life and property damage.

Value	Low Risk		Medium Risk		High Risk		Not Applicable		Total Responses
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	
Climate Change	369	27.2%	490	36.1%	466	34.3%	34	2.5%	1,359
Dam and Levee Failure	834	61.9%	190	14.1%	154	11.4%	169	12.5%	1,347
Drought	246	18.0%	470	34.4%	637	46.6%	14	1.0%	1,367
Earthquake	43	3.1%	373	26.9%	965	69.7%	4	0.3%	1,385
Flood	710	52.1%	401	29.4%	205	15.0%	48	3.5%	1,364
Landslide	747	55.4%	376	27.9%	157	11.6%	68	5.0%	1,348
Severe Thunderstorm	521	38.2%	573	42.0%	256	18.8%	13	1.0%	1,363
Strong Winds *(greater than 58 mph)*	244	17.8%	639	46.7%	478	34.9%	7	0.5%	1,368
Hail	800	58.9%	441	32.5%	101	7.4%	16	1.2%	1,358
Tsunami	977	72.6%	132	9.8%	63	4.7%	173	12.9%	1,345
Wildfire	236	17.2%	410	29.9%	712	51.9%	14	1.0%	1,372
Sea Level Rise	785	58.1%	300	22.2%	138	10.2%	128	9.5%	1,351

Spanish Survey Results

Value	Low Risk		Medium Risk		High Risk		Not Applicable		Total Responses
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	
Climate Change	4	21.1%	7	36.8%	7	36.8%	1	5.3%	19
Dam and Levee Failure	8	44.4%	6	33.3%	3	16.7%	1	5.6%	18
Drought	6	31.6%	5	26.3%	6	31.6%	2	10.5%	19
Earthquake	2	10.5%	7	36.8%	9	47.4%	1	5.3%	19
Flood	5	26.3%	9	47.4%	4	21.1%	1	5.3%	19
Landslide	7	38.9%	3	16.7%	5	27.8%	3	16.7%	18
Severe Thunderstorm	5	27.8%	9	50.0%	1	5.6%	3	16.7%	18
Strong Winds *(greater than 58 mph)*	4	21.1%	8	42.1%	6	31.6%	1	5.3%	19
Hail	7	36.8%	7	36.8%	3	15.8%	2	10.5%	19
Tsunami	11	57.9%	6	31.6%	0	%	2	10.5%	19
Wildfire	2	10.5%	5	26.3%	9	47.4%	3	15.8%	19
Sea Level Rise	6	31.6%	6	31.6%	6	31.6%	1	5.3%	19

Question 15: Please select the answer that best describes your experience.



Value	Percent	Total Responses
I have never experienced loss from a disaster(s).	47.5%	659
I have experienced minor loss from a disaster(s).	45.6%	633
I have experienced major loss from a disaster(s).	6.0%	83
I have experienced catastrophic loss from a disaster(s).	0.9%	13
	Total	**1,388**

Spanish Survey Results

Value	Percent	Total Responses
I have never experienced loss from a disaster(s).	52.6%	10
I have experienced minor loss from a disaster(s).	36.8%	7
I have experienced major loss from a disaster(s).	10.5%	2
I have experienced catastrophic loss from a disaster(s).	0.0%	0
Total		**19**

Question 16: If you have experienced any damage(s) or injury(ies) from a disaster, please list the hazard(s) that caused the damages/losses and/or injuries (e.g., flooding, wind, wildfire). **REDACTED**

Question 17: If you have experienced any damage(s) or injury(ies) from a disaster, please indicate where this occurred (e.g., my home, on a roadway or intersection, at work, on vacation, etc.). **REDACTED**

Question 18: If you have experienced any damage(s) or injury(ies) from a disaster, please describe the damages and/or injuries. (e.g., house flooded, roof was damaged, vehicle was damaged, broken bones, lacerations, etc.). REDACTED

Question 19: Based on YOUR PERCEPTION of your jurisdiction's hazards, to what degree of emphasis would you expect your jurisdiction to mitigate the following hazards?

Definition: *Hazard mitigation is any sustainable action that reduces or eliminates long-term risk to people and property from future disasters. Hazard mitigation includes long-term solutions that reduce the impact of disasters in the future.*

No Mitigation Needed: *No mitigation on this hazard is expected or needed.*
Low Priority: *This hazard should be mitigated, but is not a high priority compared to other hazards.*
Medium Priority: *It is important to mitigate this hazard.*
High Priority: *It is a high priority to emphasize mitigation for this hazard.*

Value	No Mitigation Needed		Low Priority		Medium Priority		High Priority		Total Responses
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	
Climate Change	194	14.4%	274	20.3%	373	27.6%	509	37.7%	1,350
Dam and Levee Failure	369	27.2%	415	30.6%	290	21.4%	282	20.8%	1,356
Drought	80	5.9%	250	18.4%	470	34.6%	558	41.1%	1,358
Earthquake	28	2.0%	96	7.0%	385	28.0%	865	63.0%	1,374
Flood	157	11.6%	389	28.7%	478	35.3%	331	24.4%	1,355
Landslide	223	16.5%	464	34.4%	431	31.9%	232	17.2%	1,350
Severe Thunderstorm	247	18.2%	577	42.6%	361	26.6%	170	12.5%	1,355
Strong Winds *(greater than 58 mph)*	108	8.0%	379	27.9%	547	40.3%	322	23.7%	1,356
Hail	449	33.4%	679	50.6%	160	11.9%	55	4.1%	1,343
Tsunami	630	46.8%	486	36.1%	142	10.5%	88	6.5%	1,346
Wildfire	47	3.5%	137	10.1%	281	20.6%	896	65.8%	1,361
Sea Level Rise	410	30.5%	427	31.7%	315	23.4%	193	14.3%	1,345

Spanish Survey Results

Value	No Mitigation Needed		Low Priority		Medium Priority		High Priority		Total Responses
	Count	***%***	***Count***	***%***	***Count***	***%***	***Count***	***%***	
Climate Change	0	%	4	21.1%	7	36.8%	8	42.1%	19
Dam and Levee Failure	2	11.1%	5	27.8%	6	33.3%	5	27.8%	18
Drought	2	10.5%	2	10.5%	9	47.4%	6	31.6%	19
Earthquake	1	5.3%	0	%	9	47.4%	9	47.4%	19
Flood	0	%	4	21.1%	9	47.4%	6	31.6%	19
Landslide	2	11.1%	4	22.2%	7	38.9%	5	27.8%	18
Severe Thunderstorm	2	10.5%	6	31.6%	8	42.1%	3	15.8%	19
Strong Winds *(greater than 58 mph)*	0	%	8	42.1%	7	36.8%	4	21.1%	19
Hail	5	26.3%	6	31.6%	7	36.8%	1	5.3%	19
Tsunami	3	15.8%	6	31.6%	7	36.8%	3	15.8%	19
Wildfire	0	%	2	10.5%	8	42.1%	9	47.4%	19
Sea Level Rise	1	5.3%	3	15.8%	10	52.6%	5	26.3%	19

Question 20: OPTIONAL: Please provide specific recommendations for mitigation in your area. For example, please indicate the hazard(s) in which your community/location is uniquely vulnerable and provide a brief explanation of the possible solutions (i.e., mitigation) that would address the issue(s). REDACTED

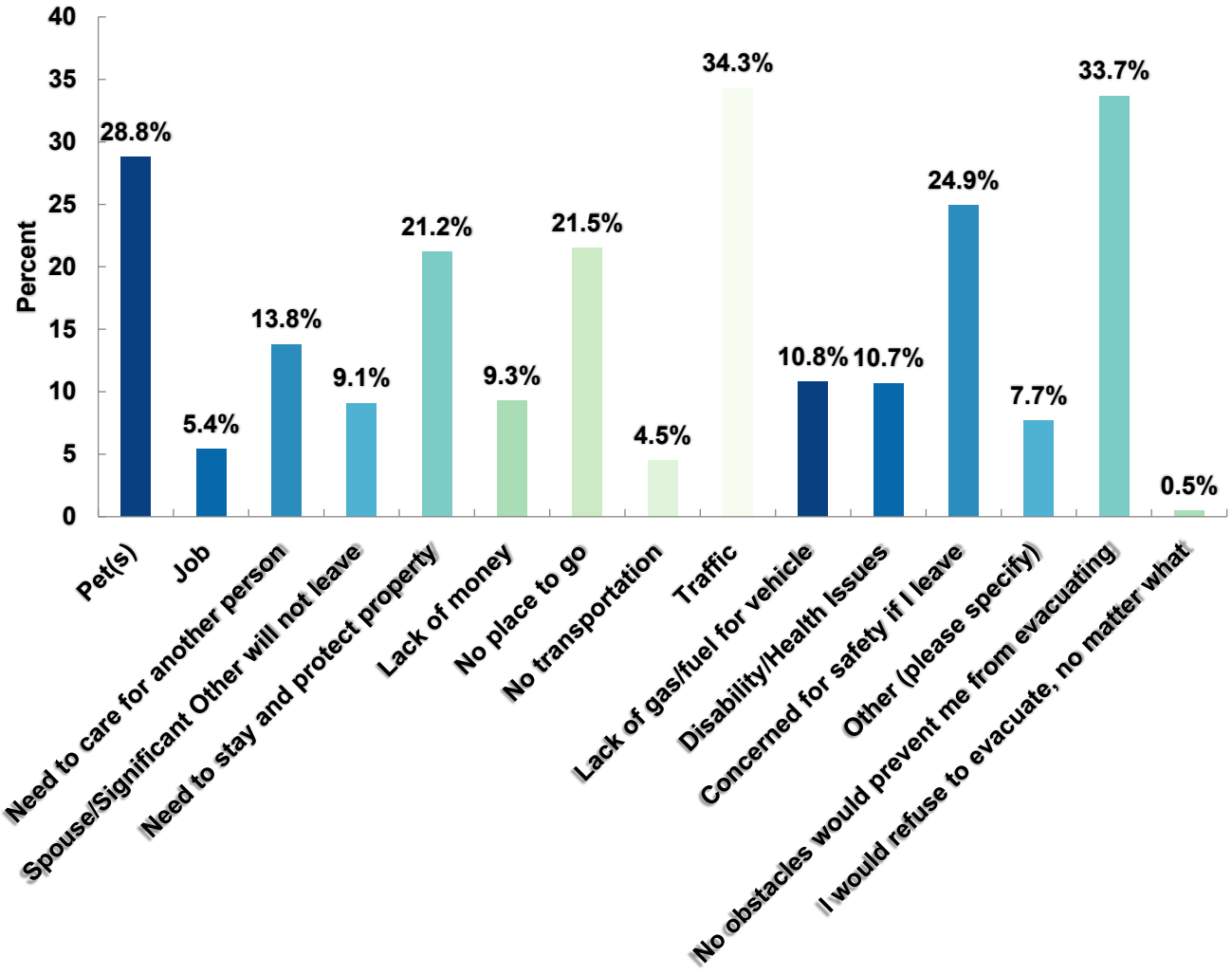
Question 21: If an evacuation were ordered for your area, please indicate how likely you would be to do the following.

Value	Very Unlikely		Unlikely		Unsure or Do Not Know		Likely		Very Likely		Not Applicable		Total Responses
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	
Immediately evacuate as instructed.	57	4.2%	51	3.8%	121	8.9%	335	24.7%	791	58.2%	3	0.2%	1,358
I would first consult with family and friends outside my household before making a decision to evacuate.	247	19.0%	323	24.9%	150	11.5%	358	27.6%	202	15.6%	19	1.5%	1,299
Wait and see how bad the situation is going to be before deciding to evacuate.	311	24.0%	456	35.2%	216	16.7%	219	16.9%	84	6.5%	11	0.8%	1,297
I refuse to evacuate, no matter what.	952	73.2%	188	14.5%	67	5.2%	18	1.4%	17	1.3%	58	4.5%	1,300

Spanish Survey Results

Value	Very Unlikely		Unlikely		Unsure or Do Not Know		Likely		Very Likely		Not Applicable		Total Responses
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	
Immediately evacuate as instructed.	1	5.6%	0	%	2	11.1%	8	44.4%	7	38.9%	0	%	18
I would first consult with family and friends outside my household before making a decision to evacuate.	3	16.7%	2	11.1%	2	11.1%	6	33.3%	5	27.8%	0	%	18
Wait and see how bad the situation is going to be before deciding to evacuate.	4	22.2%	4	22.2%	1	5.6%	7	38.9%	2	11.1%	0	%	18
I refuse to evacuate, no matter what.	11	61.1%	3	16.7%	1	5.6%	1	5.6%	1	5.6%	1	5.6%	18

Question 22: What might prevent you from leaving your place of residence if there was an evacuation order? Please select ALL that apply.



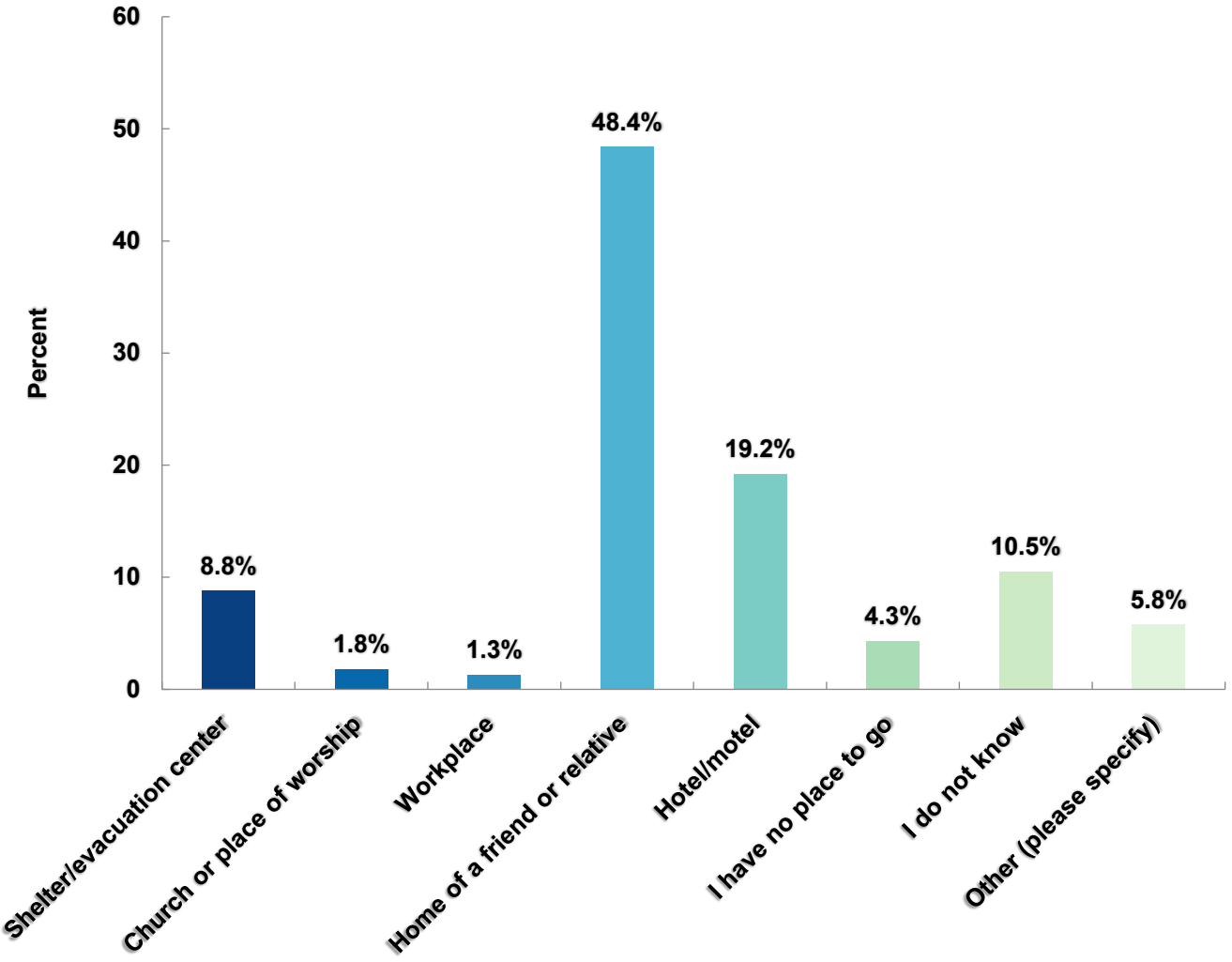
Value	Percent	Total Responses
Pet(s)	28.8%	387
Job	5.4%	72
Need to care for another person	13.8%	185
Spouse/Significant Other will not leave	9.1%	122
Need to stay and protect property	21.2%	285
Lack of money	9.3%	125
No place to go	21.5%	289
No transportation	4.5%	61
Traffic	34.3%	462

Value	Percent	Total Responses
Lack of gas/fuel for vehicle	10.8%	145
Disability/Health Issues	10.7%	144
Concerned for safety if I leave	24.9%	335
Other (please specify)	7.7%	103
No obstacles would prevent me from evacuating	33.7%	453
I would refuse to evacuate, no matter what	0.5%	7

Spanish Survey Results

Value	Percent	Total Responses
Pet(s)	52.9%	9
Job	29.4%	5
Need to care for another person	23.5%	4
Spouse/Significant Other will not leave	17.6%	3
Need to stay and protect property	35.3%	6
Lack of money	11.8%	2
No place to go	23.5%	4
No transportation	0.0%	0
Traffic	41.2%	7
Lack of gas/fuel for vehicle	5.9%	1
Disability/Health Issues	5.9%	1
Concerned for safety if I leave	5.9%	1
Other (please specify)	5.9%	1
No obstacles would prevent me from evacuating	23.5%	4
I would refuse to evacuate, no matter what	0.0%	0

Question 23: If you were to evacuate, where would you most likely stay? Please select the best answer.

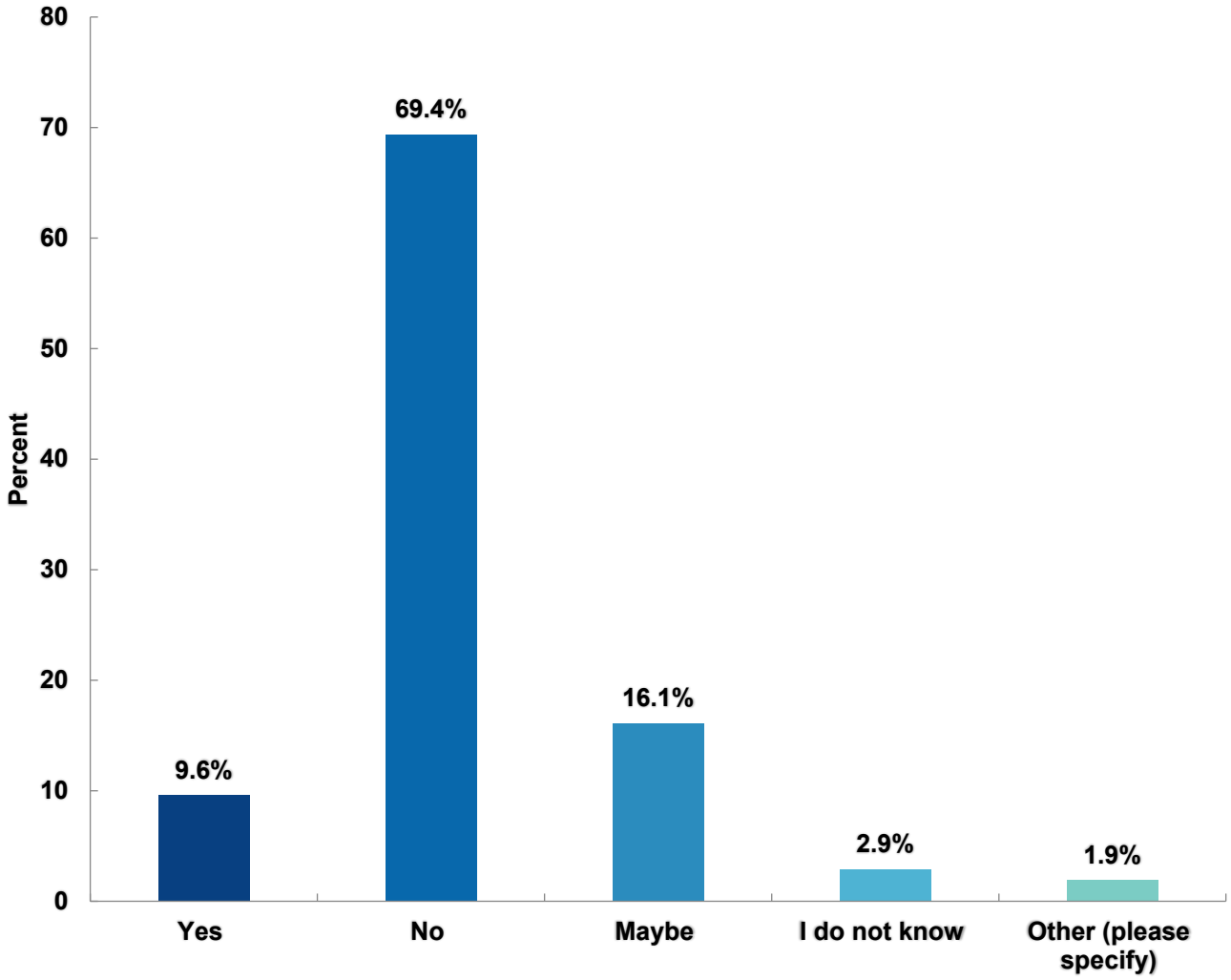


Value	Percent	Total Responses
Shelter/evacuation center	8.8%	120
Church or place of worship	1.8%	24
Workplace	1.3%	18
Home of a friend or relative	48.4%	662
Hotel/motel	19.2%	262
I have no place to go	4.3%	59
I do not know	10.5%	143
Other (please specify)	5.8%	80
	Total	**1,368**

Spanish Survey Results

Value	Percent	Total Responses
Shelter/evacuation center	11.1%	2
Church or place of worship	0.0%	0
Workplace	0.0%	0
Home of a friend or relative	61.1%	11
Hotel/motel	5.6%	1
I have no place to go	5.6%	1
I do not know	16.7%	3
Other (please specify)	0.0%	0
	Total	**18**

Question 24: In an evacuation, would you or anyone in your household require special assistance?

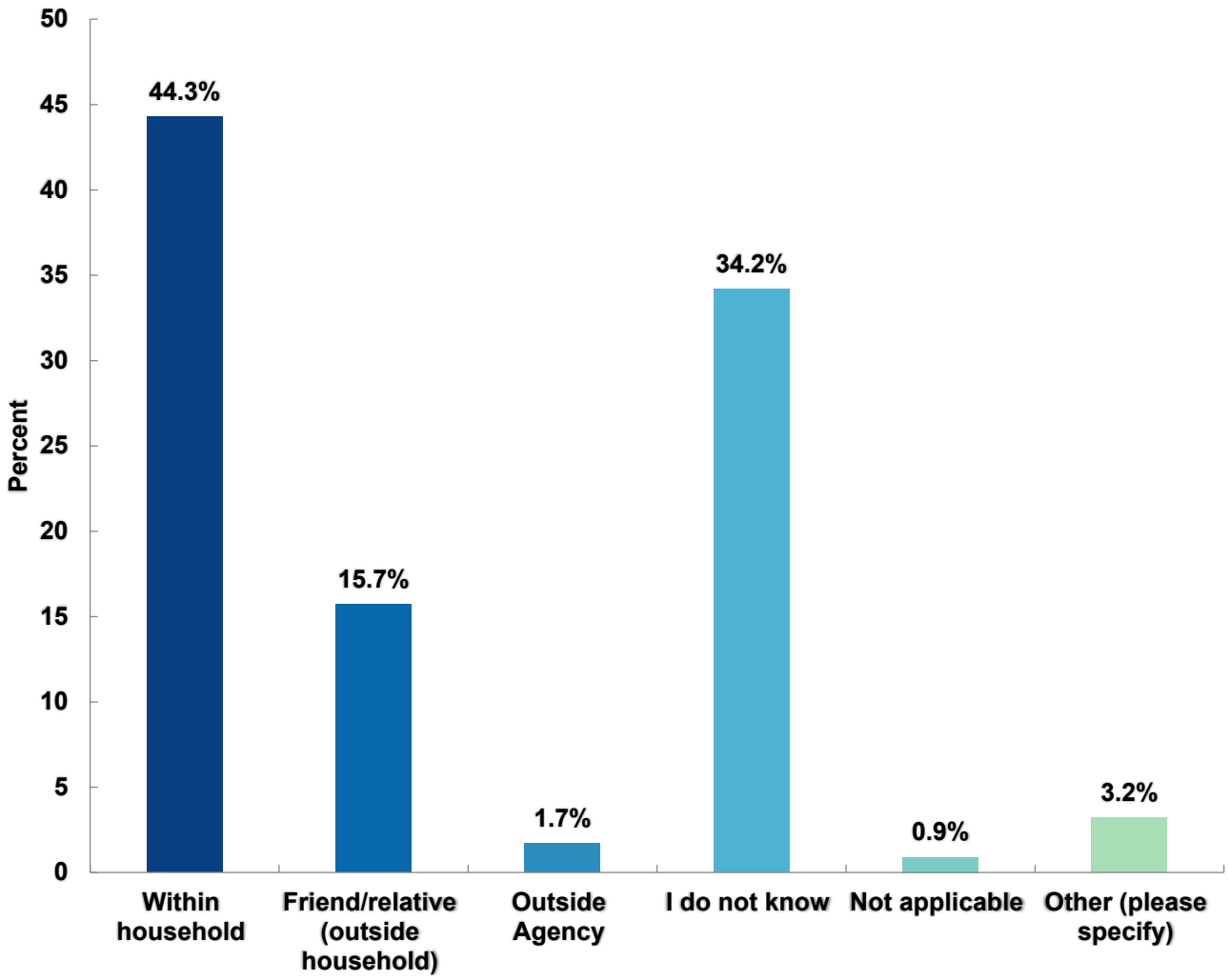


Value	Percent	Total Responses
Yes	9.6%	132
Maybe	69.4%	950
No	16.1%	221
I do not know	2.9%	40
Other	1.9%	26
	Total	**1,369**

Spanish Survey Results

Value	Percent	Total Responses
Yes	5.6%	1
Maybe	11.1%	2
No	66.7%	12
I do not know	16.7%	3
Other	0.0%	0
	Total	**18**

Question 25: If yes, who would provide assistance?



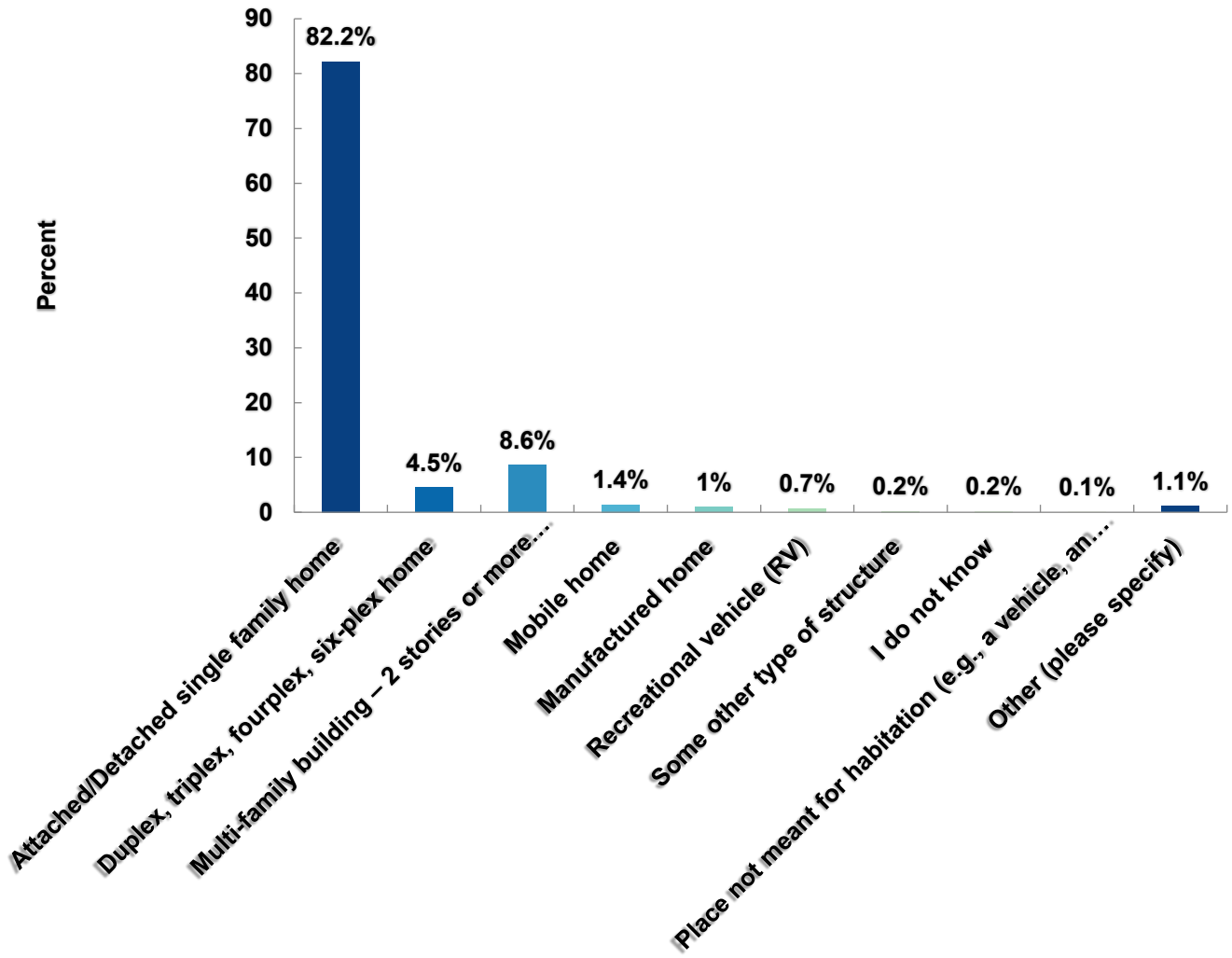
Value	Percent	Total Responses
Within household	44.3%	153
Friend/relative (outside household)	15.7%	54
Outside Agency	1.7%	6
I do not know	34.2%	118
Not applicable	0.9%	3
Other	3.2%	11
	Total	**345**

Spanish Survey Results

Value	Percent	Total Responses
Within household	0.0%	0
Friend/relative (outside household)	0.0%	0
Outside Agency	33.3%	1
I do not know	66.7%	2
Not applicable	0.0%	0
Other	0.0%	0
Total		**3**

Question 26: If applicable, please indicate what kind of outside assistance your household may need during an evacuation (e.g., transportation, medical, etc.). **REDACTED**

Question 27: Which best describes your living arrangement?



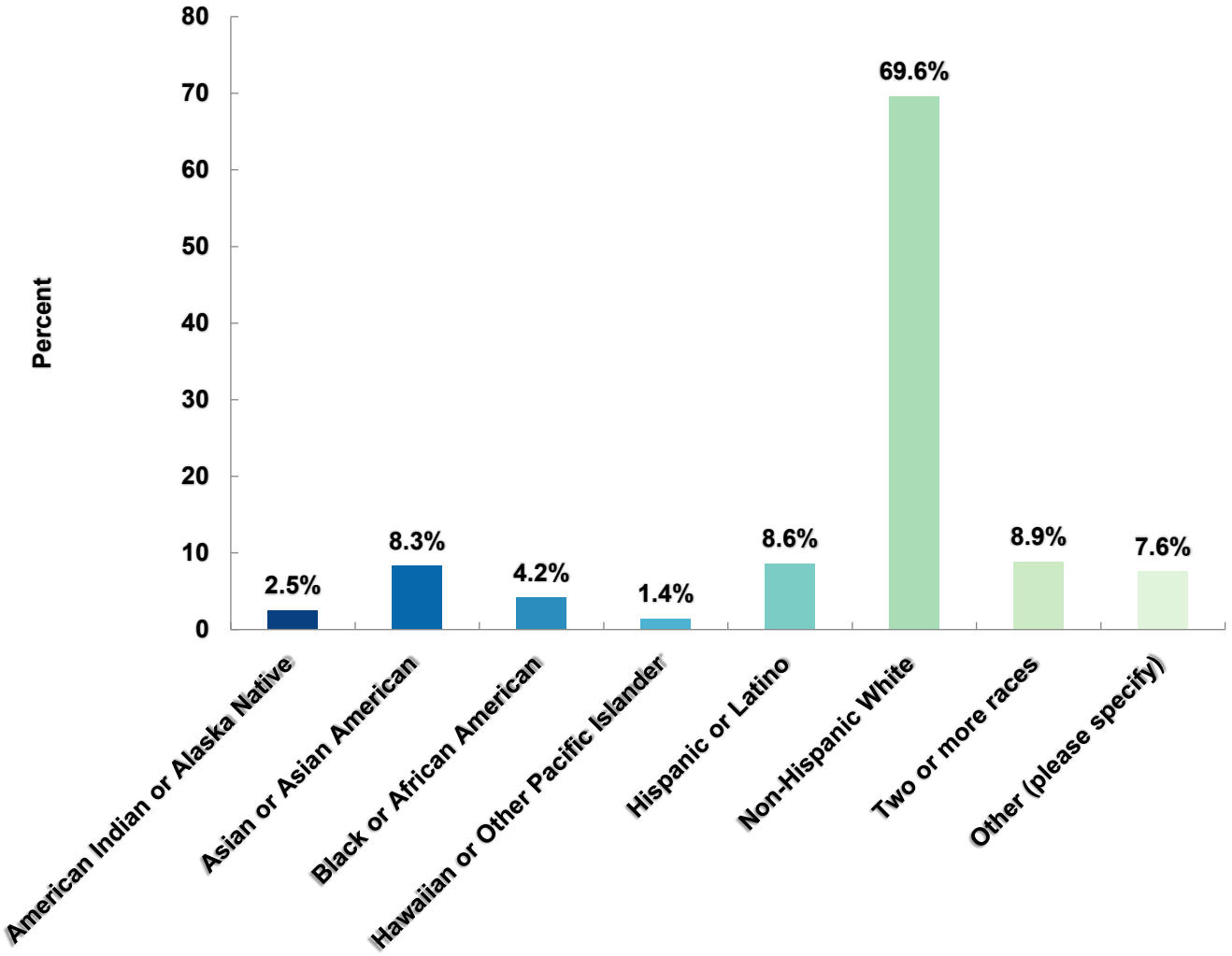
Value	Percent	Total Responses
Attached/Detached single family home	82.2%	1,119
Duplex, triplex, fourplex, six-plex home	4.5%	61
Multi-family building – 2 stories or more (apartment/condominium)	8.6%	117
Mobile home	1.4%	19
Manufactured home	1.0%	13
Recreational vehicle (RV)	0.7%	10
Some other type of structure	0.2%	3
I do not know	0.2%	3
Place not meant for habitation (e.g., a vehicle, an abandoned building, bus/train/subway station/airport or anywhere outside)	0.1%	1

Value	Percent	Total Responses
Other	1.1%	15
	Total	**1,361**

Spanish Survey Results

Value	Percent	Total Responses
Attached/Detached single family home	66.7%	12
Duplex, triplex, fourplex, six-plex home	0.0%	0
Multi-family building – 2 stories or more (apartment/condominium)	16.7%	3
Mobile home	0.0%	0
Manufactured home	0.0%	0
Recreational vehicle (RV)	0.0%	0
Some other type of structure	0.0%	0
I do not know	16.7%	3
Place not meant for habitation (e.g., a vehicle, an abandoned building, bus/train/subway station/airport or anywhere outside)	0.0%	0
Other	0.0%	0
	Total	**18**

Question 28: Which of the following best describes your race/ethnicity? Please select ALL that apply.

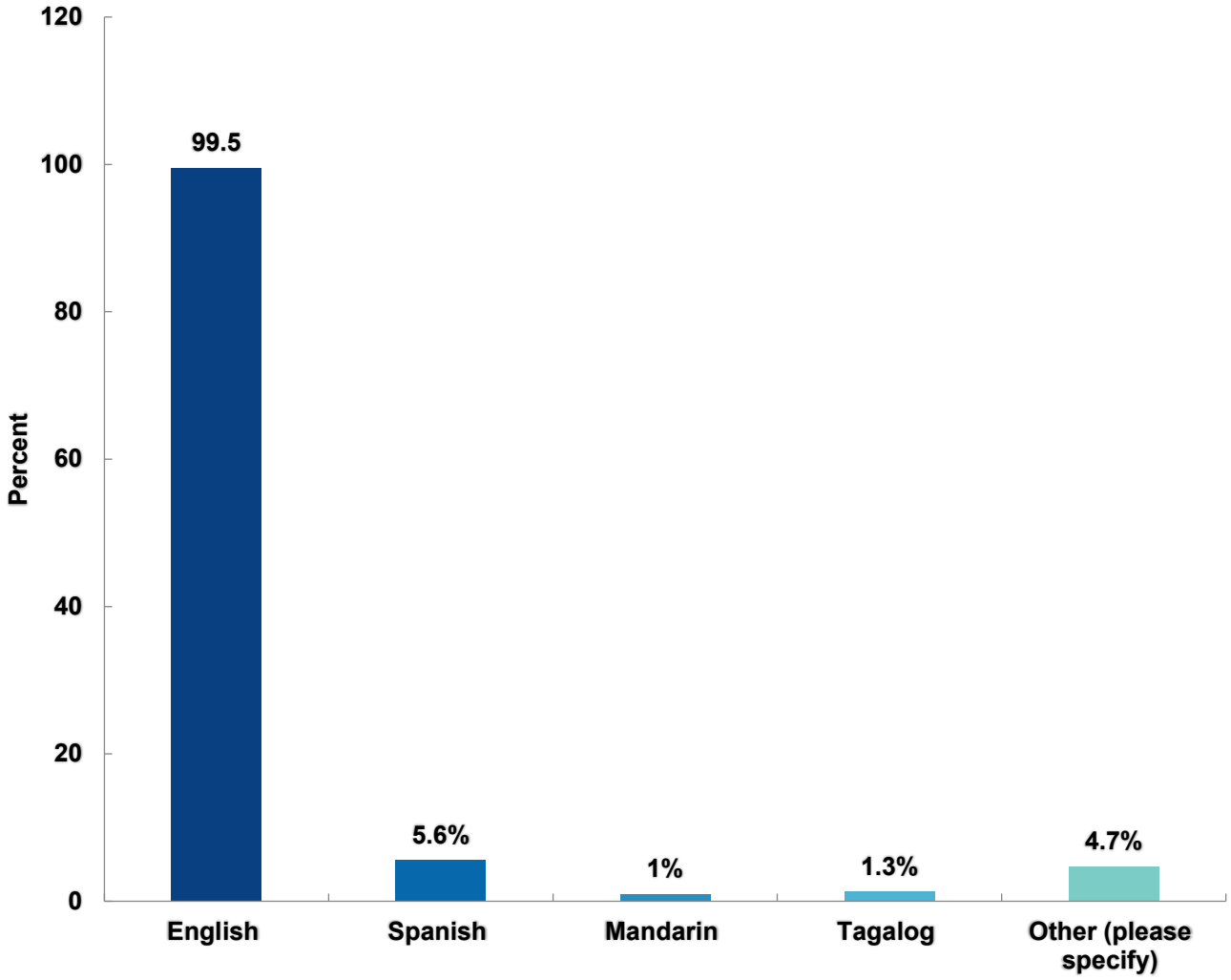


Value	Percent	Total Responses
American Indian or Alaska Native	2.5%	33
Asian or Asian American	8.3%	111
Black or African American	4.2%	56
Hawaiian or Other Pacific Islander	1.4%	18
Hispanic or Latino	8.6%	114
Non-Hispanic White	69.6%	928
Two or more races	8.9%	119
Other	7.6%	101

Spanish Survey Results

Value	Percent	Total Responses
American Indian or Alaska Native	5.9%	1
Asian or Asian American	0.0%	0
Black or African American	0.0%	0
Hawaiian or Other Pacific Islander	0.0%	0
Hispanic or Latino	76.5%	13
Non-Hispanic White	17.6%	3
Two or more races	0.0%	0
Other	5.9%	1

Question 29: Please indicate the language(s) spoken in your household. Please select ALL that apply.

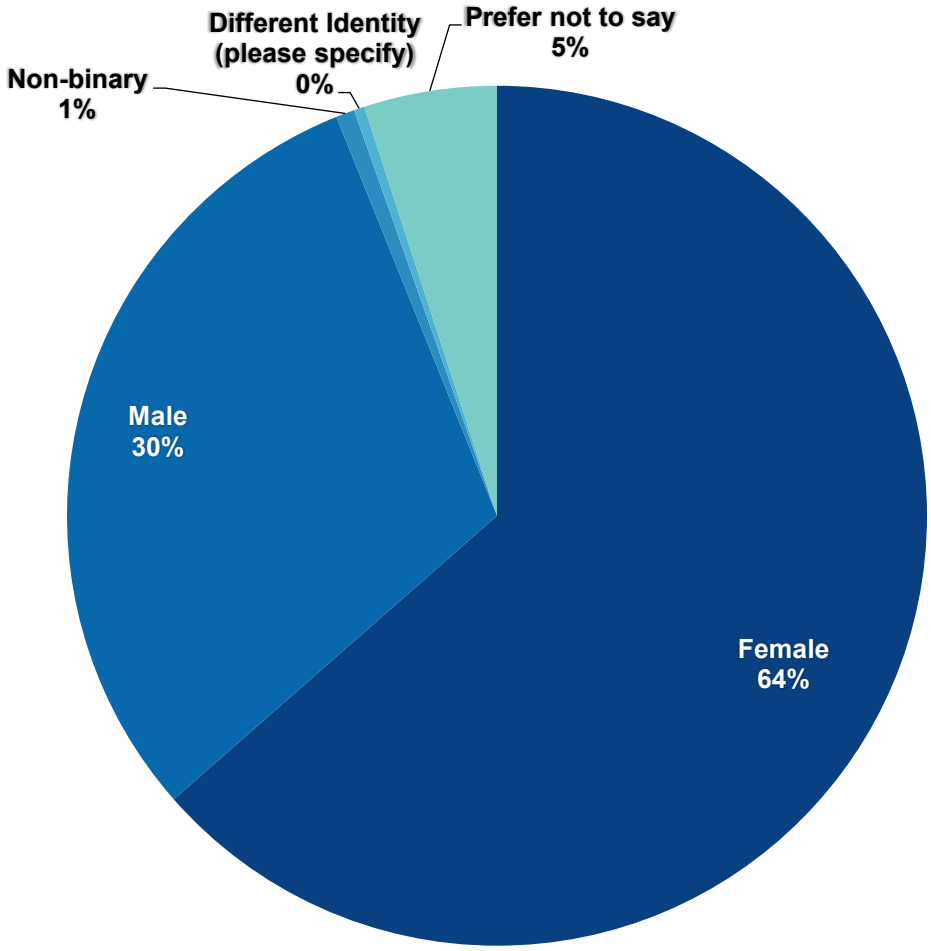


Value	Percent	Total Responses
English	99.5%	1,347
Spanish	5.6%	76
Mandarin	1.0%	13
Tagalog	1.3%	18
Other	4.7%	63
Other languages spoken: Cantonese, German, Hindi, Italian, Portuguese, Farsi, French, German, Korean, American Sign Language (ALS), Arabic, Armenian, Braille, Burmese, Gujarati		

Spanish Survey Results

Value	Percent	Total Responses
English	88.2%	15
Spanish	76.5%	13
Mandarin	0.0%	0
Tagalog	0.0%	0
Other	5.9%	1
Other languages spoken: Farsi		

Question 30: Please indicate your gender identity.

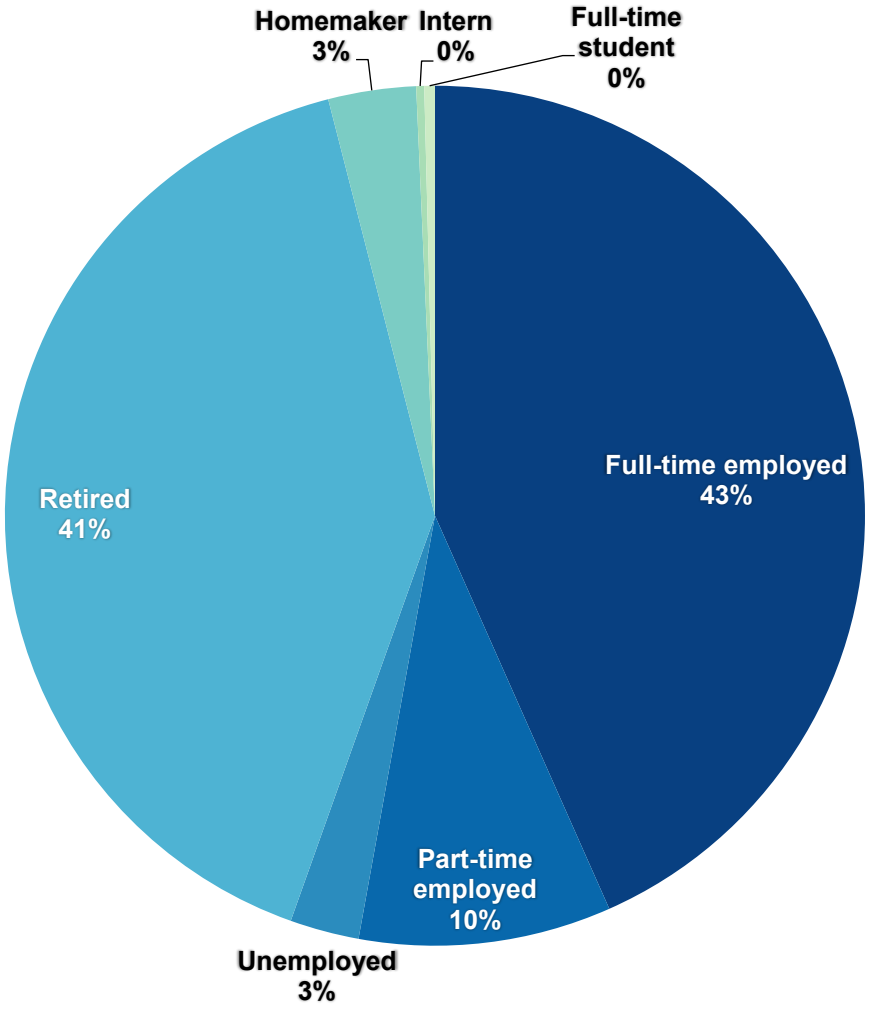


Value	Percent	Total Responses
Female	63.6%	861
Male	30.4%	411
Non-binary	0.7%	9
Different Identity (please specify)	0.4%	5
Prefer not to say	5.0%	68
Total		**1,354**

Spanish Survey Results

Value	Percent	Total Responses
Female	88.2%	15
Male	11.8%	2
Non-binary	0.0%	0
Different Identity (please specify)	0.0%	0
Prefer not to say	0.0%	0
	Total	**17**

Question 31: What is your employment status?

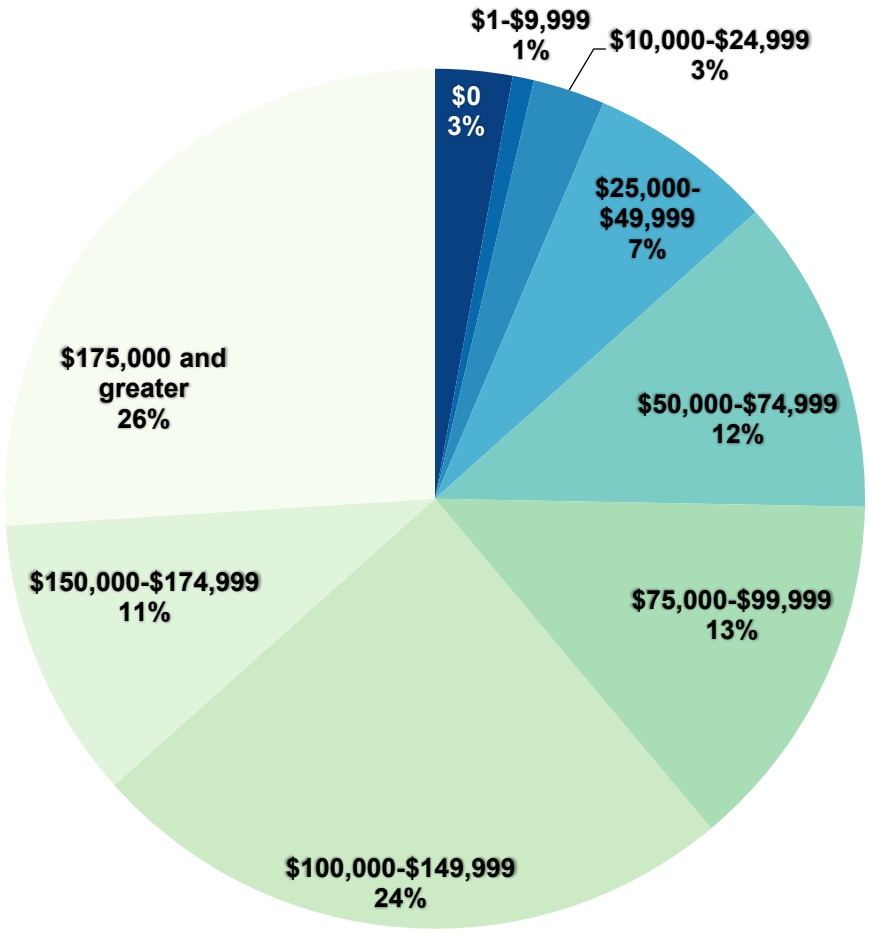


Value	Percent	Total Responses
Full-time employed	43.4%	586
Part-time employed	9.5%	128
Unemployed	2.6%	35
Retired	40.6%	549
Homemaker	3.3%	44
Intern	0.3%	4
Full-time student	0.4%	5
Total		**1,351**

Spanish Survey Results

Value	Percent	Total Responses
Full-time employed	64.7%	11
Part-time employed	17.6%	3
Unemployed	5.9%	1
Retired	5.9%	1
Homemaker	0.0%	0
Intern	0.0%	0
Full-time student	5.9%	1
	Total	**17**

Question 32: What is your annual household income?



Value	Percent	Total Responses
$0	2.9%	35
$1-$9,999	0.8%	10
$10,000-$24,999	2.7%	33
$25,000-$49,999	7.0%	85
$50,000-$74,999	11.9%	145
$75,000-$99,999	13.6%	166
$100,000-$149,999	24.5%	299
$150,000-$174,999	10.6%	129
$175,000 and greater	26.0%	317
	Total	**1,219**

Spanish Survey Results

Value	Percent	Total Responses
$0	0.0%	0
$1-$9,999	0.0%	0
$10,000-$24,999	6.3%	1
$25,000-$49,999	18.8%	3
$50,000-$74,999	12.5%	2
$75,000-$99,999	25.0%	4
$100,000-$149,999	31.3%	5
$150,000-$174,999	0.0%	0
$175,000 and greater	6.3%	1
	Total	**16**

C.3. PUBLIC COMMENT PERIOD

Once the draft Plan was completed, the public was given an opportunity to review and provide comments on Volume 1 (Planning Area-wide Elements) and each of the jurisdiction annexes prior to submitting the Plan to the State and FEMA. The countywide public comment period began on April 22, 2024, and went on through May 31, 2024. Prior to the public comment period, the Core Planning Team conducted a strategy meeting with all plan participants that served as brainstorming session and helped determine the public outreach goals and proper outreach methods for the public comment period. Subsequently, the Core Planning Team developed a public outreach strategy tool meant to guide each participating jurisdictions in their own public outreach strategies. The Core Planning Team held a second strategy meeting with all plan participants midway through the public comment period to provide additional support and guidance, if needed.

Each plan participant developed their own public outreach strategy that meets the unique needs of their community to engage stakeholders and the public during the public comment period. Public engagement participation and supporting documentation for each plan participant can be found in their respective annexes.

Contra Costa County OES coordinated with its county departments and participating jurisdictions to ensure that the public had an opportunity to learn about the Plan, mitigation actions planned for their communities, and ways to get involved in the planning process. Since many residents are covered by multiple annexes (e.g., municipalities and special districts), the County made outreach events available for all plan participants. This allowed the community to learn about the difference between Volume 1 (Planning Area-wide Elements), the annexes, and the multiple ways they might be covered by a Hazard Mitigation Plan. To ensure equitable outreach a calendar was created to strategize and map all events. Contra Costa County has many vulnerable communities, including younger (under 18 years old) and elderly (over 65 years old) population, individuals with limited English proficiency, and those with access and functional needs. Throughout these outreach events, Contra Costa County OES presented not only Volume I, but additional plans included in the planning process. This was especially important in the unincorporated areas as many special districts, including reclamation districts, participated in the planning process.

Working with the Board of Supervisor staff, the County presented to unincorporated communities across the county through 10 different Municipal Advisory Council (MAC) meetings and a Tactical Advisory Council Meeting. This allowed the County to bring the Hazard Mitigation Plan to specific communities while also working with trusted community agents to support and spread the message. All MAC agendas in the County are posted online and in public spaces 72 hours in advance, thus allowing high visibility on the agenda and enough time for individuals to review the presentations. Additionally, all MAC meetings were held after hours, which allowed OES to present to different members of these communities. The County collaborated with Contra Costa County Fire Protection District, Rodeo-Hercules Fire Protection District, Department of Public Works, Flood Control and Water Conservation District, and Ironhouse Sanitary District to present at six (6) different meetings throughout the County.

Additional Outreach through Board of Supervisor Councils such as the Advisory Council on Equal Employment Opportunity, Advisory Council on Aging, and Head Start Policy Council, further allowed us to reach the County's underserved populations. Furthermore, each council was asked to distribute hazard mitigation information to their respective demographics. The councils are comprised of county staff from various departments and community representatives countywide.

Additional outreach was through community events such as the John Muir Houses' Earth Day Celebration, where the County was able to target members regionally. The historic John Muir House attracts many people throughout the region, not just Contra Costa County. The Bay Point Bike Rodeo and Safety Fair attracted many community members on the county's East side, an area with a high population of limited English language speakers and high poverty rates.

The County partnered with the Employment and Human Services Department (EHSD) to conduct onsite hazard mitigation education and outreach in schools and community events in Richmond, San Pablo, Hercules, Antioch, Oakley, and Pleasant Hill. EHSD Navigators also placed hazard mitigation plan outreach materials in all their active school sites. This was a new partnership for Contra Costa County OES, and the collaboration ensured the information was presented from trusted community partners. Contra Costa County OES provided a training session to EHSD Navigator staff on the County's Hazard Mitigation Plan, the planning process, hazards, and how to present the information. Additionally, OES provided EHSD with printed materials, both flyers and trifolds, in all five (5) threshold languages. Due to their collaboration and support, we were able to reach local youth at school, senior citizens, and people who may have a difficult time participating in other events. The EHSD Navigator events included:

Date	Event Name	Municipality
May 17, 2024	Clean Slate Day	Richmond
May 17, 2024	Peres School Event	Richmond
May 18, 2024	Immigration Forum	San Pablo
May 22, 2024	Senior Information & Health Fair	Richmond
May 24, 2024	Youth & Young Adult Career Fair	Richmond
May 29, 2024	West Contra Costa Career Fair	Hercules
May 30, 2024	Community Resources Fair	Antioch
June 1, 2024	O'Hara Park Middle School Resource Fair	Oakley
June 1, 2024	Medical Coverage Registration Fair	Oakley
June 3, 2024	West County Community Partnership Meeting	Pleasant Hill

Other community agencies were also vital in the County's public outreach efforts. The American Red Cross presented information on the County's Hazard Mitigation Plan at events that took place during the outreach period and during Leadership Council meetings. Materials were presented to leaders from nonprofits, cities, and counties, providing the opportunity for them to comment and continue sharing the message.

Public Comment Outreach Calendar

April 2024		
Date	**Thursday, April 11th**	**Wednesday, April 17th**
Event Name	EHSD Navigator Training	East Richmond Heights MAC
Location	3105 Willow Pass Road Bay Point, CA 94565	Open Door United Methodist Church 6226 Arlington Boulevard Richmond, CA 94805
Outreach Method	Community Event	Presentation to Governing Body
Outreach Purpose	Inform, Involve	Inform, Involve
Targeted Population	Countywide (Access and Functional Needs, Age, High Poverty, Limited Access to Transportation)	Countywide (Access and Functional Needs, Age, Limited English Proficiency)
Accommodations Provided	Mobile	After Hours, Spanish Speaker Available
Date	**Saturday, April 20th**	**Tuesday, April 23rd**
Event Name	John Muir Birthday/Earth Day	Byron MAC
Location	4202 Alhambra Avenue Martinez, CA 94553	St. Anne's Church 2800 Camino Diablo (Room 1-A) Byron, CA 94514
Outreach Method	Community Event	Presentation to Governing Body
Outreach Purpose	Inform, Involve	Inform, Involve
Targeted Population	Countywide (Access and Functional Needs, Age)	Countywide (Age)
Accommodations Provided	After Hours, Spanish Speaker Available	After Hours, Spanish Speaker Available
Date	**Wednesday, April 24th**	**Wednesday, April 24th**
Event Name	Kensington MAC	Contra Costa Sustainability Exchange
Location	Kensington Library 61 Arlington Avenue Kensington, CA 94707	Virtual
Outreach Method	Presentation to Governing Body	Roundtables/Forums
Outreach Purpose	Inform, Involve	Inform, Involve
Targeted Population	Countywide (Age, Access and Functional Needs)	Countywide Effort, County Staff
Accommodations Provided	After Hours	Online, Posted Meeting Video

April 2024		
Date	**Wednesday, April 24th**	**Thursday, April 25th**
Event Name	Coffee with a Cop *(Local Mental Health Evaluation Team coordination with law enforcement and the public)*	Rodeo MAC
Location	Concord-Gratitude	Rodeo Senior Center 189 Parker Avenue Rodeo, CA 94572
Outreach Method	Community Event	Presentation to Governing Body
Outreach Purpose	Inform, Involve	Inform, Involve
Targeted Population	Countywide (Age, Access and Functional Needs)	Countywide (Age, Access and Functional Needs)
Accommodations Provided	In Person Outreach	After Hours
Date	**Thursday, April 25th**	**Friday, April 26th**
Event Name	Contra Costa County Public Health Volunteer Appreciation Event	Advisory Council on Equal Employment Opportunity
Location	2732 Systron Drive, #250 Concord, CA 94518	Virtual
Outreach Method	Community Event	Presentation to Governing Body
Outreach Purpose	Inform, Involve	Inform, Involve
Targeted Population	Countywide (Age, Access and Functional Needs)	Countywide (Age)
Accommodations Provided	Spanish Speaker Available	Digital Access, Spanish Speaker Available
Date	**Saturday, April 27th**	
Event Name	Bay Point Bike Rodeo	
Location	Ambrose Rec Center 3105 Willow Pass Road Bay Point, CA 94565	
Outreach Method	Community Event	
Outreach Purpose	Inform, Involve	
Targeted Population	Countywide (Age, Socially Vulnerable)	
Accommodations Provided	Weekend Event	

May 2024		
Date	**Saturday, May 4th**	**Tuesday, May 7th**
Event Name	El Sobrante Neighborhood Meeting	North Richmond MAC
Location	El Sobrante	North Richmond Senior Center 515 Silver Avenue North Richmond, CA 94801
Outreach Method	Community Event	Presentation to Governing Bodies
Outreach Purpose	Inform, Involve, Engage	Inform, Involve
Targeted Population	Countywide (Elderly)	Countywide (High Poverty, Age, Limited English Proficiency)
Accommodations Provided	Weekend Event	After Hours, Spanish Speaker Available
Date	**Tuesday, May 7th**	**Wednesday, May 8th**
Event Name	Alamo MAC	El Sobrante MAC
Location	Alamo Women's Club 1401 Danville Boulevard Alamo, CA 94507	El Sobrante Library 4191 Appian Way El Sobrante, CA 94803
Outreach Method	Presentation to Governing Bodies	Presentation to Governing Bodies
Outreach Purpose	Inform, Involve	Inform, Involve
Targeted Population	Countywide (Age, Access and Functional Needs)	Countywide (High Poverty, Age, Limited English Proficiency)
Accommodations Provided	After Hours	After Hours, Recording, Virtual Option, Spanish Speaker Available
Date	**Wednesday, May 8th**	**Tuesday, May 14th**
Event Name	Pacheco MAC	Diablo MAC
Location	Pacheco Community Center 5800 Pacheco Boulevard Pacheco, CA 94553	Diablo County Club 1700 Club House Road Diablo, CA 94526
Outreach Method	Presentation to Governing Bodies	Presentation to Governing Bodies
Outreach Purpose	Inform, Involve	Inform, Involve
Targeted Population	Countywide (Age, Access and Functional Needs)	Countywide (Age, Access and Functional Needs)
Accommodations Provided	After Hours, Recording, Virtual Option, Spanish Speaker Available	After Hours, Spanish Speaker Available
Date	**Tuesday, May 14th**	**Tuesday, May 14th**
Event Name	Bethel Island MAC	WCC Fire Safe Council Advisory Board
Location	Scout Hall 3090 Ranch Lane Bethel Island, CA 94511	Virtual
Outreach Method	Presentation to Governing Bodies	Presentation to Governing Bodies
Outreach Purpose	Inform, Involve	Inform, Involve
Targeted Population	Countywide (Age, Access and Functional Needs, High Poverty)	Countywide (Age, Access and Functional Needs, High Poverty)
Accommodations Provided	After Hours	Virtual Option, Spanish Speaker Available

May 2024		
Date	**Wednesday, May 15th**	**Wednesday, May 15th**
Event Name	Advisory Council on Aging	Head Start Policy Council
Location	Virtual	500 Ellingwood Way Pleasant Hill, CA 94523
Outreach Method	Presentation to Governing Bodies	Presentation to Governing Bodies
Outreach Purpose	Inform, Involve	Inform, Involve
Targeted Population	Countywide (Age, Access and Functional Needs)	Countywide (Age, Access and Functional Needs, High Poverty)
Accommodations Provided	Virtual Option, Spanish Speaker Available	After Hours, Spanish Speaker Available
Date	**Tuesday, May 21st**	
Event Name	Knightsen MAC	
Location	Knightsen Farm Bureau 3020 Second Street Knightsen, CA 94548	
Outreach Method	Presentation to Governing Body	
Outreach Purpose	Inform	
Targeted Population	Countywide (Age, Access and Functional Needs, High Poverty)	
Accommodations Provided	After Hours, Spanish Speaker Available	

The public comment period printed materials, website posts, social media samples, and agendas are below.

April 17, 2024 – East Richmond Heights MAC

East Richmond Heights Municipal Advisory Council

MEETING AGENDA

Wednesday, April 17th, 2024, 6:30 PM

Meeting Location: Open Door United Methodist Church (6226 Arlington Blvd, Richmond, CA 94805) or Zoom: https://cccounty-us.zoom.us/j/87148023649

PUBLIC ACCESS AND PUBLIC COMMENT INSTRUCTIONS: The public may attend this meeting in person at the above location.

The public also may attend this meeting remotely via Zoom or call-in. Login information and call-in information is provided below.

HOW TO JOIN THE MEETING VIA ZOOM: Link: https://cccounty-us.zoom.us/j/87148023649

HOW TO JOIN THE MEETING VIA CALL-IN: Zoom meeting Dial-In-Number: 888 278 0254
Conference code: 574604
Meeting ID: 871 4802 3649

HOW TO PROVIDE PUBLIC COMMENT:

Persons who wish to address the East Richmond Heights Municipal Advisory Council (ERHMAC) during public comment on matters within the jurisdiction of the ERHMAC that are not on the agenda, or who wish to comment with respect to an item on the agenda, may comment in person, via Zoom, or via call-in. Those participating in person should speak when called upon. Those participating via Zoom should indicate they wish to speak by using the "raise your hand" feature in the Zoom app. Those calling in should indicate they wish to speak by saying their name when asked if anyone calling in has questions.

All public comments will be limited to 2 minutes per speaker.

For assistance with remote access contact: Ronnie Mills at Ronnie.Mills@bos.cccounty.us or 510-942-2222

Public comments may also be submitted before the meeting by email at Ronnie.Mills@bos.cccounty.us or by voicemail at 510-942-2222. Comments submitted by email or voicemail will be included in the record of the meeting but will not be read or played aloud during the meeting.

Chair: Jon Sargent **Vice Chair:** Victoria Curtis

Members: Stephanie Dyer, Joann Pavlinec, Jinwei Zhang

Alternates: Bara Sapir, Royer Ramirez- Ruiz

A printed agenda will be posted on the bulletin board at the **Arlington Market**, 6462 Arlington Blvd., Richmond. Electronic copies are available for download at: https://www.contracosta.ca.gov/6805/

Call to Order/Welcome/Roll Call

Approval of minutes: February
Treasurer's Report – Ronnie Mills, District Coordinator, Office of Supervisor John Gioia

Presentations

P.1. Presentation by Contra Costa County Supervisor's Office

P.2. Presentation by Contra Costa County Fire Protection District

P.3. Presentation by Sheriff's Office Bay Station Commander, Lt. Levi Terrill

P.4. Presentation by California Highway Patrol (tentative)

P.5 Presentation by Contra Costa County Office of Emergency Services, Jennier Cannon

Discussion Items

DI.1 (UPDATE) 2024 East Richmond Heights Art & Music Festival

Subcommittee Reports

SR.1 Land Use Committee: Joann Pavlinec, Jinwei Zhang

Agenda Items / Speakers for Upcoming ERHMAC Meetings

A.I.

Regional Historical Presentation

Announcements

A.1

Public Comment – for items not on the agenda. Limit 2 minutes per speaker

Adjournment



April 24, 2024 – Byron MAC (Partnership with the City of Brentwood and Contra Costa County Fire Protection District)

CONTRA COSTA COUNTY

AGENDA

Byron Municipal Advisory Council

Tuesday, April 23, 2024 **6:00 PM** **St. Anne Church, 2800 Camino Diablo, Byron, CA 94514**

1. **Roll Call and Introductions**
2. **Approval of Agenda**
3. **Public comment on any item under the jurisdiction of the Committee and not on this agenda (speakers may be limited to three minutes).**
4. **Agency Reports**

a. Contra Costa County Office of the Sheriff
Office of Supervisor Diane Burgis
California Highway Patrol - TBD
Contra Costa County Fire Protection District - TBD

5. **Consent Items - Items are subject to removal from the consent calendar by request of any MAC member. Items removed from the consent calendar will be considered with the discussion items.**

a. APPROVE Draft Record of Action for February 27, 2024 and March 15, 2024 24-1223

Attachments: Draft Record of Action 2-27-24
Draft Record of Action 3-15-24

6. **Presentations**

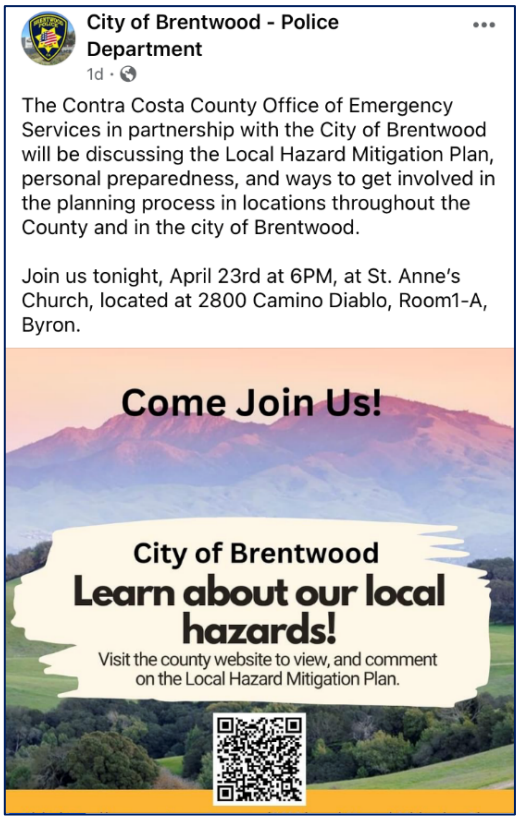
Presentation from Sheriff's Office of Emergency Services - Rick Kovar, Emergency Services Manager and Lorena Herrera, Senior Emergency Planning Coordinator 24-1224

Attachments: Local Hazard Mitigation Plan - Byron

7. **Discussion Items**

APPROVE a date for the 2024 Byron Community Clean-up in partnership with Mt. Diablo Resource Recovery 24-1225

Page 1 of 2



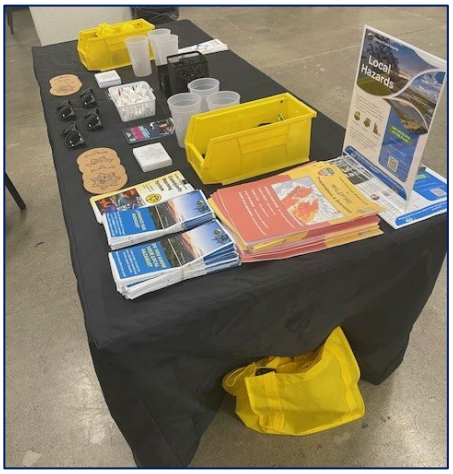


April 24, 2024 – Kensington MAC and Coffee with a Cop (Concord)









April 24, 2024 – Rodeo MAC and Contra Costa Public Health Volunteer Appreciation Event

Rodeo Municipal Advisory Council

Anthony Hodge, Chair
Vacant, Vice Chair
Deborah Drake, Treasurer
Barbara Vargen-Kotchevar, Secretary
Lauren McCollins, Councilmember

Dr. Anthony Hodge, Chairman

Supervisor Federal D. Glover, District V

The Rodeo Municipal Advisory Committee serves as an advisory body to the Contra Costa County Board of Supervisors and the County Planning Agency

RODEO Municipal Advisory Council Meeting – IN PERSON

AGENDA

Thursday April 25, 2024 - 7:00 PM
Rodeo Senior Center . 189 Parker Avenue, Rodeo, CA 94572

How to Submit Public Comments: - Written: All comments must be received **before 3:00 p.m. Wednesday, March 20.** Please email your comments to Demrhas.Johnson@bos.cccounty.us or call (925) 608-4200. Your comments will be read during the meeting. All public comments will be limited to 2 minutes.

1. Call to Order/Pledge of Allegiance/Roll Call

2. Public Comment (3 Minutes Per Speaker) Time is allotted under Public Comment for those persons who wish to speak for up to three minutes on any item NOT on the agenda. Persons who wish to speak on matters on the agenda will be heard for up to three minutes when the Chair calls for comments. After persons have spoken on an agendized item, the hearing can be closed by the Chair, and the matter is subject to discussion and action by the MAC.

3. Approval of Agenda and Record of Actions
   A. April 25, 2024 Agenda
   B. March 21, 2024 Record of Action

4. Agency Reports
   A. California Highway Patrol (CHP)
   B. Contra Costa County Sheriff's Office
   C. Rodeo-Hercules Fire Protection District Report
   D. John Swett Unified School District (JSUSD)
   E. Supervisor Federal D. Glover's Office

5. Presentations
   A. Local Hazard Mitigation Plan (Office of Emergency Services)

6. Items for Discussion and/or Action
   A. 849 Windward Drive (Shamsher Singh)

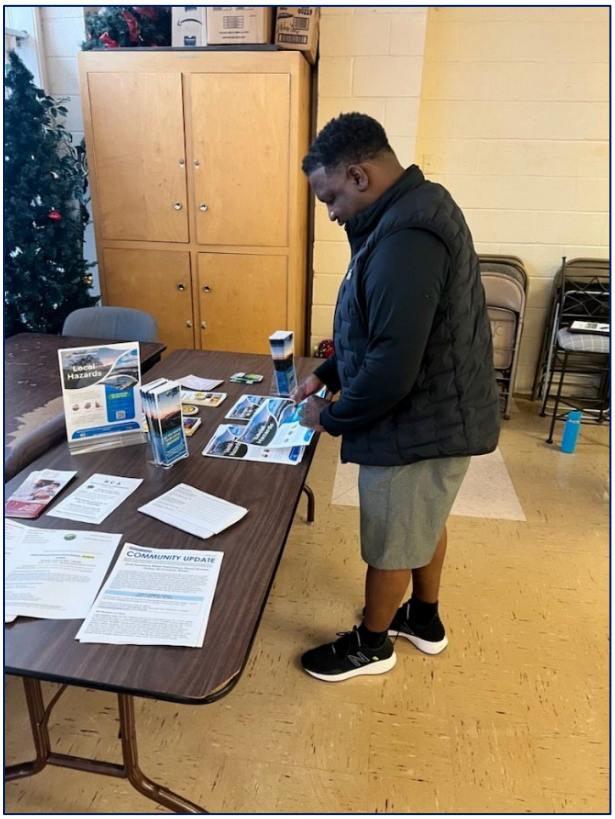
7. M.A.C. Committee and/or Member Reports

8. Future Agenda Items
   A. Representative from County CORE team to present.

9. Adjournment: The next RMAC meeting is May 23, 2024

The Rodeo Municipal Advisory Council will provide reasonable accommodations for persons with disabilities planning to attend the meeting who contact District V Supervisor's Office at least 72 hours before the meeting, at (925) 608-4200..
Materials distributed for the meeting are available for viewing at Supervisor Federal D. Glover's Rodeo website.

The Rodeo Municipal Advisory Council will provide reasonable accommodations for persons with disabilities planning to attend the meeting who contact District V Supervisor's Office at least 72 hours before the meeting, at (925) 608-4200..
Materials distributed for the meeting are available for viewing at Supervisor Federal D. Glover's Rodeo website.



April 25, 2024 – Advisory Council on Equal Employment Opportunity



ADVISORY COUNCIL ON
EQUAL EMPLOYMENT OPPORTUNITY (ACEEO)
April 26, 2024
9:30 a.m. – 11:30 a.m.
2530 Arnold Drive (Training Room)
Martinez, CA 94553

The objective of the ACEEO is to help build an inclusive workforce in an environment that fosters dignity and respect for the individual.

PUBLIC ACCESS AND PUBLIC COMMENT INSTRUCTIONS
The public may attend this meeting in person at the above location.

The public also may attend this meeting remotely via Zoom or call-in. Login information and call-in information is provided below.

JOIN ZOOM MEETING

Join from PC, Mac, Linux, iOS or Android: https://cccounty-us.zoom.us/j/81560080226?pwd=BJMLLtJrDdv0B7NjDck1YUXwP6oUrL.1

HOW TO JOIN THE MEETING VIA CALL-IN:
Zoom meeting Dial-In-Number:
USA 214 765 0478
Conference code: 480778
Meeting ID: 815 6008 0226
Passcode: 235923

HOW TO PROVIDE PUBLIC COMMENT:
Persons who wish to address the ACEEO during public comment on matters within the jurisdiction of the ACEEO that are not on the agenda, or who wish to comment with respect to an item on the agenda, may comment in person, via Zoom, or via call-in. Those participating in person should stand when called upon. Those participating via Zoom should indicate they wish to speak by using the "raise your hand" feature in the Zoom app. Those calling in should indicate they wish to speak by addressing the advisory body.

For assistance with remote access contact:
Risk Management at (925) 335-1400

Public comments may also be submitted before the meeting by email at: Antoine.Wilson@riskm.cccounty.us or by voicemail at (925) 335-1455. Comments submitted by email or voicemail will be included in the record of the meeting but will not be read or played aloud during the meeting.

1

Leonard Ramirez, Chair
Bolston Jones, Vice Chair

Agenda Items: Items may be taken out of order based on the business of the day and preference of the Committee

• Introduction / Roll Call	9:30 a.m.
• Public Comment – Limited to 3 Minutes per Speaker	9:35 a.m.
• Action Item Review and Approve the March 22, 2024, Meeting Minutes	9:40 a.m.
• Informational Speakers – Jennifer Cannon and Beatriz Portillo with CCC Office of Emergency Services (OES)	9:45 a.m.
• Action Item Discuss and approve 2024 ACEEO goals	10:30 a.m.
• Action Item Discuss 2024 ACEEO accomplishments	10:40 a.m.
• Action Item Determine if there will be a continuation of the County Workforce/Veterans Project	10:50 a.m.
• Action Item Discuss priorities for 2024 projects	11:00 a.m.
• Roundtable Discussion/Public Comment (3-minute commentary limit)	11:20 a.m.
• Adjourn	11:30 a.m.
• **The next ACEEO meeting is scheduled for May 24, 2024**	

The ACEEO will provide reasonable accommodations for persons with disabilities planning to attend. Contact the staff person listed below at least 72 hours before the meeting.

Any disclosable public records related to an open session item on a regular meeting agenda distributed by the County to a majority of members of the ACEEO less than 96 hours prior to that meeting are available for public inspection at 2530 Arnold Drive, #140 during normal business hours.

For Additional Information Contact: Antoine J. Wilson
Equal Employment Opportunity Officer
Phone (925) 335-1455, Fax (925) 500-0086
antoine.wilson@riskm.cccounty.us

2

April 27, 2024 – Bay Point Bike Rodeo









May 6, 2024 – El Sobrante Neighborhood Meeting







May 7, 2024 – North Richmond and Alamo MACs (Partnership with Contra Costa County Public Works Department and Contra Costa County Flood Control and Water Conservation District)

NORTH RICHMOND MUNICIPAL ADVISORY COUNCIL
Tuesday, May 7, 2024
515 Silver Avenue – North Richmond, CA 94801
5:00 p.m. – 7:00 p.m.
Agenda

Pursuant to Government Code Section 54953(e)(1)(A) you can also Join from PC, Mac, Linux, iOS or Android: https://cccounty-us.zoom.us/j/81046901164
How to provide public comment: Persons who wish to address the MAC during Public Comment or with respect to an item on the agenda may join via zoom and click the raise hand button or attend the meeting at the address above.

1. **CALL TO ORDER/ROLL CALL**
   _____Don Gilmore _____Dulce Galicia _____Princess Robinson
   _____ Beverly Scott _____ Annie King-Meredith _____Jorge Rico Vera ___Glory Lopez
2. **APPROVAL OF AGENDA/MINUTES**
3. **PUBLIC COMMENT (3 MINUTES/PERSON)**
4. **Law Enforcement Agency Reports (5 MINUTES/PERSON)**
5. **ITEMS FOR DISCUSSION AND/OR ACTION**
   a. 211 Parr Blvd Permit Application (CDNR24-00002)
6. **PRESENTATIONS and Proclamations (15 minutes)**
   a. Local Hazard Mitigation Plan (CCC)
   b. Richmond Field Assessment
7. **OTHER AGENCY/PROGRAM REPORTS (5 min/person)**
   a. City of Richmond Community Services Dept.
   b. Shields-Reid Neighborhood Council
   c. CCC Housing Authority
   d. Supervisor John Gioia's Office- Tania Pulido
   e. Community Housing Development Corporation (CHDC) Don Gilmore
   f. CHDC Mitigation Coordinator
   g. Cooperation Richmond
   h. Urban Tilth

Next Meeting
Tuesday, June 4, 2024, 5:00 p.m. – 7:00 p.m.
515 Silver Avenue - Richmond, CA

The North Richmond MAC will provide reasonable accommodations for persons with disabilities planning to participate in meetings who contact Robert Rogers at least 48 hours before the meeting at 510-231-8688. Any disclosable public records related to an open session item on a regular meeting agenda and distributed by the North Richmond MAC to a majority of members of the North Richmond MAC less than 96 hours prior to that meeting are available for public inspection at 11780 San Pablo Avenue, Suite D, El Cerrito, during normal business hours.

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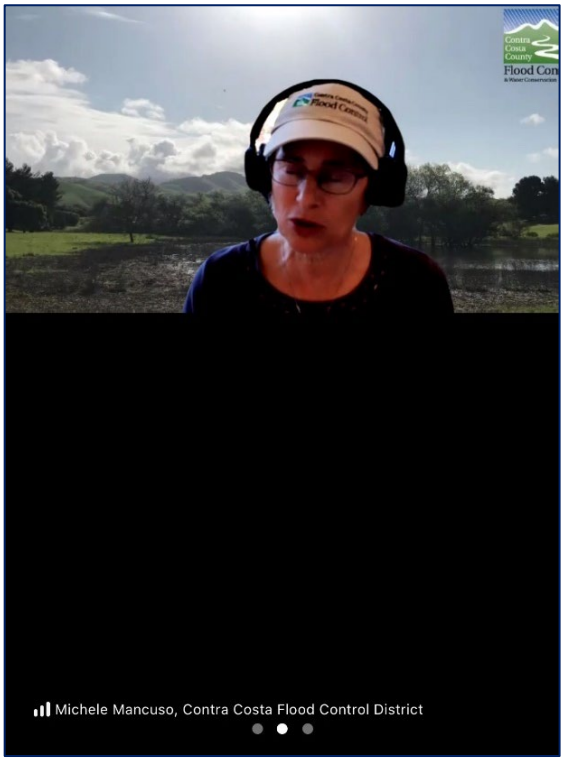
CONSEJO MUNICIPAL DE ASESORAMIENTO DE RICHMOND DEL NORTE
Martes, 7 de Mayo, 2024
515 Silver Avenue – Richmond del Norte, CA 94801
de 5:00 p.m. – 7:00 p.m.
ORDEN DEL DÍA

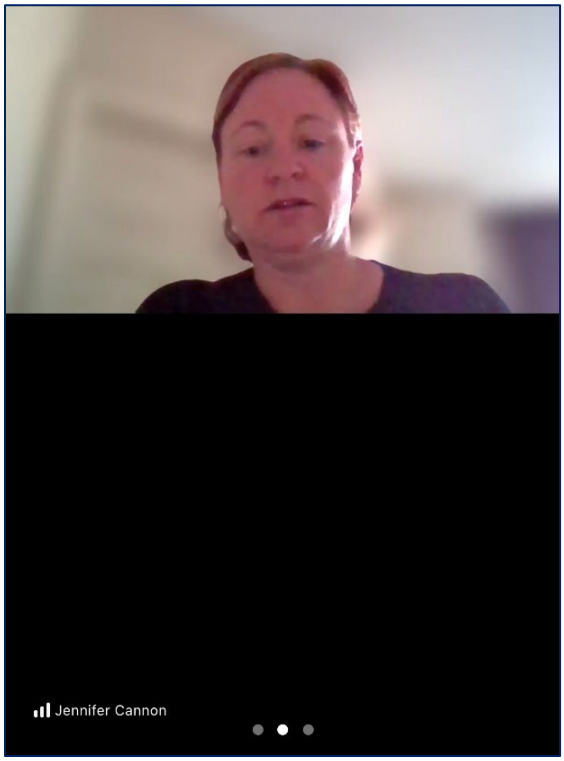
De conformidad con la Seccion 549539(e)(1)(A) del Codigo Gubernamental Tambien puede unirse desde una PC, Mac, Linux, IOS, o Android: https://cccounty-us.zoom.us/j/81046901164
Cómo proporcionar comentarios públicos: las personas que deseen dirigirse al MAC durante los comentarios públicos o con respecto a un elemento de la agenda pueden unirse a través de zoom y hacer clic en el botón de levantar la mano o asistir a la reunión en la dirección anterior.

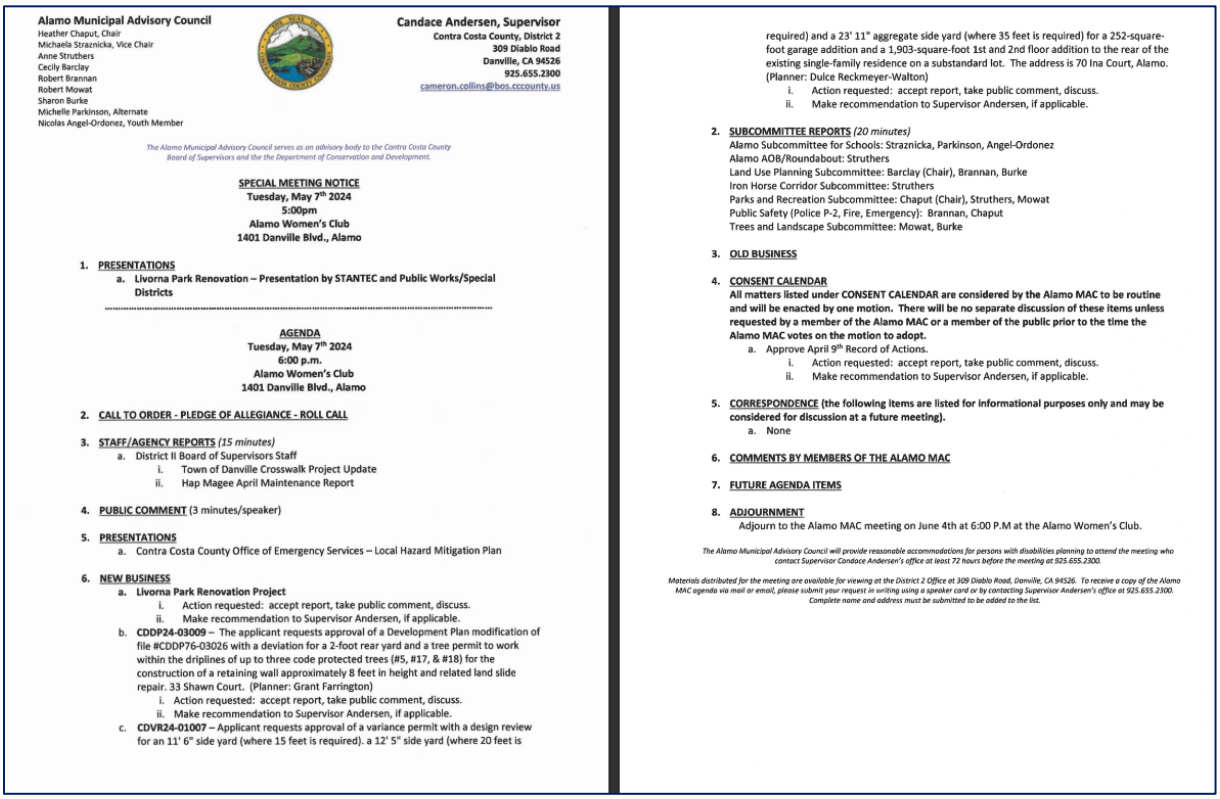
1. **LLAMADA AL ORDEN/A LOS PRESENTES**
   _____Don Gilmore _____Dulce Galicia ____Jorge Rico Vera
   _____ Beverly Scott _____Princess Robinson
   _____Annie King-Meredith
2. **APROBACIÓN DEL PROGRAMA /LAS ACTAS**
3. **COMENTARIO PÚBLICO (3 MINUTOS POR PERSONA)**
4. **INFORME SOBRE LAS AGENCIAS DEL ORDEN PÚBLICO (5 MINUTOS POR PERSONA)**
5. **TEMAS PARA LA DISCUSIÓN y/o ACCIÓN A TOMAR**
   a. 211 Parr Blvd Aplicacion (CDNR24-00002)
6. **PRESENTACTIONES y PROCLAMACIONES (15 minutos)**
   a. Plan Local de Mitigacion de Materiales Peligrosos
   b. Evaluacion de campo de Richmond
7. **AGENCIA ADJUNTA/REPORTES DEL PROGRAMA (5 MINUTOS POR PERSONA)**
   A. Ciudad de Richmond
   B. Concilio de Shields-Reid
   C. CCC Autoridad de Vivienda
   D. Oficina del Supervisor John Gioia- Tania Pulido
   E. Corporación de Desarrollo de Vivienda de la Comunidad (CHDC)
   F. CHDC (Financiado Fee Mitigation)
   G. Cooperation Richmond
   H. Urban Tilth
8. **CORRESPONDENCIA/ANUNCIOS**

Próxima reunión
Martes, 4 de Junio, 2024, 5:00 p.m. – 7:00 p.m.
515 Silver Avenue - Richmond, CA

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Alamo Municipal Advisory Council
Heather Chaput, Chair
Michaela Straznicka, Vice Chair
Anne Struthers
Cecily Barclay
Robert Brannan
Robert Mowat
Sharon Burke
Michelle Parkinson, Alternate
Nicolas Angel-Ordonez, Youth Member

The Alamo Municipal Advisory Council serves as an advisory body to the Contra Costa County Board of Supervisors and the the Department of Conservation and Development.

Candace Andersen, Supervisor
Contra Costa County, District 2
309 Diablo Road
Danville, CA 94526
925.655.2300
cameron.collins@bos.cccounty.us

SPECIAL MEETING NOTICE
Tuesday, May 7th 2024
5:00pm
Alamo Women's Club
1401 Danville Blvd., Alamo

1. **PRESENTATIONS**
   a. **Livorna Park Renovation – Presentation by STANTEC and Public Works/Special Districts**

AGENDA
Tuesday, May 7th 2024
6:00 p.m.
Alamo Women's Club
1401 Danville Blvd., Alamo

2. **CALL TO ORDER - PLEDGE OF ALLEGIANCE - ROLL CALL**
3. **STAFF/AGENCY REPORTS** *(15 minutes)*
   a. District II Board of Supervisors Staff
      i. Town of Danville Crosswalk Project Update
      ii. Hap Magee April Maintenance Report
4. **PUBLIC COMMENT** (3 minutes/speaker)
5. **PRESENTATIONS**
   a. Contra Costa County Office of Emergency Services – Local Hazard Mitigation Plan
6. **NEW BUSINESS**
   a. **Livorna Park Renovation Project**
      i. Action requested: accept report, take public comment, discuss.
      ii. Make recommendation to Supervisor Andersen, if applicable.
   b. **CDDP24-03009** – The applicant requests approval of a Development Plan modification of file #CDDP76-03026 with a deviation for a 2-foot rear yard and a tree permit to work within the driplines of up to three code protected trees (#5, #17, & #18) for the construction of a retaining wall approximately 8 feet in height and related land slide repair. 33 Shawn Court. (Planner: Grant Farrington)
      i. Action requested: accept report, take public comment, discuss.
      ii. Make recommendation to Supervisor Andersen, if applicable.
   c. **CDVR24-01007** – Applicant requests approval of a variance permit with a design review for an 11' 6" side yard (where 15 feet is required). a 12' 5" side yard (where 20 feet is required) and a 23' 11" aggregate side yard (where 35 feet is required) for a 252-square-foot garage addition and a 1,903-square-foot 1st and 2nd floor addition to the rear of the existing single-family residence on a substandard lot. The address is 70 Ina Court, Alamo. (Planner: Dulce Reckmeyer-Walton)
      i. Action requested: accept report, take public comment, discuss.
      ii. Make recommendation to Supervisor Andersen, if applicable.
2. **SUBCOMMITTEE REPORTS** *(20 minutes)*
   Alamo Subcommittee for Schools: Straznicka, Parkinson, Angel-Ordonez
   Alamo AOB/Roundabout: Struthers
   Land Use Planning Subcommittee: Barclay (Chair), Brannan, Burke
   Iron Horse Corridor Subcommittee: Struthers
   Parks and Recreation Subcommittee: Chaput (Chair), Struthers, Mowat
   Public Safety (Police P-2, Fire, Emergency): Brannan, Chaput
   Trees and Landscape Subcommittee: Mowat, Burke
3. **OLD BUSINESS**
4. **CONSENT CALENDAR**
   All matters listed under CONSENT CALENDAR are considered by the Alamo MAC to be routine and will be enacted by one motion. There will be no separate discussion of these items unless requested by a member of the Alamo MAC or a member of the public prior to the time the Alamo MAC votes on the motion to adopt.
   a. Approve April 9th Record of Actions.
      i. Action requested: accept report, take public comment, discuss.
      ii. Make recommendation to Supervisor Andersen, if applicable.
5. **CORRESPONDENCE (the following items are listed for informational purposes only and may be considered for discussion at a future meeting).**
   a. None
6. **COMMENTS BY MEMBERS OF THE ALAMO MAC**
7. **FUTURE AGENDA ITEMS**
8. **ADJOURNMENT**
   Adjourn to the Alamo MAC meeting on June 4th at 6:00 P.M at the Alamo Women's Club.

The Alamo Municipal Advisory Council will provide reasonable accommodations for persons with disabilities planning to attend the meeting who contact Supervisor Candace Andersen's office at least 72 hours before the meeting at 925.655.2300.

Materials distributed for the meeting are available for viewing at the District 2 Office at 309 Diablo Road, Danville, CA 94526. To receive a copy of the Alamo MAC agenda via mail or email, please submit your request in writing using a speaker card or by contacting Supervisor Andersen's office at 925.655.2300. Complete name and address must be submitted to be added to the list.



May 8, 2024 – Pacheco MAC (Partnership with Contra Costa County Public Works Department, Contra Costa County Flood Control and Water Conservation District, and El Sobrante MAC)

Pacheco Municipal Advisory Council

Shawn Garcia, Chair
David Joslin, Vice Chair
Nam Trinh, Secretary
Vince Robb, Councilmember
Wayne Pope, Councilmember
Warren Ritter, Alternate

Shawn Garcia, Chair
Office of
Supervisor Federal D. Glover
1025 Escobar Street
Martinez, CA 94553
(925) 608-4200

The Pacheco Municipal Advisory Committee serves as an advisory body to the Contra Costa County Board of Supervisors and the County Planning Agencies.

How to Submit Public Comments: All comments must be received by 5:00 p.m. the day before the meeting, which is Tuesday, May 7, 2023. Email your comments to Demnlus.Johnson@bos.cccounty.us. Comments will be read during the meeting.

A G E N D A – May 8, 2024 – 6:30 p.m. (IN-PERSON)

Pacheco Community Center- Conference Room - 5800 Pacheco Blvd, Pacheco, CA 94553

1. Call to Order/Roll Call
2. Public Comment (3 minutes per speaker) - Time is allotted under Public Comment for those persons who wish to speak for up to three minutes on any item NOT on the agenda. Persons who wish to speak on matters on the agenda will be heard for up to three minutes when the Chair calls for comments. After persons have spoken on an agenda item, the hearing can be closed by the Chair, and the matter is subject to discussion and action by the MAC.
3. Approval of Agenda
4. Agency Reports
   a. California Highway Patrol
   b. Sheriff's Department
   c. Pacheco Town Council
   d. Supervisor Federal D. Glover's Office
5. Presentations:
   a Local Hazard Mitigation Plan (Office of Emergency Services)
6. Consent Items: *All matters listed under Consent Items are considered by the MAC to be routine and will be enacted by one motion. There will be no separate discussion of these items unless requested by a member of the MAC or a member of the public prior to the time the MAC votes on the motion to adopt.*
   a. Approval of the Record of Action (Minutes) for the April 10, 2024, meeting.
7. Items for Discussion and/or Action:
   a. *Department of Conservation and Development (Crown Castle)*
   b. *Department of Conservation and Development (AT&T Wireless)*
   c. Department of Conservation and Development *(Eric Girod BKF Engineers)*
8. Correspondence/Announcements: *There are no Correspondence/Announcements*
9. Future Agenda Items:
   a. Grant Proposal Brainstorm
10. Adjournment to the Next meeting: Next Meeting: **June 12, 2024 In-Person – PACHECO COMMUNITY CENTER**

The Pacheco Municipal Advisory Council will provide reasonable accommodations for persons with disabilities planning to attend the meeting who contact Supervisor Glover's Office at least 72 hours before the meeting at (925) 608-4200.

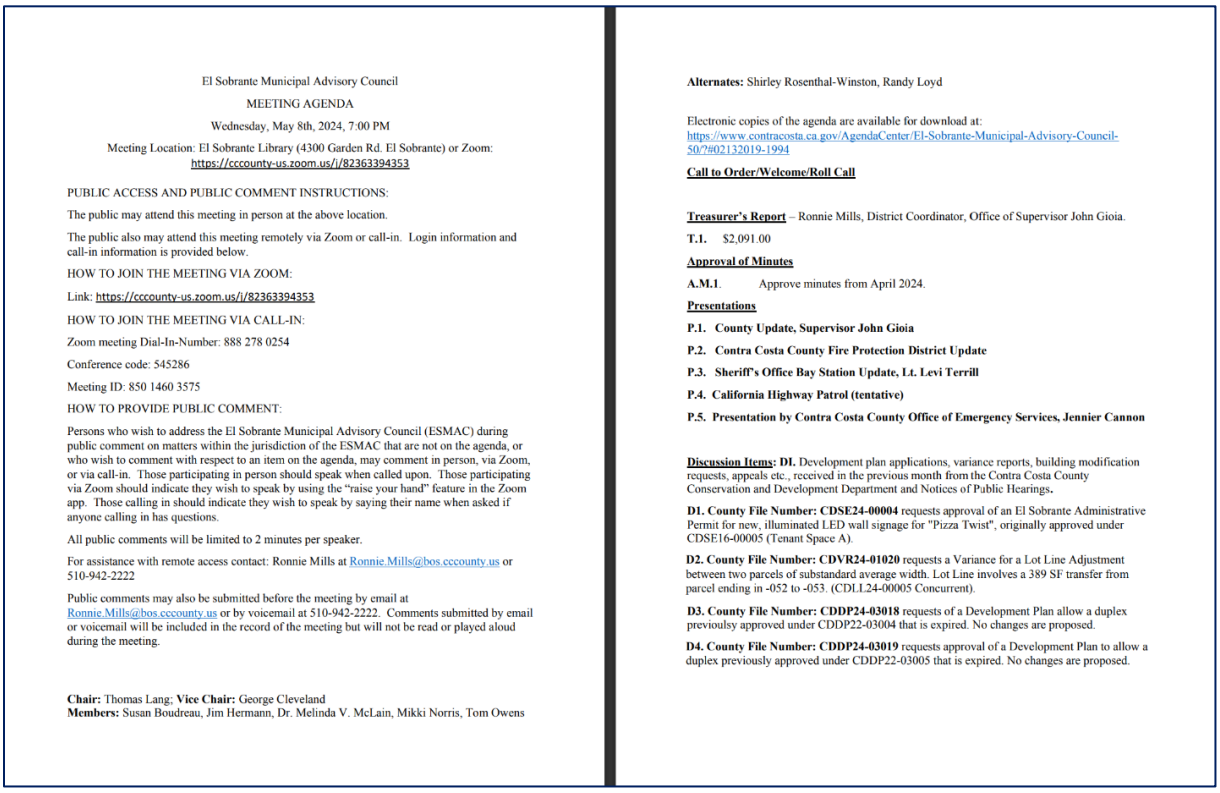
Materials distributed for the meeting can be obtained by contacting Demnlus Johnson at (925) 608-4200 or by email at Demnlus.johnson@bos.cccounty.us

The Pacheco Municipal Advisory Council will provide reasonable accommodations for persons with disabilities planning to attend the meeting who contact Supervisor Glover's Office at least 72 hours before the meeting at (925) 608-4200.

Materials distributed for the meeting can be obtained by contacting Demnlus Johnson at (925) 608-4200 or by email at Demnlus.johnson@bos.cccounty.us







El Sobrante Municipal Advisory Council

MEETING AGENDA

Wednesday, May 8th, 2024, 7:00 PM

Meeting Location: El Sobrante Library (4300 Garden Rd. El Sobrante) or Zoom:
https://cccounty-us.zoom.us/j/82363394353

PUBLIC ACCESS AND PUBLIC COMMENT INSTRUCTIONS:

The public may attend this meeting in person at the above location.

The public also may attend this meeting remotely via Zoom or call-in. Login information and call-in information is provided below.

HOW TO JOIN THE MEETING VIA ZOOM:

Link: https://cccounty-us.zoom.us/j/82363394353

HOW TO JOIN THE MEETING VIA CALL-IN:

Zoom meeting Dial-In-Number: 888 278 0254

Conference code: 545286

Meeting ID: 850 1460 3575

HOW TO PROVIDE PUBLIC COMMENT:

Persons who wish to address the El Sobrante Municipal Advisory Council (ESMAC) during public comment on matters within the jurisdiction of the ESMAC that are not on the agenda, or who wish to comment with respect to an item on the agenda, may comment in person, via Zoom, or via call-in. Those participating in person should speak when called upon. Those participating via Zoom should indicate they wish to speak by using the "raise your hand" feature in the Zoom app. Those calling in should indicate they wish to speak by saying their name when asked if anyone calling in has questions.

All public comments will be limited to 2 minutes per speaker.

For assistance with remote access contact: Ronnie Mills at Ronnie.Mills@bos.cccounty.us or 510-942-2222

Public comments may also be submitted before the meeting by email at Ronnie.Mills@bos.cccounty.us or by voicemail at 510-942-2222. Comments submitted by email or voicemail will be included in the record of the meeting but will not be read or played aloud during the meeting.

Chair: Thomas Lang; **Vice Chair:** George Cleveland
Members: Susan Boudreau, Jim Hermann, Dr. Melinda V. McLain, Mikki Norris, Tom Owens

Alternates: Shirley Rosenthal-Winston, Randy Loyd

Electronic copies of the agenda are available for download at:
https://www.contracosta.ca.gov/AgendaCenter/El-Sobrante-Municipal-Advisory-Council-50/?#02132019-1994

Call to Order/Welcome/Roll Call

Treasurer's Report – Ronnie Mills, District Coordinator, Office of Supervisor John Gioia.

T.1. $2,091.00

Approval of Minutes

A.M.1. Approve minutes from April 2024.

Presentations

P.1. County Update, Supervisor John Gioia

P.2. Contra Costa County Fire Protection District Update

P.3. Sheriff's Office Bay Station Update, Lt. Levi Terrill

P.4. California Highway Patrol (tentative)

P.5. Presentation by Contra Costa County Office of Emergency Services, Jennier Cannon

Discussion Items: DI. Development plan applications, variance reports, building modification requests, appeals etc., received in the previous month from the Contra Costa County Conservation and Development Department and Notices of Public Hearings.

D1. County File Number: CDSE24-00004 requests approval of an El Sobrante Administrative Permit for new, illuminated LED wall signage for "Pizza Twist", originally approved under CDSE16-00005 (Tenant Space A).

D2. County File Number: CDVR24-01020 requests a Variance for a Lot Line Adjustment between two parcels of substandard average width. Lot Line involves a 389 SF transfer from parcel ending in -052 to -053. (CDLL24-00005 Concurrent).

D3. County File Number: CDDP24-03018 requests of a Development Plan allow a duplex previoulsy approved under CDDP22-03004 that is expired. No changes are proposed.

D4. County File Number: CDDP24-03019 requests approval of a Development Plan to allow a duplex previously approved under CDDP22-03005 that is expired. No changes are proposed.

May 14, 2024 – West Contra Costa Fire Safe Council Advisory Board Presentation (Partnership Contra Costa County Fire Protection District)

MEETING OF THE ADVISORY BOARD
of
The West Contra Costa Fire Safe Council

Tuesday, May 14, 2024 @ Noon - 1:00 PM

Join Zoom Meeting
https://us02web.zoom.us/j/87962385788
Meeting ID: 879 6238 5788
One tap mobile
+16694449171,,87962385788#

AGENDA

- **Announcements:**
  - **$10M for First Community Resiliency Center in Contra Costa County**
- **Reports:**
  - **Jon Kaufman** - Wildfire Prevention Coordinating Group (WPCG)
  - **Con Fire** – Update on Evacuation Traffic Analysis, Measure X mitigation activities
  - **Richmond Fire Dept.** – CERT enrollment
  - **Richmond Fire Dept.** – Hilltop Green fuel reduction
  - **WCCFSC** - CWS Follow Ups
  - **WCCFSC** - Phillips 66 Annual Spill Drill
  - **WCCFSC** – PG&E lack of safety reports & communication

New Business:

- **Local Hazard Mitigation Plan (LHMP)**
  - **FEMA –**Why LHMP needed for pre & post-disaster grants, Purpose of Community Feedback
  - **County OES** – Contra Costa County HMP Volume 1
  - **Con Fire** - CCCFPD Annex HMP
  - **RFD** – Richmond Annex HMP

May 14, 2024 – Diablo MAC and Bethel Island MAC (Partnership with Contra Costa County Public Works Department, Ironhouse Sanitary District, Contra Costa County Fire Protection District)






Contra Costa County
IRONHOUSE
Bethel Island is Covered by Multiple Plans
CONTRA COSTA
IRONHOUSE
B-M-I-D

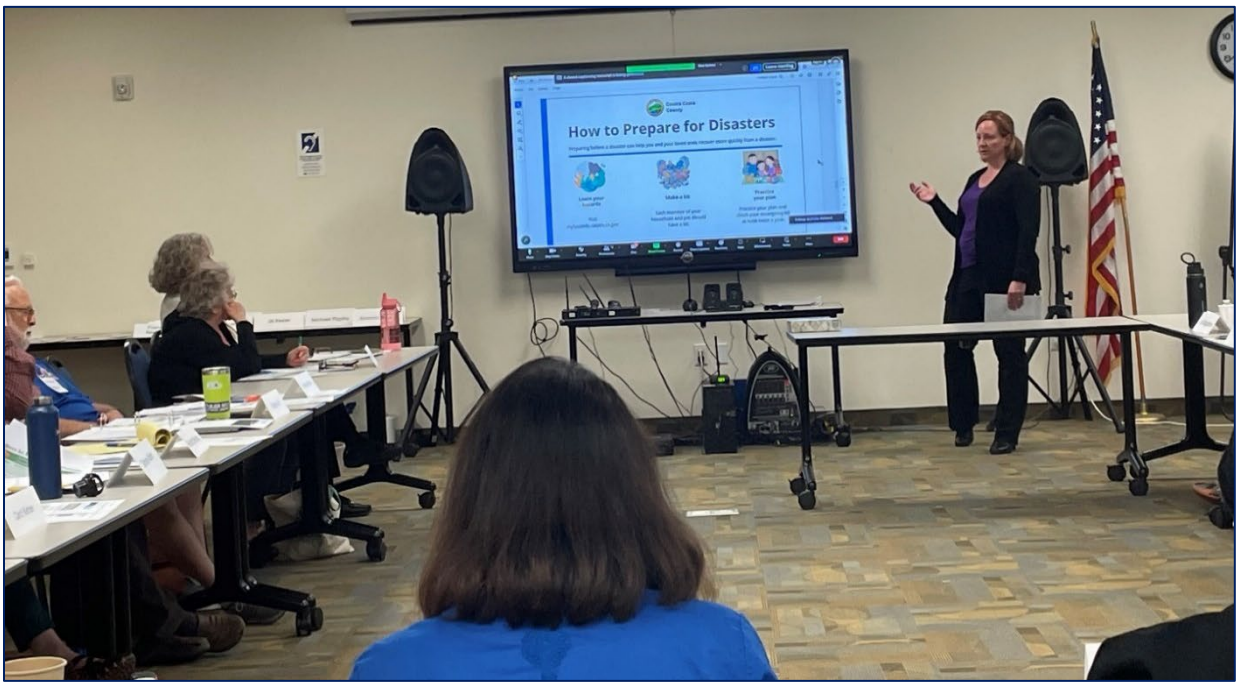

Local Hazards





May 15, 2024 – Advisory Council on Aging and Head Start Policy Council





May 21, 2024 – Knightsen Tactical Advisory Council (Partnership with Contra Costa County Public Works Department and Contra Costa County Fire Protection District)

CONTRA COSTA COUNTY

AGENDA

Knightsen Town Advisory Council

Tuesday, May 21, 2024 **7:00 PM** **Knightsen Farm Bureau 3020 Second Street, Knightsen, CA 94548**

1. **Roll Call and Introductions**
2. **Approval of Agenda**
3. **Public comment on any item under the jurisdiction of the Committee and not on this agenda (speakers are limited to three minutes).**
4. **Agency Reports**

a. Contra Costa County Office of the Sheriff
Contra Costa County Fire Protection District
Office of Supervisor Burgis

5. **Consent Items - Items are subject to removal from the consent calendar by request of any TAC member. Items removed from the consent calendar will be considered with the discussion items.**

a APPROVE Record of Actions - April 16, 2024 **24-1531**

Attachments: 4-16-24 Draft Record of Actions

6. **Discussion Items**

a. RECEIVE presentation on Contra Costa County Local Hazard Mitigation Plan. (Contra Costa County Office of Emergency Services, Contra Costa Public Works Department, Contra Costa Fire Protection District, Ironhouse Sanitary District) **24-1532**

Attachments: Knightsen MAC LHMP Public Comment Period Presentation Final

7. **Correspondence/Announcements**

a. RECEIVE KTAC May 2024 Correspondence. **24-1533**

Attachments: KTAC May 2024 Correspondence

8. **Future Agenda Items**

Page 1 of 2

Knightsen Town Advisory Council **AGENDA** **May 21, 2024**

9. **Adjourn**

The next meeting is currently scheduled for June 18, 2024.

The Committee will provide reasonable accommodations for persons with disabilities planning to attend the Committee meetings. Contact the staff person listed below at least 72 hours before the meeting. Any disclosable public records related to an open session item on a regular meeting agenda and distributed by the County to a majority of members of the Committee less than 96 hours prior to that meeting are available for public inspection at 3361 Walnut Boulevard Suite 140, Brentwood, CA 94513, during normal business hours. Staff reports related to items on the agenda are also accessible on line at www.contracosta.ca.gov. Public comment may be submitted via electronic mail on agenda items at least one full work day prior to the published meeting time.

For Additional Information Contact: Stephen Griswold, Deputy Chief of Staff, (925) 655-2330.

Page 2 of 2



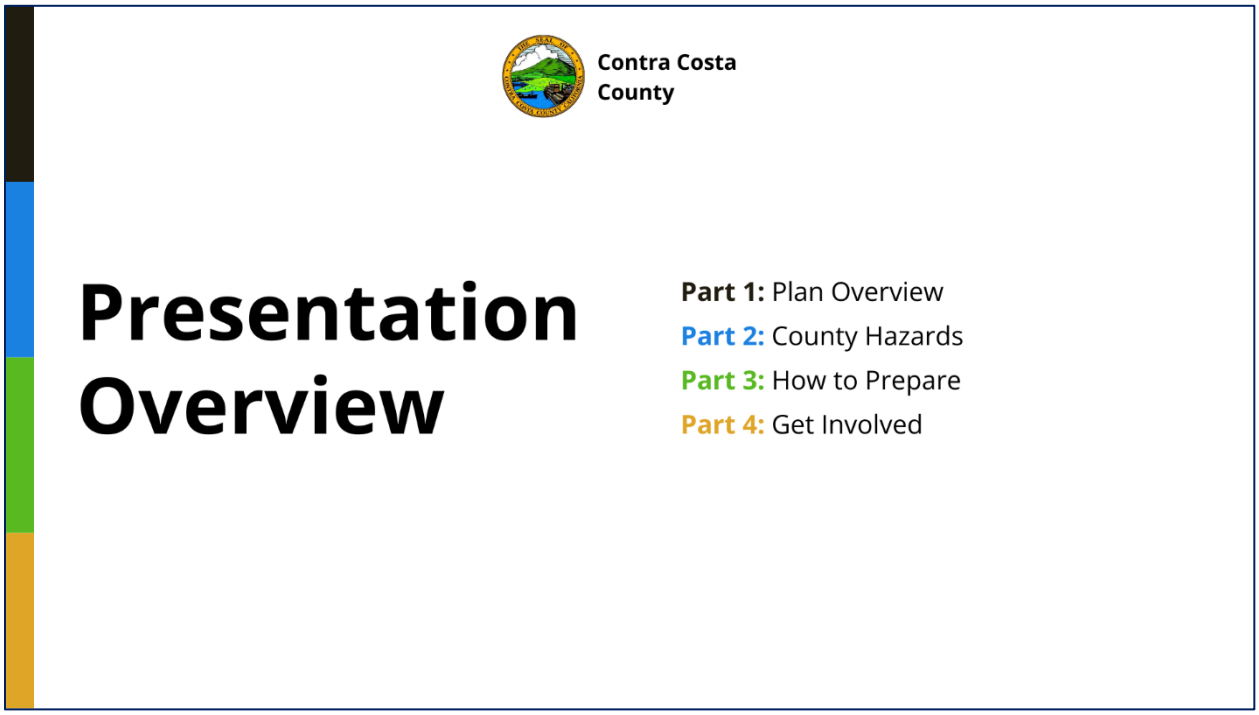
May 29, 2024 – Contra Costa County Fire Protection District Town Hall in Brentwood (Partnership with the City of Brentwood and Contra Costa County Fire Protection District)





Figure C-4 Presentation Template





Contra Costa County

Local Hazard Mitigation Plan

The Local Hazard Mitigation Plan (LHMP) is a 5-year plan that sets the mitigation priorities for the County.

Over 40 partners county wide are a part of this plan: 16 cities, 20 special districts, and many County Departments.

The planning process includes:



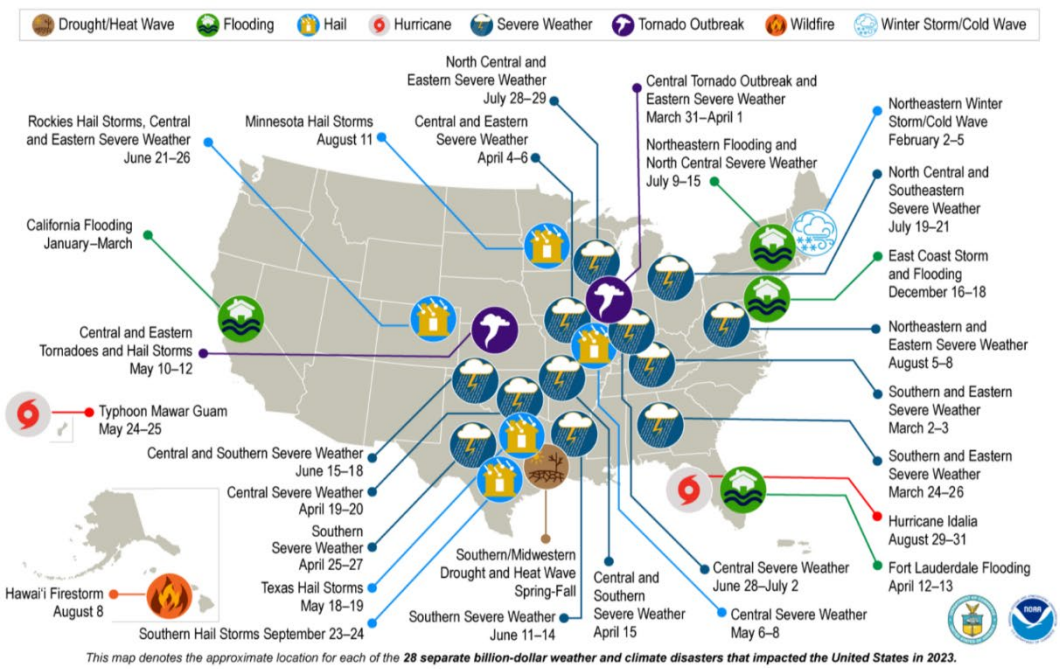
working with cities, special districts, and county departments to identify priority hazards in their jurisdictions.



identifying mitigation strategies for each hazards identified.



asking the public for feedback on the plan. Now that we have a draft, we want to hear your comments!



Contra Costa County

County-Wide Hazards



Natural Hazards *(Required)*

- Climate Change
- Dam and Levee Failure
- Drought
- Earthquake
- Flood
- Landslide
- Sea Level Rise (new)
- Severe Weather
- Tsunami
- Wildfire

Human-Caused / Technological Hazards

- Cybersecurity Threats
- Hazardous Materials Incidents
- Utility Interruptions
- Active Shooter Incidents
- Terrorism

Contra Costa County

How to Prepare for Disasters

Preparing before a disaster can help you and your loved ones recover more quickly from a disaster.



Learn your hazards

Visit myhazards.caloes.ca.gov



Make a kit

Each member of your household and pet should have a kit.



Practice your plan

Practice your plan and check your emergency kit at least twice a year.

Contra Costa County

Get Involved in the Planning Process

Read the plan!

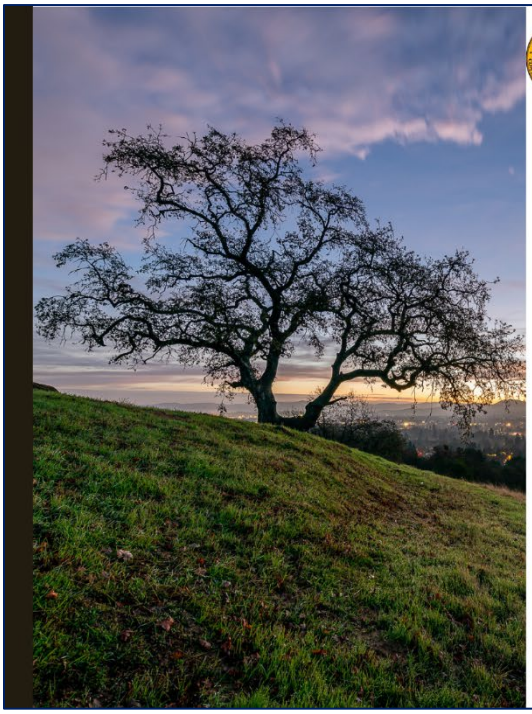
Comment!

SCAN ME

Share what you learned!

Check out https://www.contracosta.ca.gov/6415/Local-Hazard-Mitigation-Plan





Contra Costa County

Thank you!

For questions or comments contact:

OES Staff

oes-staff@so.cccounty.us

Printed Materials

Printed materials were distributed in the County's five (5) top languages – English, Spanish, Tagalog, and Traditional and Simplified Chinese. Materials were distributed at all public meetings and outreach events. Additionally, plan participants were given access to edit the designs for their own use. Having the materials available in multiple languages allowed more of the community to receive information about the Hazard Mitigation Plan, ways to comment, and how to prepare for disasters. Printed materials are especially helpful to communities with Limited English Proficiency as the materials include a visual component.

Two (2) different types of materials were created specifically for the public comment period. The trifold contains information on the planning process, the top three (3) hazards in the county, ways to prepare, and ways to get involved in the planning process. A full-page flyer was created with information on the planning process, ways to get involved, and ways to prepare. As central hubs for community resources, printed materials were delivered to 15 of the county's libraries. These libraries cover cities and unincorporated areas, as well as special- and reclamation districts. Printed materials were also provided to VistAbility, an agency that serves people with developmental disabilities. VistAbility distributed the materials at their office and through their networks to ensure that their constituents had the opportunity to educate themselves and provide feedback.

Figure C-5 Trifold (English)



Figure C-6 Trifold (Spanish)





Figure C-7 Trifold (Tagalog)

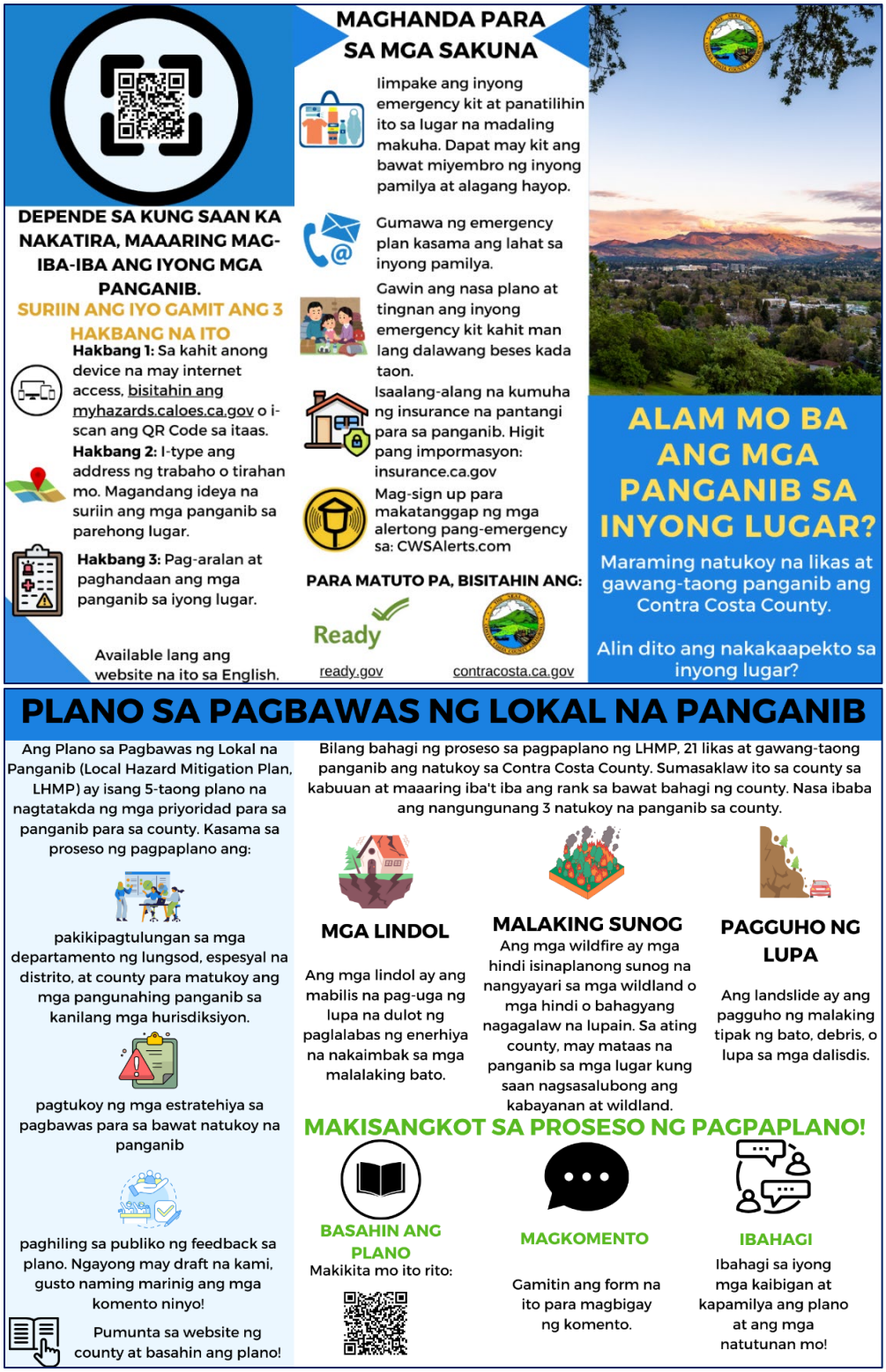


Figure C-8 Trifold (Traditional Chinese)



Figure C-9 Trifold (Simplified Chinese)



Figure C-10 Local Hazards Flyer (English)



Figure C-11 Local Hazards Flyer (Spanish)



Figure C-12 Local Hazards Flyer (Tagalog)



Figure C-13 Local Hazards Flyer (Simplified Chinese)



Figure C-14 Local Hazards Flyer (Traditional Chinese)



Social Media

Two (2) different social media posts were created, translated, and distributed in the County's top languages – English, Spanish, Tagalog, and Traditional and Simplified Chinese. The County's most active social media platforms are Facebook, X (formerly Twitter), and Nextdoor. The different social media platforms allowed us to reach the younger and older generations and bring a call to action in a different way. All participating jurisdictions were given access to duplicate and edit County's templates to serve their communities. This collaboration allowed for consistent messaging across all plan participants to avoid confusion.

Figure C-15 Social Media Infographics (English)







Figure C-16 Social Media Infographics (Spanish)







Figure C-17 Social Media Infographics (Tagalog)





Figure C-18 Social Media Infographics (Simplified Chinese)





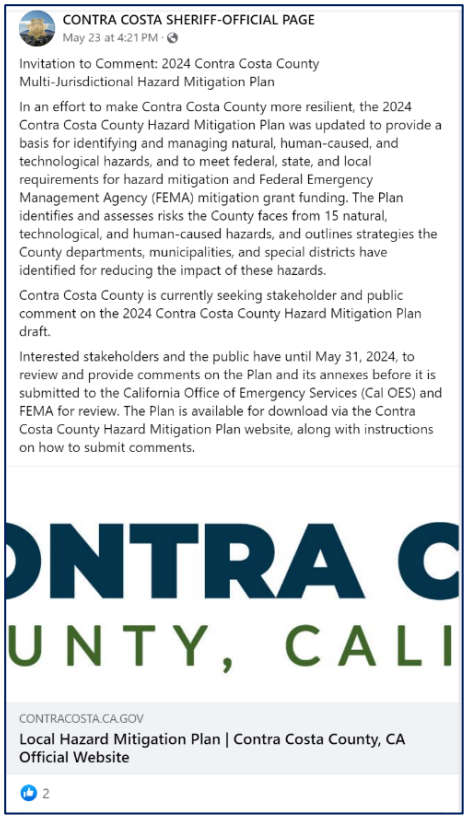
Figure C-19 Social Media Infographics (Traditional Chinese)

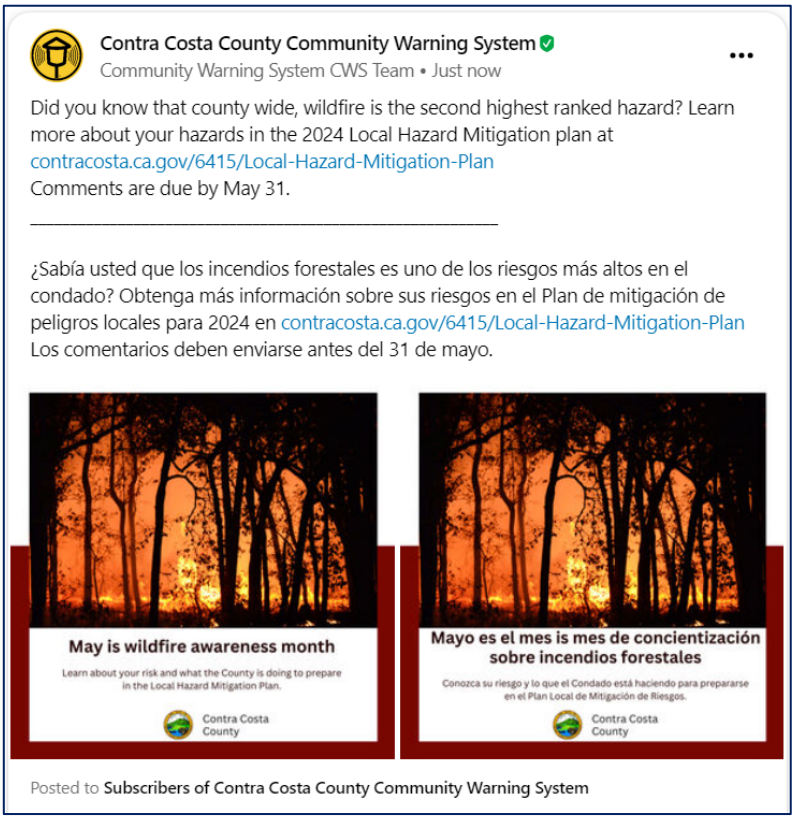




Figure C-20 Social Media Posts Samples







County Website

Contra Costa County OES worked with the Office of Communications and Media to update the County's website to include information on the planning process, upcoming events, and other hazard mitigation information. The information was presented online in English and Spanish, with transcription and screen reading abilities to increase community member accessibility. As a central place for all plan participants, this allowed all residents, stakeholders, and partners in the County to view Volume 1 (Planning Area-wide Elements) and the 40 annexes, and thus promoted more public comment.

Figure C-21 Contra Costa County Hazard Mitigation Plan Website



Stakeholder E-mails

Contra Costa County provided key stakeholders an opportunity to review and provide feedback on the draft Plan. Due to the size of the Plan (the Base Plan and 40 annexes), some stakeholders would receive the same invitation a significant amount of times. For a more productive outreach and to avoid overwhelming stakeholders, Contra Costa County sent a single invitation to all the countywide stakeholders via e-mail. Images of the e-mails sent are below. However, each plan participant was required to cross-reference the countywide list and invite additional stakeholders that applied to their jurisdiction. The full list of stakeholders can be found in **Appendix B**.

Invitation to Countywide Stakeholders

Invitation to Comment: 2024 Contra Costa County Multi-Jurisdictional Hazard Mitigation Plan

Beatriz Portillo <bport001@so.cccounty.us>
To
Cc ● Oes Staff

Reply | Reply All | Forward

Thu 5/23/2024 4:55 PM

Good afternoon,

This e-mail is being sent on behalf of the Contra Costa County municipalities and special districts (i.e., plan participants) listed below.

In an effort to make Contra Costa County more resilient, the 2024 Contra Costa County Hazard Mitigation Plan was updated to provide a basis for identifying and managing natural, human-caused, and technological hazards, and to meet federal, state, and local requirements for hazard mitigation and Federal Emergency Management Agency (FEMA) mitigation grant funding. The Plan identifies and assesses risks the County faces from 15 natural, technological, and human-caused hazards, and outlines strategies the County departments, municipalities, and special districts have identified for reducing the impact of these hazards.

Contra Costa County is currently seeking stakeholder and public comment on the 2024 Contra Costa County Hazard Mitigation Plan draft. The Plan is comprised of Volume 1, which includes the Planning Area-wide Elements and 40 Annexes – one (1) for each of the plan participants listed below.

Interested stakeholders have until **May 31, 2024**, to review and provide comments on the Plan and its annexes before it is submitted to the California Office of Emergency Services (Cal OES) and FEMA for review. The Plan is available for download via the Contra Costa County Hazard Mitigation Plan website, along with instructions on how to submit comments.

Cities, Towns, Unincorporated Contra Costa County		
Contra Costa County **(Volume 1)**	City of Lafayette	City of Pleasant Hill
City of Brentwood	City of Martinez	City of Richmond
City of Clayton	Town of Moraga	City of San Pablo
Town of Danville	City of Oakley	City of San Ramon
City of El Cerrito	City of Orinda	City of Walnut Creek
City of Hercules	City of Pinole	
Special Districts		
Bethel Island Municipal Improvement District	Kensington Fire Protection District	Reclamation District No. 2065 (Veale Tract)
Central Contra Costa Sanitary District	Kensington Police Protection and Community Services District	Reclamation District No. 2122 (Winter Island)
Contra Costa County Fire Protection District	Mt. View Sanitary District	Reclamation District No. 2137
Contra Costa County Flood Control and Water Conservation District	Pleasant Hill Parks and Recreation District	Rodeo-Hercules Fire Protection District
Contra Costa Water District	Reclamation District No. 799 (Hotchkiss Tract)	San Ramon Valley Fire Protection District
Delta Diablo	Reclamation District No. 830 (Jersey Island)	San Ramon Valley Unified School District
Diablo Water District	Reclamation District No. 2025 (Holland Tract)	Town of Discovery Bay Community Services District
Ironhouse Sanitary District	Reclamation District No. 2026 (Webb Tract)	West County Wastewater District

If you have any questions, please contact Beatriz Portillo with Contra Costa County OES via e-mail at bport001@so.cccounty.us.

Thank you,
Beatriz Portillo (she/her/hers)
Senior Emergency Planning Coordinator
Sheriff's Office of Emergency Services
Contra Costa County
1850 Muir Rd, Martinez, CA 94553

Invitation to Neighboring Communities

Invitation to Comment: 2024 Contra Costa County Multi-Jurisdictional Hazard Mitigation Plan

BP Beatriz Portillo <bport001@so.cccounty.us>
To
Cc OES Duty Officer

Reply | Reply All | Forward
Thu 5/23/2024 5:35 PM

Good afternoon,

This e-mail is being sent on behalf of the Contra Costa County municipalities and special districts (i.e., plan participants) listed below.

Contra Costa County is currently seeking stakeholder and public comment on the 2024 Contra Costa County Hazard Mitigation Plan draft. The Plan is comprised of Volume 1, which includes the Planning Area-wide Elements and 40 Annexes – one (1) for each of the plan participants listed below. As emergency management organizations from neighboring counties, your comments would be greatly appreciated.

To review and provide comments on the Plan and its annexes before it is submitted to Cal OES and FEMA for review please visit the Contra Costa County Hazard Mitigation Plan website, before May 31, 2024.

Cities, Towns, Unincorporated Contra Costa County		
Contra Costa County **(Volume 1)**	City of Lafayette	City of Pleasant Hill
City of Brentwood	City of Martinez	City of Richmond
City of Clayton	Town of Moraga	City of San Pablo
Town of Danville	City of Oakley	City of San Ramon
City of El Cerrito	City of Orinda	City of Walnut Creek
City of Hercules	City of Pinole	
Special Districts		
Bethel Island Municipal Improvement District	Kensington Fire Protection District	Reclamation District No. 2065 (Veale Tract)
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Diablo Water District	Reclamation District No. 2025 (Holland Tract)	Town of Discovery Bay Community Services District
Ironhouse Sanitary District	Reclamation District No. 2026 (Webb Tract)	West County Wastewater District

Feel free to reach out with any questions!

Thank you,
Beatriz Portillo (she/her/hers)
Senior Emergency Planning Coordinator
Sheriff's Office of Emergency Services
Contra Costa County
1850 Muir Rd, Martinez, CA 94553

C.4. CONTINUED PUBLIC ENGAGEMENT

In order to keep the Plan current after it is approved, it is important to ensure that the public continues to be involved in the Plan and how it is carried out. To ensure continued public engagement, Contra Costa County will ensure the Plan is available in the County's Hazard Mitigation webpage after it has been approved to allow the public an opportunity to provide continual feedback and input. As future needs and concerns arise, or if the public would like to provide feedback regarding the latest version of the Contra Costa County Plan, the public is invited to use the comment form, which is provided on the website, to provide comments.

County Hazard Mitigation Webpage: www.contracosta.ca.gov/6415/Local-Hazard-Mitigation-Plan

Comment Form: survey.alchemer.com/s3/7792090/CommentFormContraCostaCountyHMP.

Incorporating hazard mitigation into other planning efforts can help the public learn about mitigation and its importance to their communities. Contra Costa County will continue to work with its stakeholders to ensure that the public has an opportunity to learn about the Plan, mitigation actions planned for their communities, and ways to get involved. Hazard mitigation will be a part of the County's community outreach strategy to include, but not limited to, public meetings, community events, social media, and public surveys throughout the year. Furthermore, the County will continue to ensure equitable outreach by working with other departments, non-profits, and agencies that work with underserved communities throughout the County.

APPENDIX D. PLAN ADOPTION

[Placeholder for adoption documentation after State and FEMA Approval]