Del Norte County Operational Area Hazard Mitigation Plan

Volume 1—Area-Wide Elements

June 2019

TETRA TECH

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Tetra Tech Project #103S5175
DelNorteCountyHMP_Vol1_Final_06042019.docx

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Special Acknowledgments

The development of this plan would not have been possible without the dedication and commitment to this process by the Hazard Mitigation Plan Steering Committee. The dedication of this volunteer committee to allocate their time to this process is greatly appreciated. Also, the citizens of Del Norte County are to be commended for their participation in the outreach strategy identified by the Steering Committee. This outreach success will set the course for successful implementation of this plan.

EXECUTIVE SUMMARY

HAZARD MITIGATION OVERVIEW

Hazard mitigation is the use of long-term and short-term policies, programs, projects, and other activities to alleviate the death, injury, and property damage that can result from a disaster. Del Norte County and a partnership of local and tribal governments within the county have developed a hazard mitigation plan to reduce risks from natural disasters in the Del Norte County Operational Area—defined as the unincorporated county, incorporated cities, special purpose districts and areas for which tribal planning partners are authorized to govern, develop, or regulate. The plan complies with federal and state hazard mitigation planning requirements to establish eligibility for funding under Federal Emergency Management Agency (FEMA) grant programs for all planning partners.

UPDATING THE DEL NORTE COUNTY PLAN

This plan is a comprehensive update of the 2010 Crescent City/Del Norte County Hazard Mitigation Plan, which covered the unincorporated county, the city and five special purpose districts. FEMA approved the 2010 plan on February 15, 2011, and it expired on February 15, 2016. This update reestablishes FEMA hazard mitigation grant assistance eligibility for participating planning partners. All but one of the original planning partners have participated in the update and four new planning partners were added, as listed in Table ES-1.

Table ES-1. Planning Partners

Jurisdiction	Point of Contact	Title
County of Del Norte	Cindy Henderson	Emergency Services Manager
City of Crescent City	Eric Taylor	Director of Community Development
Elk Valley Rancheria	Heidi Valadao	Disaster/Safety Preparedness Committee Chair
Big Rock Community Services District	Craig Bradford	President District Board of Directors
Gasquet Community Services District	Michael J Morgan	General Manager
Klamath Community Services District	Margaret Caldwell	President District Board of Directors
Smith River Community Services District	Chris Vaughan	General Manager
Crescent Fire Protection District	Bill Gillespie	Fire Chief
Smith River Fire Protection District	Geoff Antill	Projects Administrator
Crescent City Harbor District	Charlie Helms	CEO / Harbormaster
County of Del Norte	Cindy Henderson	Emergency Services Manager
City of Crescent City	Eric Taylor	Director of Community Development
Elk Valley Rancheria	Heidi Valadao	Disaster/Safety Preparedness Committee Chair
Big Rock Community Services District	Craig Bradford	President District Board of Directors

PLAN DEVELOPMENT APPROACH

Organization

A core planning team consisting of a contract consultant and Del Norte County Office of Emergency Services staff was assembled to facilitate this plan update. A planning partnership was formed by engaging eligible local and tribal governments within the Operational Area and making sure they understood their expectations for compliance under the updated plan. A 13-member steering committee was assembled to oversee the plan update, consisting of both governmental and non-governmental stakeholders within the Operational Area. Coordination with other county, state, and federal agencies involved in hazard mitigation occurred throughout the plan update process. Organization efforts included a review of the 2010 Crescent City/Del Norte County Hazard Mitigation Plan, the California statewide hazard mitigation plan, and existing programs that may support hazard mitigation actions.

Public Outreach

The planning team implemented a multi-media public involvement strategy utilizing the outreach capabilities of the planning partnership that was approved by the Steering Committee. The strategy included public meetings, a hazard mitigation survey, an information booth at the Veteran's day parade, a project website, the use of social media and multiple media releases.

Plan Document Development

The planning team and Steering Committee assembled a document to meet federal hazard mitigation planning requirements for all partners. The updated plan contains two volumes. Volume 1 contains components that apply to all partners and the broader Operational Area. Volume 2 contains all components that are jurisdiction-specific. Each planning partner has a dedicated annex in Volume 2.

Adoption

Once pre-adoption approval has been granted by the California Office of Emergency Services and FEMA Region IX, the final adoption phase will begin. Each planning partner will individually adopt the updated plan.

RISK ASSESSMENT

Risk assessment is the process of measuring the potential loss of life resulting from natural hazards, as well as personal injury, economic injury and property damage, in order to determine the vulnerability of people, buildings, and infrastructure to natural hazards. For this update, risk assessment models were enhanced with new data and technologies that have become available since 2010. The Steering Committee used the risk assessment to rank risk and to gauge the potential impacts of each hazard of concern in the Operational Area. The risk assessment included the following:

- Hazard identification and profiling
- Assessment of the impact of hazards on physical, social, and economic assets
- Identification of particular areas of vulnerability
- Estimates of the cost of potential damage.

Based on the risk assessment, hazards were ranked for the risk they pose to the overall Operational Area, as shown in Table ES-3. Each planning partner also ranked hazards for its own area. Table ES-4 summarizes the categories of high, medium and low (relative to other rankings) based on the numerical ratings that each jurisdiction assigned each hazard.

The results indicate the following general patterns:

- Almost all planning partner ranked earthquake as high and more than half ranked wildland fire as high.
- The flooding and severe weather hazards were most commonly ranked as medium.
- The drought hazard was most commonly ranked as low.
- Exposure and vulnerability to the hazards differ significantly among the planning partners.

Table ES-2. Hazard Risk Ranking

Hazard Ranking	Hazard Event	Category[a]
1	Earthquake	High
2	Tsunami	High
3	Severe weather	Medium
4	Wildland Fire	Medium
5	Flooding	Medium
5	Landslide	Medium
6	Drought	Low
6	Sea Level Rise	Low
7	Dam Failure	Low

Table ES-3. Summary of Hazard Ranking Results

	Number of Jurisdictions Assigning Ranking to Hazard			
	High	Medium	Low	Not Ranked
Dam Failure	0	1	3	6
Drought	0	2	5	3
Earthquake	9	1	0	0
Flooding	1	5	3	1
Landslide	3	3	2	2
Sea Level Rise	0	1	4	5
Severe Weather	2	8	0	0
Tsunami	4	1	2	3
Wildland Fire	6	0	2	2

MITIGATION GOALS AND OBJECTIVES

The Steering Committee reviewed and made minor updates to the guiding principle, goals, and objectives from the 2010 Crescent City/Del Norte County Hazard Mitigation Plan. The following guiding principle guided the Steering Committee and planning partners in selecting actions contained in this plan update:

> *Reduce the vulnerability to natural hazards in order to protect the health, safety, welfare and economy of Del Norte County.*

Goals

The Steering Committee and planning partners established the following goals for the plan update:

1. Save or protect lives from the impact of hazards.
2. Protect the environment.

3. Protect property from the impact of hazards.
4. Maintain economic viability after a disaster event.
5. Promote efficient use of public funds

The effectiveness of a mitigation strategy is assessed by determining how well these goals are achieved.

Objectives

Each selected objective meets multiple goals, serving as a stand-alone measurement of the effectiveness of a mitigation action, rather than as a subset of a goal. The objectives also are used to help establish priorities. The objectives are as follows:

1. Consider the impacts of hazards in all planning mechanisms that address current and future land uses within Del Norte County.
2. Sustain reliable local emergency operations and facilities before during and after a disaster.
3. Pursue implementation of all feasible measures that reduce the risk exposure and promote the adaptive capacity of public and private property within Del Norte County.
4. Seek mitigation projects that provide the highest degree of hazard protection in a cost-effective manner.
5. Inform the public on the hazard risk exposure and ways to increase the public's capability and adaptive capacity to prepare for, respond to, recover from, and mitigate the impacts of natural-hazard events.
6. Increase resilience and the continuity of operations of identified critical facilities within Del Norte County.
7. Consider codes that require new construction to consider the impacts of hazards.
8. Utilize the best available data, science and technologies to improve understanding of the location and potential impacts of hazards, the vulnerability of building types, community development patterns, and the measures needed to protect life safety.
9. Enhance emergency management capability within the planning area.
10. Address identified/known repetitive losses within the planning area.

MITIGATION ACTION PLAN

The planning partnership selected a range of appropriate mitigation actions to work toward achieving the goals set forth in this plan update. Mitigation actions presented in this update are activities designed to reduce or eliminate losses resulting from natural hazards. The update process resulted in the identification of 139 mitigation actions for implementation by individual planning partners, as presented in Volume 2 of this plan. In addition, the Steering Committee and planning partners identified countywide actions benefiting the whole partnership, as listed in Table ES-5.

IMPLEMENTATION

The Steering Committee developed a plan implementation and maintenance strategy that includes grant monitoring and coordination, a strategy for continued public involvement, a commitment to plan integration with other relevant plans and programs, and a recommitment from the planning partnership to actively monitoring and evaluating the plan over the five-year performance period.

Full implementation of the recommendations of this plan will require time and resources. The measure of the plan's success will be its ability to adapt to changing conditions. The County of Del Norte and its planning partners will assume responsibility for adopting the recommendations of this plan and committing resources toward implementation. The framework established by this plan commits all planning partners to pursue actions when the benefits of a project exceed its costs. The planning partnership developed this plan with extensive public input, and public support of the actions identified in this plan will help ensure the plan's success.

Table ES-4. Area-Wide Hazard Mitigation Actions

Action Number and Description	Implementation Priority
CW-1—To the extent possible based on available resources, provide coordination and technical assistance in the application for grant funding that includes assistance in cost vs. benefit analysis for grant eligible projects	High
CW-2—Encourage the development and implementation of a county-wide hazard mitigation public-information strategy that meets the needs of all planning partners.	High
CW-3—Coordinate updates to land use and building regulations as they pertain to reducing the impacts of natural hazards, to seek a regulatory cohesiveness within the planning area. This can be accomplished via a commitment from all planning partners to involve each other in their adoption processes, by seeking input and comment during the course of regulatory updates or general planning.	High
CW-4—Sponsor and maintain a natural hazards informational website to include the following types of information: • **Hazard-specific information such as GIS layers, private property mitigation alternatives, important facts on risk and vulnerability** • **Pre- and post-disaster information such as notices of grant funding availability** • **CRS creditable information** • **Links to Planning Partners' pages, FEMA, Red Cross, NOAA, USGS and the National Weather Service.** • **Information such as progress reports, mitigation success stories, update strategies, Steering Committee meetings.**	Medium
CW-5—The Steering Committee will remain as a functioning body over time to monitor progress of the plan, provide technical assistance to planning partners and oversee the update of the plan according to schedule. This body will continue to operate under the ground rules established at its inception.	High
CW-6—Amend or enhance this hazard mitigation plan as needed to comply with state or federal mandates as compliance guidelines become available.	High
CW-7—All planning partners that fully participated in this planning effort will formally adopt this plan once pre-adoption approval has been granted by CalEMA and FEMA, and will adhere to the plan maintenance protocol identified in Chapter 21.	High

Del Norte County Operational Area Hazard Mitigation Plan

PART 1—PLANNING PROCESS AND COMMUNITY PROFILE

1. INTRODUCTION TO HAZARD MITIGATION PLANNING

1.1 WHY PREPARE THIS PLAN?

1.1.1 The Big Picture

Hazard mitigation is defined as any action taken to reduce or alleviate the loss of life, personal injury, and property damage that can result from a disaster. It involves long- and short-term actions implemented before, during and after disasters. Hazard mitigation activities include planning efforts, policy changes, programs, studies, improvement projects, and other steps to reduce the impacts of hazards.

For many years, federal disaster funding focused on relief and recovery after disasters occurred, with limited funding for hazard mitigation planning in advance. The Disaster Mitigation Act (DMA), passed in 2000, shifted the federal emphasis toward planning for disasters before they occur. The DMA requires state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. Regulations developed to fulfill the DMA's requirements are included in Title 44 of the Code of Federal Regulations (44 CFR).

The responsibility for hazard mitigation lies with many, including private property owners, commercial interests, and local, state and federal governments. The DMA encourages cooperation among state and local authorities in pre-disaster planning. The enhanced planning network called for by the DMA helps local governments to articulate accurate needs for mitigation, resulting in faster allocation of funding and more cost-effective risk-reduction projects.

The DMA also promotes sustainability in hazard mitigation. To be sustainable, hazard mitigation needs to incorporate sound management of natural resources and address hazards and mitigation in the largest possible social and economic context.

1.1.2 Purposes for Planning

The County of Del Norte and the City of Crescent City jointly prepared a hazard mitigation plan in compliance with the DMA in 2010. Special purpose districts with jurisdiction inside Del Norte County participated as planning partners in the plan. The 2010 plan identified resources, information, and strategies for reducing risk from natural hazards. It called for ongoing updates, and this *2018 Del Norte County Operational Area Hazard Mitigation Plan* fulfills the update requirement.

In preparing this update, Del Norte County has again partnered with local communities and special-purpose districts. One of the benefits of such multi-jurisdictional planning is the ability to pool resources and eliminate redundant activities within a planning area that has uniform risk exposure and vulnerabilities. The Federal Emergency Management Agency (FEMA) encourages multi-jurisdictional planning under its guidance for the DMA. Elements and strategies in the plan were selected because they meet a program requirement and because they best meet the needs of all the planning partners and their citizens.

The *2018 Del Norte County Operational Area Hazard Mitigation Plan* will help guide and coordinate mitigation activities throughout the planning area. It was developed to meet the following objectives:

- Meet or exceed requirements of the DMA.
- Enable all planning partners to continue using federal grant funding to reduce risk through mitigation.
- Meet the needs of each planning partner as well as state and federal requirements.
- Create a risk assessment of local hazards of concern.
- Meet the planning requirements of FEMA's Community Rating System (CRS), allowing eligible planning partners to consider participation in the CRS program.
- Coordinate existing plans and programs so that high-priority projects to mitigate possible disaster impacts are funded and implemented.

1.2 WHO WILL BENEFIT FROM THIS PLAN?

All citizens and businesses of Del Norte County are the ultimate beneficiaries of this hazard mitigation plan. The plan reduces risk for those who live in, work in, and visit the planning area. It provides a viable planning framework for all foreseeable natural hazards. Participation in development of the plan by key stakeholders helped ensure that outcomes will be mutually beneficial. The resources and background information in the plan are applicable across the planning area, and the plan's goals and recommendations can lay groundwork for the development and implementation of local mitigation activities and partnerships.

1.3 CONTENTS OF THIS PLAN

This plan has been set up in two volumes so that elements that are jurisdiction-specific can easily be distinguished from those that apply to the whole planning area:

- Volume 1—Volume 1 includes all federally required elements of a disaster mitigation plan that apply to the entire planning area. This includes the description of the planning process, public involvement strategy, goals and objectives, planning area hazard risk assessment, planning area mitigation actions, and a plan maintenance strategy.
- Volume 2—Volume 2 includes all federally required jurisdiction-specific elements, in annexes for each participating jurisdiction. It includes a description of the participation requirements established by the Steering Committee, as well as instructions and templates that the partners used to complete their annexes. Volume 2 also includes "linkage" procedures for eligible jurisdictions that did not participate in development of this plan but wish to adopt it in the future.

Both volumes include elements required under federal guidelines. DMA compliance requirements are cited at the beginning of subsections as appropriate to illustrate compliance.

The following appendices provided at the end of Volume 1 include information or explanations to support the main content of the plan:

- Appendix A—Public involvement information used in preparation of this update
- Appendix B—A summary of federal and state programs and regulations relevant to hazard mitigation.
- Appendix C—Quantitative results from risk assessment modeling.
- Appendix D— Plan adoption resolutions from planning partners.

All planning partners will adopt Volume 1 in its entirety and at least the following parts of Volume 2: Part 1; each partner's jurisdiction-specific annex; and the appendices.

2. PLAN UPDATE—WHAT HAS CHANGED

2.1 THE PREVIOUS PLAN

The *2010 Crescent City/Del Norte County Hazard Mitigation Plan* was prepared for a planning partnership that consisted of Del Norte County, the City of Crescent City, and special-purpose districts within the county. Having initiated the hazard mitigation planning process, Crescent City, the only incorporated city in Del Norte County, sought out other planning partners with similar hazard exposures and capabilities, so that together the planning partners could pool resources to support the planning effort. This multi-jurisdiction approach addressed several meaningful considerations:

- The County of Del Norte provides many services on a countywide basis that influence or directly impact Crescent City and the special purpose districts.
- Due to the rural nature of Del Norte County, many local jurisdictions in the county lack the financial or technical resources to prepare a DMA-compliant plan.
- As the principal economic center of Del Norte County, Crescent City could be directly impacted by mitigation activities throughout the county.
- FEMA promotes multi-jurisdictional planning, so a multi-jurisdictional partnership was more likely to receive grant funding for the planning effort.
- The State of California's Standardized Emergency Management System encourages multi-jurisdictional efforts for emergency planning and establishes the "***operational area***"—consisting of a county and all political subdivisions within it—as one of the five state-defined levels for use in all emergencies and disasters involving multiple agencies or multiple jurisdictions.

The 2010 plan recommended six countywide mitigation actions and 71 actions specific to individual planning partners. The actions address the following identified hazards of concern:

- Dam failure
- Earthquake
- Flood
- Landslide and other mass movement
- Severe weather
- Tsunami
- Wildfire.

Of the 14 participating planning partners, Del Norte County, Crescent City and five special purpose districts completed individual annexes to the plan, thereby achieving DMA compliance through the plan. FEMA issued approval of the plan on February 15, 2011.

2.2 WHY UPDATE?

2.2.1 Federal Eligibility

Under 44 CFR, hazard mitigation plans must present a schedule for monitoring, evaluating, and updating the plan. This provides an opportunity to reevaluate recommendations, monitor the impacts of actions that have been accomplished, and determine if there is a need to change the focus of mitigation strategies. A jurisdiction covered by a plan that has expired is not able to pursue elements of federal funding for which a current hazard mitigation plan is a prerequisite.

2.2.2 Changes in Development

Hazard mitigation plan updates must be revised to reflect changes in development within the planning area during the previous performance period of the plan (44 CFR Section 201.6(d)(3)). The plan must describe changes in development in hazard-prone areas that increased or decreased vulnerability for each jurisdiction since the last plan was approved. If no changes in development impacted the jurisdiction's overall vulnerability, plan updates may validate the information in the previously approved plan. The intent of this requirement is to ensure that the mitigation strategy continues to address the risk and vulnerability of existing and potential development and takes into consideration possible future conditions that could impact vulnerability.

The planning area experienced a 17.1-percent increase in population between 2000 and 2015, an average annual growth rate of 1.1 percent per year. The County of Del Norte and the City of Crescent City have general plans that govern land-use decisions and policy-making, as well as building codes and specialty ordinances based on state and federal mandates. This plan update assumes that some new development triggered by increased population occurred in hazard areas. Because all such new development would have been regulated pursuant to local programs and codes, it is assumed that vulnerability did not increase even if exposure did. More detailed information on the types and location of new construction over the last five years is available in the City of Crescent City and Del Norte County annexes in Volume 2 of this plan.

Please note that the changes in risk assessment results between the 2010 plan and the 2018 plan are significant. The Planning Team believe that 2010 plan was an overestimation and 2018 plan is an underestimation and this results from the differing methodologies the availability of better data to support the risk assessment. Therefore, performing a comparative analysis between the two risk assessments would result in a false reading in change of risk due to new development.

2.2.3 New Analysis Capabilities

The risk assessment for the 2010 plan used both quantitative and qualitative analyses. Building count data and annualized average loss estimates were provided for some, but not all, hazards of concern. These estimates were predominantly reported at the countywide scale. The updated risk assessment provides more detailed information on exposed population and building counts for each hazard of concern. This update also expands the level of detail in multiple-scenario loss estimation modeling for earthquake, flood, landslide, wildfire, and sea level rise. Exposure and vulnerability estimates are presented at the jurisdictional level. This enhanced risk assessment allows for a more detailed understanding of the ways risk in the planning area is changing over time.

2.3 THE UPDATED PLAN—WHAT IS DIFFERENT?

The updated plan differs from the initial plan in a variety of ways. Table 2-1 indicates the major changes between the two plans as they relate to 44 CFR planning requirements.

Table 2-1. Plan Changes Crosswalk

44 CFR Requirement	Previous Plan	Updated Plan
§201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: *(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;* *(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and* *(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.*	The 2010 plan followed an outreach strategy utilizing multiple media developed and approved by the Steering Committee. This strategy involved: • Public participation on an oversight Steering Committee. • Establishment of a plan informational website. • Press releases. • Use of a public information survey Stakeholders were identified and coordinated with throughout the process. A comprehensive review of relevant plans and programs was performed by the planning team.	Building upon the approach from the 2010 plan, the 2018 planning effort deployed the same public engagement methodology. Enhancements included: • Utilization of social media • Web deployed survey • Enhanced press coverage As with the 2010 plan, the 2017 planning process identified key stakeholders and coordinated with them throughout the process. A comprehensive review of relevant plans and programs was performed by the planning team.
§201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.	The 2010 plan included a comprehensive risk assessment of seven hazards of concern. Risk was defined as (probability x impact), where impact is the impact on people, property and economy of the planning area. All planning partners ranked risk as it pertains to their jurisdiction. The potential impacts of climate change are discussed for each hazard.	The same methodology, using new, updated data, was deployed for the 2018 plan update. The risk assessment now includes a detailed profile of potential impacts of climate change on the assessed hazards of concern. A qualitative profile of non-natural hazards was included. These hazards were profiled only and not fully assessed or ranked as with the natural hazards.
§201.6(c)(2)(i): [The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.	The 2010 plan presented a risk assessment of each hazard of concern. Each chapter included the following components: • Hazard profile, including maps of extent and location, historical occurrences, frequency, severity and warning time. • Secondary hazards • Climate change impacts • Exposure of people, property, critical facilities and environment • Vulnerability of people, property, critical facilities and environment. • Future trends in development • Scenarios • Issues	The same format, using updated data, was deployed for the 2018 plan update. Climate change was addressed as a stand-alone chapter.

44 CFR Requirement	Previous Plan	Updated Plan
§201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i). This description shall include an overall summary of each hazard and its impact on the community	Vulnerability was assessed for all hazards of concern. The Hazus computer model (version MR-3) was used for the dam failure, earthquake, and flood hazards. These were Level 2 analyses using city and county data. Site-specific data on County-identified critical facilities were entered into the Hazus model. Loss outputs were generated for other hazards by applying an estimated damage function to an asset inventory extracted from Hazus.	The same methodology was deployed for the 2018 plan update, using updated data. Hazus version 4.0 was utilized for all analyses.
§201.6(c)(2)(ii): [The risk assessment] must also address National Flood Insurance Program insured structures that have been repetitively damaged floods	The 2010 plan included a CRS level of detail repetitive loss area analysis based on 2011 repetitive loss data and the 2007 CRS Coordinators Manual.	The 2018 plan included a CRS level of detail repetitive loss area analysis based on 2016 repetitive loss data and the 2017 CRS Coordinators Manual.
§201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.	A complete inventory of the numbers and types of buildings exposed was generated for each hazard of concern. The Steering Committee defined "critical facilities" for the planning area, and these were inventoried by exposure. Each hazard chapter provides a discussion on future development trends.	The same methodology was deployed for the 2018 plan update, using updated data.
§201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) and a description of the methodology used to prepare the estimate.	Loss estimates were generated for all hazards of concern. These were generated by Hazus for the dam failure, earthquake and flood hazards. For the other hazards, loss estimates were generated by applying a regionally relevant damage function to the exposed inventory. In all cases, a damage function was applied to an asset inventory. The asset inventory was the same for all hazards and was generated in Hazus.	The same methodology was deployed for the 2018 plan update, using updated data.
§201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.	There is a discussion of future development trends as they pertain to each hazard of concern. This discussion looks predominantly at the existing land use and the current regulatory environment that dictates this land use.	The same methodology was deployed for the 2018 plan update, using updated data. In addition, a look at the change in risk due to new development over the performance period of the plan was performed for each hazard of concern.
§201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.	The 2010 plan contained a guiding principle, goals, objectives and actions. The guiding principal, goals and objectives were regional and covered all planning partners. Each planning partner identified actions that could be implemented within its capabilities. The actions were jurisdiction-specific and strove to meet multiple objectives. All objectives met multiple goals and stand alone as components of the plan. Each planning partner completed an assessment of its regulatory, technical and financial capabilities.	The same methodology for setting goals, objectives and actions was applied to the 2018 plan update. The Steering Committee reviewed and reconfirmed the guiding principle, goals and objectives for the plan. Each planning partner used the progress reporting from the plan maintenance and evaluated the status of actions identified in the 2010 plan. Actions that were completed or no longer considered to be feasible were removed. The rest of the actions were carried over to the 2017 plan and in some cases, new actions were added to the action plan.

44 CFR Requirement	Previous Plan	Updated Plan
§201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.	The Steering Committee identified a guiding principle, five goals and 10 objectives. These were completely new goals and objectives targeted specifically for this hazard mitigation plan. They were not carried over from any other planning document and were identified based upon the capabilities of the planning partnership. These planning components supported the actions identified in the plan.	The same methodology for setting goals, objectives and actions was applied to the 2018 plan update. The Steering Committee reviewed and reconfirmed the guiding principle, goals and objectives for the plan with minor wording changes.
§201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.	The 2010 plan includes a hazard mitigation catalog that was developed through a facilitated process. This catalog identifies actions that manipulate the hazard, reduce exposure to the hazard, reduce vulnerability, or increase mitigation capability. The catalog further segregates actions by scale of implementation. A table in the action plan section analyzes each action by mitigation type to illustrate the range of actions selected.	The mitigation catalog was reviewed and updated by the Steering Committee for the 2018 update. As with the 2010 plan, the catalog is included in the 2018 plan to represent the comprehensive range of alternatives considered by each planning partner. The analysis of mitigation action was again used in jurisdictional annexes to the plan.
§201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program, and continued compliance with the program's requirements, as appropriate.	All municipal planning partners that participate in the National Flood Insurance Program identified an action stating their commitment to maintain compliance and good standing under the program. Communities that participate in the Community Rating System identified actions to maintain or enhance their standing under the CRS.	The same methodology was deployed for the 2018 plan update, using updated data.
§201.6(c)(3)(iii): [The mitigation strategy shall describe] how the actions identified in Section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.	Each recommended action was prioritized using a qualitative methodology based on the objectives the project will meet, the timeline for completion, how the project will be funded, the impact of the project, the benefits of the project and the costs of the project.	The same methodology was deployed for the 2018 plan update, using updated data.
§201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.	The 2010 plan details a plan maintenance strategy that involved a protocol for annual progress reporting by all planning partners. The strategy identifies triggers for plan updates, integration with other plans and programs and identifies protocol for continuing public involvement.	The 2010 plan maintenance strategy was revised for this plan update. The planning partnership will not be preparing annual progress reports of any of the prescribed process for an annual review of the plan.
§201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.	The 2010 plan details recommendations for incorporating the plan into other planning mechanisms such as: • Comprehensive Plan • Emergency Response Plan • Capital Improvement Programs • Municipal Code • Continuity of Operations Plan	This component of the plan maintenance strategy from the 2010 plan was carried over to the 2018 plan.

44 CFR Requirement	Previous Plan	Updated Plan
§201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.	The 2010 plan details a strategy for continuing public involvement	This component of the plan maintenance strategy from the 2010 plan was carried over to the 2018 plan.
§201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commission, Tribal Council).	All planning partners that fully met their "participation" requirements as defined by the planning process formally adopted the plan. Appendix D presents the resolutions of all planning partners that adopted this plan	All planning partners that fully met their "participation" requirements as defined by the planning process formally adopted the plan. Appendix D presents the resolutions of all planning partners that adopted this plan
§201.7(c): This section presents requirements specific to hazard mitigation planning for Indian tribes.	No Indian tribes participated in the 2010 plan.	The Elk Valley Rancheria annex provided in Volume 2 of this plan meets the requirements of 44 CFR 201.7(c).

3. PLAN UPDATE APPROACH

The process followed to develop the 2018 *Del Norte County Operational Area Hazard Mitigation Plan* had the following primary objectives:

- Secure grant funding
- Form a planning team
- Establish a planning partnership
- Define the planning area
- Establish a steering committee
- Coordinate with other agencies
- Review existing programs
- Engage the public.

These objectives are discussed in the following sections.

3.1 GRANT FUNDING

This planning effort was supplemented by a FEMA Hazard Mitigation Assistance grant (Hazard Mitigation Grant Program for DR 4240) in fiscal year 2015. The Del Norte County Office of Emergency Services (OES) was the applicant agent for the grant. It covered 75 percent of the cost for development of this plan; the planning partners covered the balance through in-kind contributions.

3.2 DEFINING STAKEHOLDERS

At the beginning of the planning process, the planning team identified a list of stakeholders to engage during the update of the Hazard Mitigation Plan. For this planning process, "stakeholder" was defined as any person or public or private entity that owns or operates facilities that would benefit from the mitigation actions of this plan, and/or has an authority or capability to support mitigation actions identified by this plan. Stakeholders were separated into two categories:

- **Participatory Stakeholders**—Stakeholders that actively participated in the planning process as planning partners or members of the Steering Committee.
- **Coordinating Stakeholders**—Stakeholders that were not able to commit to actively participating in the process as a participatory stakeholder but were kept apprised of plan development milestones or were able to provide data that was used in the plan development.

3.3 FORMATION OF THE PLANNING TEAM

Del Norte County OES hired Tetra Tech, Inc. to assist with development and implementation of the plan. The Tetra Tech project manager assumed the role of the lead planner, reporting directly to the Del Norte County OES project manager. A planning team was formed to lead the planning effort, made up of the following members:

- Cindy Henderson, Emergency Services Manager, Del Norte County Office of Emergency Services
- Rob Flaner, Tetra Tech, Project Manager
- Stephen Veith, Tetra Tech, Lead Project Planner
- Carol Baumann, Tetra Tech, Risk Assessment Lead
- Kristen Gelino, Tetra Tech, Planner/Profiler

3.4 ESTABLISHMENT OF THE PLANNING PARTNERSHIP

Del Norte County OES opened this planning effort to all eligible local governments within the planning area. The planning team made a presentation at a stakeholder kickoff meeting on July 13, 2017 to introduce the mitigation planning process and solicit planning partners. Key meeting objectives were as follows:

- Provide an overview of the Disaster Mitigation Act.
- Describe the reasons for a plan.
- Outline the hazard mitigation plan update- work plan.
- Outline planning partner expectations.
- Seek commitment to the planning partnership.
- Seek volunteers for the Steering Committee.

Each jurisdiction wishing to join the planning partnership was asked to provide a “letter of intent to participate” that designated a point of contact for the jurisdiction and confirmed the jurisdiction’s commitment to the process and understanding of expectations. Linkage procedures have been established (see Volume 2 of this plan) for any jurisdiction wishing to link to the *Del Norte County Operational Area Hazard Mitigation Plan* in the future. The planning partners covered under this plan are shown in Table 3-1.

Table 3-1. Hazard Mitigation Planning Partners

Jurisdiction	Point of Contact	Title
County of Del Norte	Cindy Henderson	Emergency Services Manager
City of Crescent City	Eric Taylor	Director of Community Development
Elk Valley Rancheria	Heidi Valadao	Disaster/Safety Preparedness Committee Chair
Big Rock Community Services District	Craig Bradford	President District Board of Directors
Gasquet Community Services District	Michael J Morgan	General Manager
Klamath Community Services District	Margaret Caldwell	President District Board of Directors
Smith River Community Services District	Chris Vaughan	General Manager
Crescent Fire Protection District	Bill Gillespie	Fire Chief
Smith River Fire Protection District	Geoff Antill	Projects Administrator
Crescent City Harbor District	Charlie Helms	CEO / Harbormaster

3.5 DEFINING THE PLANNING AREA

The planning area was defined to consist of the unincorporated county, incorporated cities, and special purpose districts within the geographical boundary of Del Norte County. All partners to this plan have jurisdictional authority within this planning area. A map showing the geographic boundary of the defined planning area for this plan update is provided in Chapter 4, along with a description of planning area characteristics.

This plan will also provide compliance for the Elk Valley Rancheria with 44 CFR 201.7, which outlines requirements for tribal hazard mitigation plan. The defined planning area for this update includes the lands upon which the tribal government is authorized to govern, develop, or regulate. These lands may include, but are not limited to, lands within the reservation and off-reservation lands owned by, managed by, or held in trust for the tribal government, allotted trust land, and fee land. These lands may be either contiguous or noncontiguous and for multi-jurisdictional planning may include other tribes or non-tribal jurisdictions. All such areas for the Elk Valley Rancheria are within the Del Norte County Operational Area.

3.6 THE STEERING COMMITTEE

Hazard mitigation planning enhances collaboration among diverse parties who can be affected by hazard losses. A key element of the public engagement strategy for this plan update was the formation of a stakeholder steering committee to oversee all phases of the update. The members of this committee included planning partner representatives, citizens, and other stakeholders from within the planning area. The planning team assembled a list of candidates representing interests within the planning area that could have recommendations for the plan or be impacted by its recommendations. The planning partners confirmed a committee of 13 members at the kickoff meeting. Table 3-2 lists the Steering Committee members and their designated alternates.

Table 3-2. Steering Committee Members

Name	Title	Jurisdiction/Agency
PRIMARY MEMBERS		
Randy Hooper [a]	Assistant Director	Del Norte County Community Development Department
Taylor Carsley	Planning	Del Norte County Community Development Department
Cindy Henderson	Emergency Services Manager	Del Norte County Office of Emergency Services
Kymmie Scott [b]	Public Information Officer	Crescent City
Heidi Valadao	Disaster/Safety Preparedness Committee Chair	Elk Valley Rancheria
Craig Bradford	President District Board of Directors	Big Rock Community Services District
Eileen Rutledge	Secretary/Treasurer	Gasquet Community Services District
Margaret Caldwell	President District Board of Directors	Klamath Community Services District
Chris Vaughan	General Manager	Smith River Community Services District
Bill Gillespie[c]	Fire Chief	Crescent Fire Protection District
Geoff Antill	Projects Administrator	Smith River Fire Protection District
Charlie Helms	CEO/Harbormaster	Crescent City Harbor District
DESIGNATED ALTERNATES		
Heidi Kunstal	Del Norte County Community Development Department	Del Norte County Community Development Department
Jay Sarina	Del Norte County Administrative Officer	Del Norte County Office of Emergency Services
Eric Taylor[b]	Director, Community Development Department	Crescent City
Rob Jacob	Environmental Coordinator	Elk Valley Rancheria
Crista Stewart	Director of Grants	Elk Valley Rancheria
Caitlin Smith	Emergency Manager	Elk Valley Rancheria
Sam Rutledge	Board Director	Gasquet Community Services District
Mike Morgan	General Manager	Gasquet Community Services District
Vanessa Duncan	Administrative Assistant	Crescent Fire Protection District
Elaine Fallgren	Board Chair	Smith River Fire Protection District
Lane Tavasci	Deputy Harbormaster	Crescent City Harbor District

a. Chairperson
b. Vice-Chairperson. Kymmie Scott left employment with Crescent City midway through the hazard mitigation plan update process. Eric Taylor attended all remaining meetings
c. Stephen Wakefield was fire chief and Steering Committee member at the beginning of the hazard mitigation plan update process. Bill Gillespie became fire chief and Steering Committee member in April 2018.

Leadership roles and ground rules were established during the Steering Committee's first meeting, on July 13, 2017. The Steering Committee then met on the third Thursday of every month as needed throughout the course of the plan's development. The planning team facilitated each Steering Committee meeting, which addressed a set of objectives based on an established work plan. The Steering Committee met eight times from July 2017 through April 2018. Meeting summaries and attendance logs are provided in Appendix A to this volume. All Steering Committee meetings were open to the public and were advertised as such on the hazard mitigation plan website. Agendas were posted to the website prior to each scheduled Steering Committee meeting, and meeting summaries were posted to the hazard mitigation plan website following their approval by the Steering Committee.

3.7 COORDINATION WITH STAKEHOLDERS AND AGENCIES

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2) and Section 201.7(c)(2)). Agency coordination for this plan was accomplished as follows:

- **Steering Committee Involvement**—Agency representatives were invited to participate on the Steering Committee.
- **Agency Notification—**The following agencies were invited to participate in the plan development process from the beginning and were kept apprised of plan development milestones:
  - American Red Cross-Northern California Coastal Region
  - California Department of Water Resources, California State National Flood Insurance Program Coordinator
  - California Office of Emergency Services, Emergency Services Coordinator
  - FEMA Region IX, Lead Community Planner
  - U.S. Geological Survey, Science Advisor
  - California Department of Transportation, Director-District 1
  - Bureau of Land Management, Tribal Relations
  - California Department of Forestry and Fire Protection, Resource Management Division
  - The Yurok Tribe
  - Resighini Rancheria
  - Smith River Rancheria

  These agencies received meeting announcements, meeting agendas, and meeting minutes by e-mail throughout the plan development process and were provided the option to attend meetings. Some agencies supported the effort by attending meetings or providing feedback on issues.
- **Pre-Adoption Review**—All the agencies listed above were provided an opportunity to review and comment on this plan, primarily through the hazard mitigation plan website (see Section 3.9). All were sent an e-mail message informing them that draft portions of the plan were available for review. Upon completion of a public comment period, a complete draft plan was sent to the California Office of Emergency Services for a pre-adoption review to ensure program compliance.

Special assistance with the planning process was provided by the following federal and state agencies:

- FEMA Region IX provided updated planning guidance, provided summary and detailed data for the planning area from the National Flood Insurance Program (NFIP) (including repetitive loss information), and conducted plan review.
- The U.S. Geological Survey (USGS) provided maps to support the earthquake risk assessment.

- The California Governor's Office of Emergency Services (Cal OES) facilitated FEMA review, provided updated planning guidance, and reviewed the draft and final versions of the plan prior to FEMA review.
- The California Department of Forestry and Fire Protection (CAL FIRE) provided fire severity mapping to support the wildfire risk assessment.
- The California Department of Water Resources (DWR) provided information on NFIP compliance for local cities.

3.8 REVIEW OF EXISTING PROGRAMS

Hazard mitigation planning must include review and incorporation, if appropriate, of existing plans, studies, reports and technical information (44 CFR, Section 201.6(b)(3) and Section 201.7(c)(3)). Chapter 5 of this plan provides a review of laws and ordinances in effect within the planning area that can affect hazard mitigation actions. In addition, the following programs can affect mitigation within the planning area:

- California Fire Code
- The California Fire Alliance
- 2016 California Building Code
- California State Hazard Mitigation Forum
- Local capital improvement programs
- Local emergency operations plans
- Local general plans
- Local tribal hazard mitigation plans
- Housing elements of general plans
- Safety elements of general plans
- Local zoning ordinances
- Local coastal program policies.

Assessments of all planning partners' regulatory, technical and financial capabilities to implement hazard mitigation actions are presented in the individual jurisdiction-specific annexes in Volume 2. Many of these relevant plans, studies and regulations are cited in the capability assessments. See Section 5.3 for discussion on how these capabilities were reviewed for opportunities to integrate or be informed by information presented in this hazard mitigation plan.

3.9 PUBLIC INVOLVEMENT

Broad public participation in the planning process helps ensure that diverse points of view about local needs are considered and addressed. The public must have opportunities to comment on disaster mitigation plans during the drafting stages and prior to plan approval (44 CFR, Section 201.6(b)(1) and Section 201.7(c)(1)). The Community Rating System expands on these requirements by making CRS credits available for optional public involvement activities. For this plan update, "public" has been defined as the general public within the Del Norte County planning area. This includes, but is not limited to:

- Residents
- Tribal members
- Tourists
- Employers within the operational area
- Employees within the operational area
- Students (primary and secondary education levels).

3.9.1 Strategy

The strategy for involving the public in this plan emphasized the following elements:

- Include members of the public on the Steering Committee.
- Use a survey to determine if the public's perception of risk and support of hazard mitigation has changed since the initial planning process.
- Attempt to reach as many planning area citizens as possible using multiple media.
- Identify and involve planning area stakeholders.

Stakeholders and the Steering Committee

Stakeholders are the individuals, agencies and jurisdictions that have a vested interest in the recommendations of the hazard mitigation plan, including all planning partners. The effort to include stakeholders in this process included stakeholder participation on the Steering Committee. The planning team vetted all the following potential stakeholders to actively participate in the plan update process:

- **Federal Agencies**—FEMA Region IX provided updated planning guidance and data from the National Flood Insurance Program (including repetitive loss information) and conducted plan review. Representatives from the U.S. Geological Survey served as subject matter advisors for the Steering Committee.
- **State Agencies—**Cal OES facilitated FEMA review, provided updated planning guidance, and reviewed the draft and final versions of the plan prior to FEMA review.
- **Regional and Local Stakeholders**—The following organizations received information about the planning process and invitations to provide input, and elected to participate in the planning process as members or subject matter advisors to the Steering Committee:
  - Crescent City
  - Elk Valley Rancheria
  - The Yurok Tribe
  - Resighini Rancheria
  - Smith River Rancheria
  - Crescent City Harbor District
  - Crescent Fire Protection District
  - Gasquet Community Services District
  - Smith River Community Services District
  - Smith River Fire Protection District
  - Big Rock Community Services District
  - Fort Dick Fire Protection District
  - Del Norte Resource Conservation District
  - Klamath Fire Protection District
  - Del Norte County Office of Education
  - Del Norte County Library District.

Internet

At the beginning of the plan development process, a website was created to keep the public posted on plan development milestones and to solicit relevant input (http://www.co.del-norte.ca.us/hmp; see Figure 3-1). The site's address was publicized in all press releases, mailings, surveys and public meetings. Each planning partner established a link to this site on its own agency website. Information on the plan development process, the Steering Committee, a plan survey, and drafts of the plan was made available to the public on the site throughout the process. Del Norte County intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

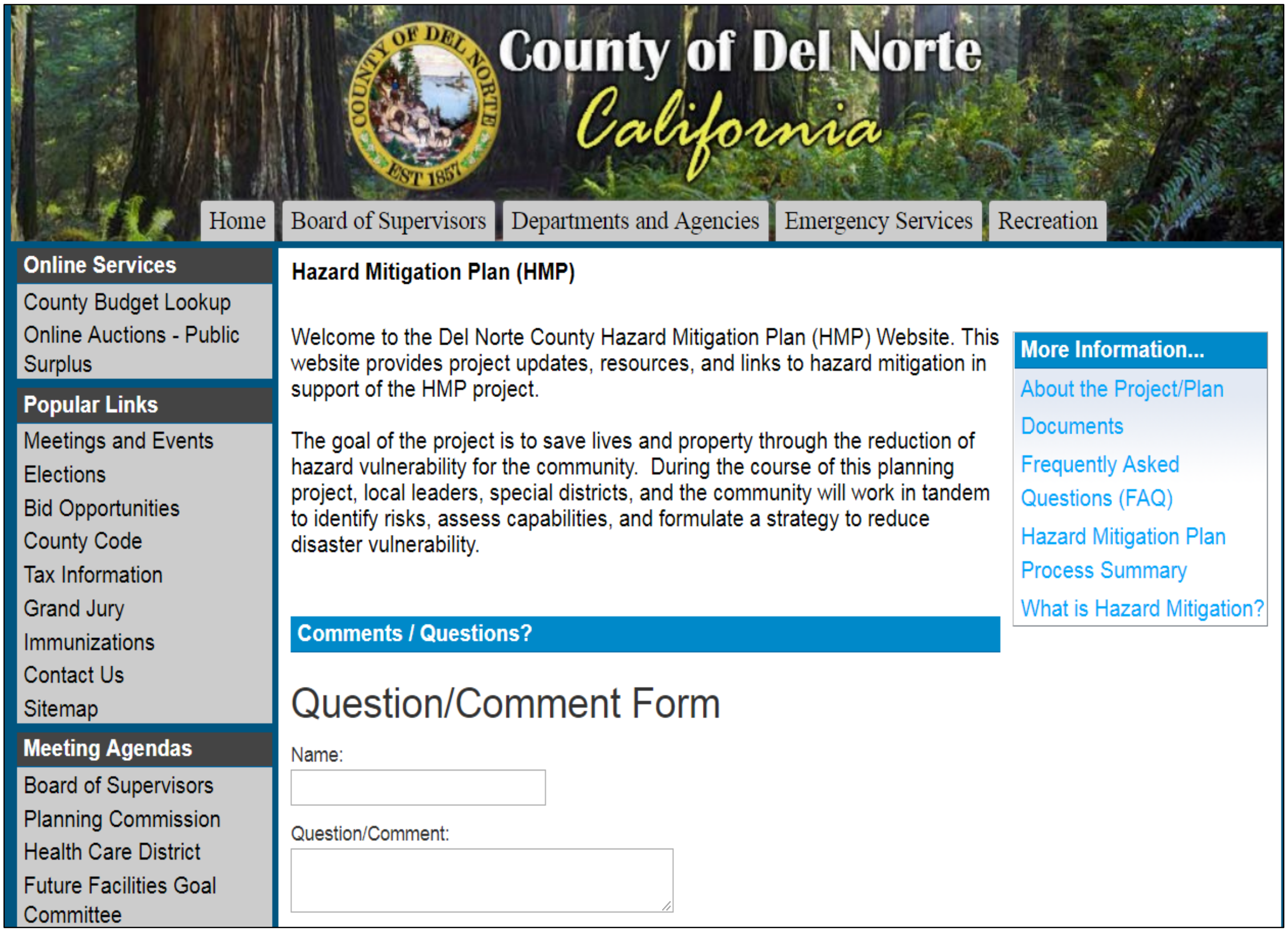


Figure 3-1. Sample Page from Hazard Mitigation Plan Web Site

Survey

A hazard mitigation plan survey (see Figure 3-2) was developed by the planning team with guidance from the Steering Committee. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its 18 questions helped guide the Steering Committee in selecting goals, objectives and mitigation strategies. The survey was made available on the hazard mitigation plan website and advertised throughout the course of the planning process. The results of the survey were provided to each of the planning partners in toolkits used to support the jurisdictional annex process (as described in the introduction to Volume 2 of this plan). Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

During the course of this planning process, 288 completed surveys were submitted. The complete survey and a summary of its findings can be found in Appendix A of this volume.

Del Norte County Local Hazard Mitigation Plan Survey

Hazard Knowledge

First, please answer this set of questions about your experience and knowledge of natural hazards and steps your household has taken to prepare for disasters:

1. How knowledgeable would you rate yourself on natural hazards?

- ○ Not knowledgeable
- ○ Somewhat knowledgeable
- ○ Knowledgeable
- ○ Very knowledgeable
- ○ Extremely knowledgeable

2. Which of the following natural hazard events have you experienced in the Del Norte County? (Check all that apply)

- ☐ Dam/Levee Failure
- ☐ Drought
- ☐ Earthquake
- ☐ Flood
- ☐ Landslide & Mass Movements (sinkholes, geologic hazards)
- ☐ Severe Weather (high wind, heavy rain, lightning, etc.)
- ☐ Tsunami
- ☐ Wildfire
- ☐ None
- ☐ Other (please specify)

Figure 3-2. Sample Page from Survey Distributed to the Public

Public Outreach

The public outreach process for this plan update consisted of two phases. Phase 1 took place early in the process to share information with the public from the risk assessment and gauge perception of risk within the planning area. The second phase was conducted at the end of the process during a formal public comment period to provide the public an opportunity to review and comment on the draft plan.

Phase 1

The Phase 1 public outreach was held during the Veteran's Day Parade on Saturday, November 11, 2017. planning team members staffed a booth during the event, provided literature about the plan update, and had maps on site showing the extent and location of the hazards of concern addressed by the plan as well as copies of the survey and note cards with a QR code that provided a smart-phone link to the website (see Figure 3-3).

Figure 3-3. QR Code Notice for the Survey Provided at Phase 1 Public Meeting

Phase 2

Phase 2 of the public outreach was the two-week final public comment period, May 8 – 22, 2018, following release of the draft hazard mitigation plan. Three public meetings were held

- May 7 at the Crescent City City Council meeting
- May 8 at the Del Norte County Board of Supervisors meeting
- May 21 at the Crescent City City Council meeting.

These meetings, advertised via a press release, presented a short overview of the final plan and provided an opportunity for the public to comment. An article about the public comment period was published May 5, 2018 in the *Del Norte Triplicate* ("Public comment requested for hazard mitigation plan").

The public comment period gave the public an opportunity to comment on the draft plan update prior to its submittal to Cal OES. The principle avenue for public comment on the draft plan was the website established for this plan update. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

3.9.2 Public Involvement Results

Survey

Detailed analysis of the survey findings is presented in Appendix A; a summary is as follows:

- Number of hard copy surveys received—55
- Number of surveys completed via the internet—203
    - 24 via direct link for the Elk Valley Rancheria
    - 179 on the main link advertised on the website
- Surveys acquired via social media—32
- Total surveys analyzed—290
- Surveys were received from each planning partner

- Survey respondents ranked tsunami as the hazard of greatest concern, followed by landslide, severe weather, earthquake and wildfire.
- 87 percent of respondents reported having experienced severe weather, and more than half reported having experienced earthquake and tsunami.
- Most respondents (80 percent) expect to receive information on immediate threats caused by hazards from the Del Norte Community Alert System, followed by radio (75 percent). More than half would expect to be notified through a public notification system or Facebook.
- 55 percent of respondents stated that they felt “somewhat prepared” to get along without electricity for up to 10 days. The remainder were about evenly divided between those who feel “very prepared” and those who feel “not at all prepared.”

Survey results were provided to the Steering Committee for use in support of confirming the guiding principle, goals, objectives and county-wide actions for this plan update. Additionally, the survey results were included in the toolkit provided to each planning partner through the jurisdictional annex process described in Volume 2. Each planning partner was instructed to use the survey results to help frame mitigation actions and public outreach strategies to include in their action plans.

Public Outreach Events

The public involvement strategy used for this plan update introduced the concept of mitigation to the public and provided the Steering Committee with feedback to use in developing the plan. All citizens of the planning area were provided ample opportunities to provide comment during all phases of this plan update process. Details of attendance and comments received from the public outreach events are summarized in Table 3-3. Public comments received during this process were mainly questions on the data presented in the plan. No comments were received that resulted in changes or edits to the plan.

Table 3-3. Summary of Public Outreach Events

Date	Location	Number of Citizens in Attendance	Number of Comments Received
11/11/2017	Veterans Day Parade	100+	5
5/7/2018	Crescent City City Council	10 (plus 12 views on live stream)	0
5/8/2018	Del Norte County Board of Supervisors	50	0
5/21/2018	Crescent City City Council	30	0
Total		**200+**	**5**

3.10 PLAN DEVELOPMENT CHRONOLOGY/MILESTONES

Table 3-4 summarizes important milestones in the plan update process.

Table 3-4. Plan Development Chronology/Milestones

Date	Event	Description	Attendance
2017			
4/15	Organize Resources	County releases request for proposals for a technical support contractor to facilitate the update to the hazard mitigation plan.	N/A
5/23	Organize Resources	County selects Tetra Tech as its technical assistance contractor to facilitate the plan update process.	N/A
7/20	Steering Committee Meeting #1	• Review work plan • Organize Steering Committee • Discuss mission/vision statement • Discuss current plan goals/objectives • Initiate plan review – Del Norte and State • Discuss options for public involvement strategy	15
8/17	Steering Committee Meeting #2	• Confirm steering committee charter • Review hazards of concern • Discuss mission/vision/guiding principle statement • Discuss current plan goals and objectives	15
9/21	Steering Committee Meeting #3	• Introduce jurisdiction annex development process • Discuss hazards of concern • Confirm guiding principle statement • Confirm plan goals and objectives • Discuss critical facility definition • Discuss public survey	15
10/19	Steering Committee Meeting #4	• Update on jurisdiction annex development process • Confirm hazards of concern • Review critical facilities definition and inventory • Confirm public outreach survey for deployment • Discuss plan maintenance strategy • Update on other aspects of public involvement strategy	16
10/23	Public Outreach	Web-based public outreach survey deployed via Survey Monkey with web-links distributed via the hazard mitigation website and social media.	N/A
11/11	Public Outreach	Public outreach at Veteran's Day Parade	100+
11/16	Steering Committee Meeting #5	• Update on jurisdiction annex development process • Risk assessment update • Review and confirm critical facilities definition • Review of plan maintenance strategy • Update on results of public involvement strategy and future outreach	15
2018			
1/18	Public Outreach	• Presentation at Rotary Club	15
1/18	Steering Committee Meeting #6	• Review project timeline • Discuss jurisdiction annex status and questions • Review and discuss preliminary risk assessment results • Update on results of the public involvement strategy	19
2/15	Steering Committee Meeting #7	• Initiate Phase 3 of jurisdiction annex development • Review public survey results • Discuss public comment period and future public outreach	17
4/19	Steering Committee Meeting #8	• Review plan maintenance strategy • Update on annex Phase 3 process • Discussion of public comment period	17

Date	Event	Description	Attendance
5/7	Phase 2 public meeting	Public meeting held at Crescent City City Council to present draft plan and provide opportunity for the public to provide comment.	22
5/8	Begin Comment Period	Initiate public comment period	N/A
5/8	Phase 2 public meeting	Public meeting held at Del Norte County Board of Supervisors to present draft plan and provide opportunity for the public to provide comment.	50
5/21	Phase 2 public meeting	Public meeting held at Crescent City City Council to present draft plan and provide opportunity for the public to provide comment.	30
5/22	End Comment Period	Public comment period is closed	N/A
5/31	Steering Committee Meeting #9	• Review draft plan • Public comment on draft plan • Next steps, plan submittal	13
6/1	Plan submittal	Pre-adoption review draft of the plan submitted to Cal OES.	XX
12/21	APA	Approval Pending Adoption (APA) provided by FEMA	XX
12/22	Adoption	Adoption Window opens for planning partnership	XX
2019			
3/29	Approval	Final Plan approval issued by FEMA Region IX	XX

4. DEL NORTE COUNTY PROFILE

4.1 GEOGRAPHIC OVERVIEW

Del Norte County is at the far northwest corner of the State of California on the Pacific coast, adjacent to Oregon (see Figure 4-1). The county is bounded on the north by Curry County, Oregon; on the east by Siskiyou County; on the south by Humboldt County and on the west by the Pacific Ocean. The county encompasses 1,070 square miles, 80 percent of which is forestlands, protected redwoods and recreation areas. Most of the county is located in Six Rivers National Forest. Elevations in the county range from sea level to 6,424 feet at Bear Mountain along the county's eastern boundary. Geographically, the county is defined by its coastal plain, mountainous region and rivers. The county seat is Crescent City, the county's only incorporated city.

The county's name (commonly pronounced del nort) is from the Spanish for "the land of the north" (la tierra del norte). Because of its rugged terrain and sparse population, it is one of the least known areas in California. The county is known for its recreational fishing and hunting areas and for its natural wonders, in particular the coastal redwoods, scores of unique plants and flowers, dozens of species of coastal birds, rocky, primitive beaches and sea stacks, pristine rivers, and historic lighthouses.

4.2 HISTORICAL OVERVIEW

The first Europeans to explore the Del Norte County area were most likely the Spanish who arrived by ship in the 17th and 18th centuries. The area was described by George Vancouver in his journal in 1792. The first American to explore the region was Jedediah Smith in the early 1800s. Smith and his party of trappers were the first to reach the area overland on foot. The party established trade with the Native Americans of the region, discovered Lake Earl and established base camps in the area now known as Crescent City.

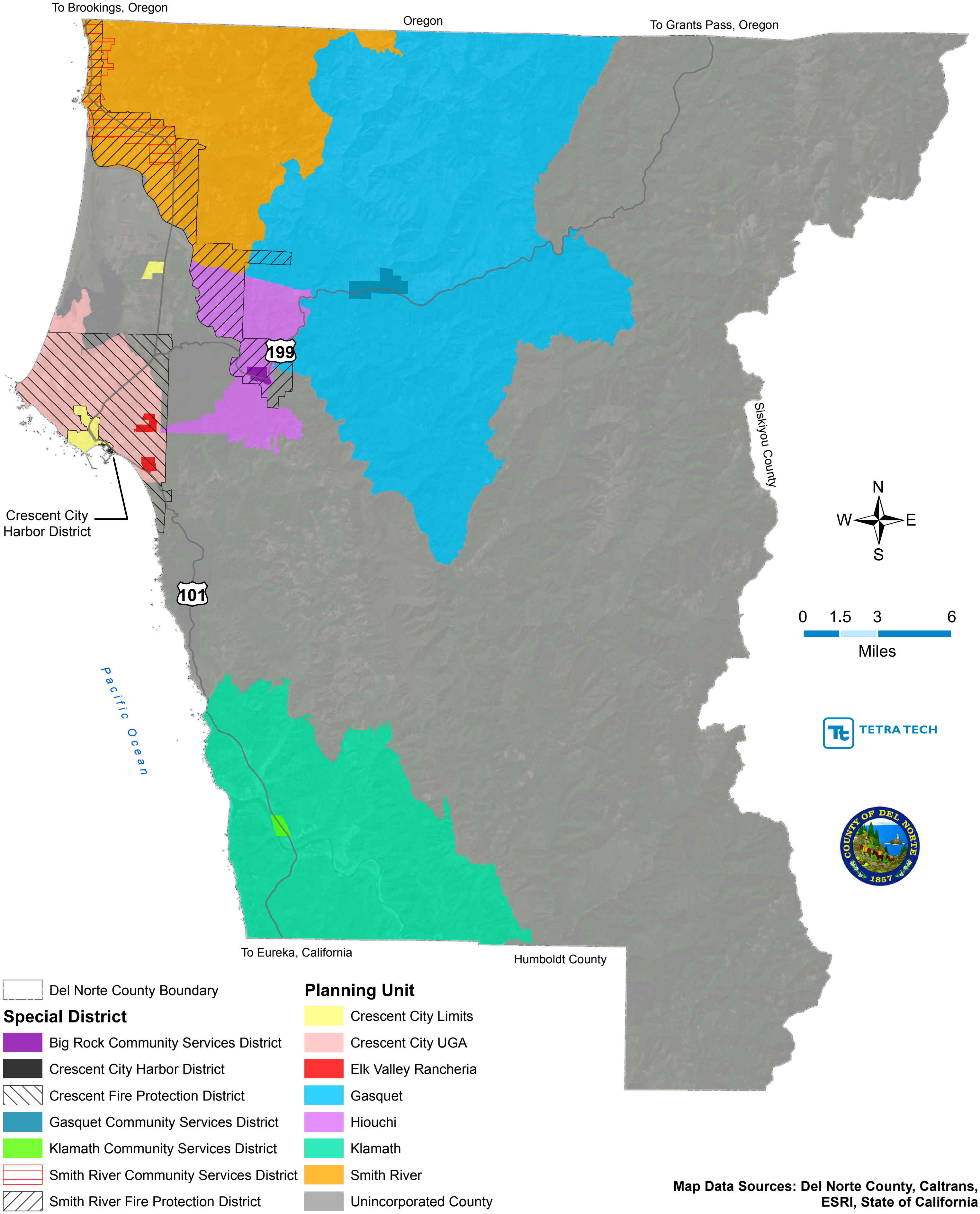
In 1848, gold was discovered along the Trinity River by Major Pierson Reading. By 1850, northwestern California, including the Del Norte County area, was teeming with miners. Klamath City, at the mouth of the Klamath River, was founded in 1851 and was intended to be a port city and provide access to the gold-rich back country. However, shifting sand bars at the mouth of the river made navigation uncertain and the town was deserted soon after.

The Town of Crescent City was established in 1853 by J.F. Wendell, who was issued a land warrant for 230 acres. Crescent City became a bustling shipping and trade center, catering to and supplying the miners. In 1855 Congress authorized the building of a lighthouse at "the battery point" (a high tide island on the coast of Crescent City) to facilitate the use of Crescent Bay as a harbor. This lighthouse is still functioning today as an historic landmark.

Gold discoveries in the immediate vicinity of Crescent City and along the south fork of the Smith River fueled a major growth boom in the Del Norte County area. However, within a few years, a decline in the production from local mines and the opening of more promising fields elsewhere in the state drew all but a handful of miners from the area. By the late 1850s, the population boom for Del Norte County was over. Del Norte County was officially founded in 1857, from part of the Territory of Klamath County.

Figure 4-1

Del Norte County Planning Units & Special Districts



Map Data Sources: Del Norte County, Caltrans, ESRI, State of California

4.3 MAJOR PAST HAZARD EVENTS

Presidential disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A presidential disaster declaration puts federal recovery programs into motion to help disaster victims, businesses and public entities. Some of the programs are matched by state programs. Review of presidential disaster declarations helps establish the probability of reoccurrence for each hazard and identify targets for risk reduction. Table 4-1 shows the declared disasters that have affected Del Norte County through 2018 (records date back to 1954).

Table 4-1. Historical Del Norte County Natural Hazard Events

Type of Event	State or Federal Disaster # (if applicable)	Date
Tsunami	DR-169	3/311964
Heavy rains, flooding	DR-183	12/24/1964
Severe storms, flooding	DR-212	1/22/1966
Severe storms, flooding	DR-329	4/5/1972
Winter storms	DR-677	2/9/1983
Severe storms, flooding	DR-758	2/18/1986
Wildland fire (lightning)	GP-1987	9/10/1987
Earthquake	DR-943	4/25/1992
Fishing losses (El Nino effect)	DR-1038	9/20/1994
Severe winter storms	DR-1044	1/13/1995
Severe storms, flooding	DR-1155	1/4/1997
El Nino floods	DR-1203	2/9/1998
State road damage (landslide)	GP-2003	1/1/2003
Severe storms, flooding, landslides	DR-1628	2/3/2006
Tsunami waves	DR-1968	4/18/2011
Severe storm, flooding, wind	DR-4308	2/2017

4.4 PHYSICAL SETTING

4.4.1 Geology

Del Norte County can be divided into two topographic regions: the eastern mountainous belt in the Northern Coast Range and the Klamath Mountains; and the coastal lowlands, extending from Crescent City to the Oregon border. The wide part of the coastal lowlands is referred to as the Smith River Plain, which encompass approximately 75 square miles.

The mountainous portion of the county, which extends to the coastline 5 miles south of Crescent City, covers 92 percent of the county. The rocks of the western portion of this mountainous terrain consist predominantly of sandstone (greywacke variety) and shale of the Franciscan Complex, an intensely sheared and dismembered assemblage of mainly marine rocks deposited 90 million to 145 million years ago. Other rocks present in lesser quantities in this assemblage are metamorphosed igneous rocks (green stones), cherts, and conglomerates. These rocks were deformed during and following their deposition. The presence of numerous shear zones within this region, combined with the abundant shales, often creates serious slope stability problems in the moist climate of Northern California. To the east of the Franciscan rocks lie the older and more variable rocks of the Klamath Mountains province. While the geology of the Klamath Mountains and Northern Coast Range has been partially mapped, many details remain obscure.

4.4.2 Soils

The soils of Del Norte County reflect the geologic materials of the Klamath Mountain province and coastal plain, the vegetation of the county's extensive forests and coastal plain, high annual rainfall and resulting hydrology, and a mild climate. The coastal plain includes most of the prime agricultural lands in the county, which are defined in the county land use plan on the basis of soils and area in contiguous ownership. The soils in the area were mapped by the University of California, Davis in 1966. The mapping identified five classifications of soil within the coastal plain:

- **Arcata Soils**—The Arcata series consists of well drained alluvial soils situated on old marine terraces. With a medium texture profile and good internal drainage characteristics, this soil type is considered good to excellent for agricultural uses. Fertilizer applications and irrigation are necessary for the production of pasture or bulbs. Arcata soils are found southeast of Crescent City, east of Lake Earl, and north of the mouth of the Smith River.
- **Carlotta Soils**—The Carlotta series consist of moderately well drained, medium-texture soils developed in alluvial materials. Only the Carlotta loam (Ca 2) is considered very good to excellent for agriculture. The major limiting factor with Carlotta soils is their generally low nutrient levels. Fertilized and irrigated pastures, however, can be productive.
- **Ferndale Soils**—Ferndale soils are some of the county's better, more extensive agricultural soils. They are medium-texture soils of recent alluvial origin and little profile development. The Ferndale silt loam (Fe 2) and Ferndale sandy loam (Fe 3) are rated for high agricultural production. Irrigation and annual applications of nitrogen and phosphate fertilizers are known to increase yields. Permanent pasture and some field crops are the predominant uses for this soil type.
- **Rowdy Soils**—The Rowdy series consists of young soils developed on alluvial fans. Rowdy loam (Ry 2, Ry 3) and Rowdy gravelly clay loam (Ry 4) are designated as very good to excellent agricultural soils. Because of generally low nutrient levels in these soils, however, annual fertilizer applications are required to maintain productivity. The principal uses of Rowdy soils are as permanent pasture and lily bulb production. Rowdy soils are located on gently sloping lands near Rowdy Creek above the Smith River and Klamath River basins.
- **Russ Soils**—Russ soils, which occur primarily along small streams, develop from sedimentary rock alluvium. The overriding factor in the utilization of Russ soils is drainage. Russ silt loam (Ru 2) and Russ fine sandy loam (Ru 3) are, however, moderately well-to-well-drained and, therefore, rated as productive soils. Pasture and supplementary feed crops are the major uses. Russ soils are located adjacent to Rowdy and Wilson Creeks.

4.4.3 Climate

Del Norte County is an area of moderate temperatures and considerable precipitation. Annual precipitation in the county is commonly 96 to 150 inches, with 90 percent falling between October and April. While some precipitation is in the form of snow, primarily above 4,000 feet, most is rain that soaks into forest soils, seeps into stream channels or recharges aquifers. Temperatures along the coast vary only 10 degrees from summer to winter, although a greater range is found over inland areas. The average high temperature for July is 69ºF, while the average low temperature during January is 38.4ºF.

4.5 DEVELOPMENT PROFILE

4.5.1 Planning Units

Since there is only one incorporated jurisdiction in Del Norte County, the planning area was divided into planning units for segmenting the results of the risk assessment for this plan update. Figure 4-1 shows the planning unit boundaries, which correlate with census block boundaries contained in the computer model used to assess risk. All risk assessment components for each hazard of concern were analyzed for each planning unit. The units are briefly described below.

Crescent City and Crescent City Urban Growth Area Planning Units

Crescent City and its Urban Growth Area (UGA) lie on the Pacific Ocean, just south of Point Saint George, and about 20 miles south of the Oregon border. The city is on the coastal plain. Its UGA extends to the southern portion of the Lake Earl area. Highway 101 bisects this region. The Pelican Bay State Prison is legally a part of Crescent City and is included in the Crescent City planning unit, though it is outside the UGA in otherwise unincorporated county areas.

Elk Valley Rancheria

The Elk Valley Rancheria is a tribal reservation covering about 100 acres of land located within the Crescent City UGA. The reservation is accessible from Howland Hill Road to the south and Norris Avenue to the north, and is bisected by Mathews Street and Wyentae Street. Of the reservation's 41 parcels, 12 are held in trust (approximately 40 acres). The remainder are fee lands owned by tribal and non-tribal individuals or by the tribe.

Gasquet Planning Unit

Gasquet is small community of approximately 500 year-round residents (over 600 summer residents) along the banks of the Middle Fork Smith River and Highway 199, surrounded by the Smith River National Recreation Area. This planning unit is 18 miles inland from Highway 101 and the coast. Gasquet was designated as a community at risk by the Department of Interior on August 17, 2001.

The planning unit includes various private parcels along Highway 199 to the Oregon border. Patrick Creek Lodge is a historical building at the mouth of Patrick Creek on the Smith River. Across the highway is a Forest Service campground. There are also a few homes on Siskiyou Fork Road.

Hiouchi Planning Unit

The Hiouchi planning unit is centered on the community of Hiouchi, located on Highway 199 just east of Jedediah Smith Redwoods State and National Park. The planning unit includes the residential areas along North Bank Road (Highway 197), South Bank Road, and Low Divide Road. The planning unit boundary is the park and main stem Smith River on the west, including the private residences along Highway 197. To the north, east, and south the planning unit is bounded by the Smith River National Recreation Area, as well as Redwood National Park to the south. Situated on the Smith River, the area receives canyon winds as afternoon breezes come up the river. It is on the edge of the maritime climate, with the fog reaching the nearby redwoods, so it is cooler than Gasquet, a few miles upriver.

The town of Hiouchi straddles Highway 199 and the main stem of the Smith River just west of the confluence of the South and Middle Forks. Hiouchi is experiencing increasing development on both sides of the highway, including Hiouchi mountain on the north, South Fork, Howland Hill, and Douglas Park areas on the south side of the Smith River, and along North Bank Road, which follows the Smith River from Highway 199 to Highway 101. Several of these areas have one-way in and out access and are in densely vegetated or steep terrain. Together, these areas are both a risk and hazard. Hiouchi was designated as a community at risk by the Department of Interior on August 17, 2001.

Klamath Planning Unit

The Klamath Planning Unit is the southernmost area of Del Norte County. The county border here with Humboldt County occurs near the northern end of the Prairie Creek Redwoods State Park. Much of the land along the coast in this planning unit is managed by Redwood National and State Parks. Much of the rest of the planning compartment is private timberland owned by Green Diamond Resource Company (formerly Simpson Timber). There is a thin band of private residential parcels along Highway 101 and along the Klamath River. The Yurok Reservation, which includes one mile on both sides of the river, totals approximately 15,000 acres in Del Norte County (most of the reservation is in Humboldt County). The Resighini Reservation is on the south side of the Klamath River east of Highway 101, with approximately one dozen homes.

The northern extent of this planning unit is near the mouth of Wilson Creek and the Del Norte Coast Redwoods State Park and Redwood National Park. This area includes the communities of Klamath and Klamath Glen. Much of Klamath Glen was destroyed by the 1964 flood. Shortly after that, a dike was built to better protect the town. On January 4, 2001, Klamath was the first community in Del Norte County to be designated a community at risk by the U.S. Department of Interior.

Smith River Planning Unit

The Smith River planning unit is centered on the community of Smith River, the northernmost community in coastal Del Norte County. It lies just south of the Oregon border and east of the mouth of the river. The town center is located near Rowdy Creek. On the east, it is bounded by Green Diamond Resource Company lands and on the south by the Smith River. The western edge of Smith River is covered in agricultural land, where flower bulbs are principally grown. This planning unit includes the tribal lands of the Smith River Rancheria.

Unincorporated County Planning Unit

This planning unit represents all of the county not included in the other planning areas. A portion of this planning unit, west of the Hiouchi planning unit between the Crescent City UGA and the Smith River planning unit, is the Fort Dick area, which is largely agricultural, with many acres in flower bulb production. Lake Earl State Park/Tolowa Dunes is a dominant landscape feature. The rest of the planning unit is primarily state and federal forest and wilderness lands.

4.5.2 Current Land Ownership and Use

The total land area of Del Norte County is 1,070 square miles, and 77.6 percent of the land is in public ownership, most of it is held by the federal Government in the Smith River National Recreation Area and Redwood National Park. With extensive federal and state land ownership, the planning partners exercise land use regulatory jurisdiction over only 23 percent of the land in the county, as shown in Figure 4-2. This means that decisions concerning development on more than three-quarters of the land in the county are out of the control of the jurisdictional entities under this plan. This makes strategic land use planning difficult to accomplish without extensive cooperation among the jurisdictions with regulatory control over land use for the balance of the county (federal, state and Native American governments).

Land use in the planning area is dictated by the Del Norte County General Plan, dated January 28, 2003. Table 4-2 presents counts of buildings by land use type in the planning area.

4.5.3 Critical Facilities and Infrastructure

Critical facilities and infrastructure are those that are essential to the health and welfare of the population. These become especially important after any hazard event. Critical facilities are typically defined to include police and fire stations, schools and emergency operations centers. Critical infrastructure can include the roads and bridges that provide ingress and egress and allow emergency vehicles access to those in need and the utilities that provide water, electricity and communication services to the community. Also included are Tier II facilities and railroads, which hold or carry significant amounts of hazardous materials with a potential to impact public health and welfare in a hazard event.

Source: Del Norte Local Transportation Commission, 2016

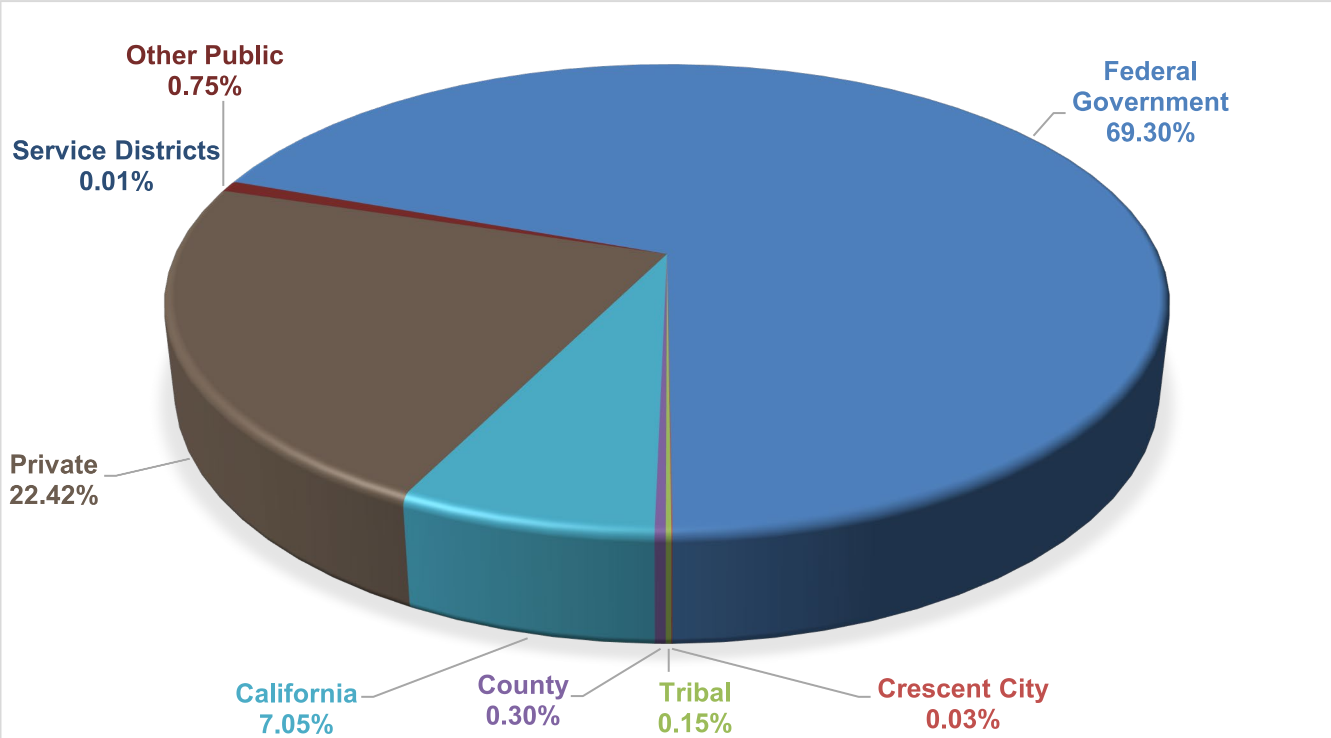


Figure 4-2. Regulatory Jurisdiction of Land within Del Norte County

Table 4-2. Planning Area Building Counts by Land Use Type

Planning Unit	Number of Buildings							
	Residential	Commercial	Industrial	Agricultural	Religious	Government	Education	Total
Crescent City Limits	988	241	1	0	16	13	7	**1,266**
Crescent City UGA	3,940	233	13	0	18	7	7	**4,218**
Elk Valley Rancheria	26	4	0	0	0	1	1	**32**
Gasquet	285	16	0	0	3	0	1	**305**
Hiouchi	305	14	0	0	0	0	0	**319**
Klamath	422	47	0	0	2	8	0	**479**
Smith River	670	53	16	2	7	2	1	**751**
Unincorporated County	1,339	55	2	0	3	5	2	**1,406**
Total	**7,975**	**663**	**32**	**2**	**49**	**36**	**19**	**8,776**

The Steering Committee created the following definition of critical facilities and infrastructure specific to Del Norte County:

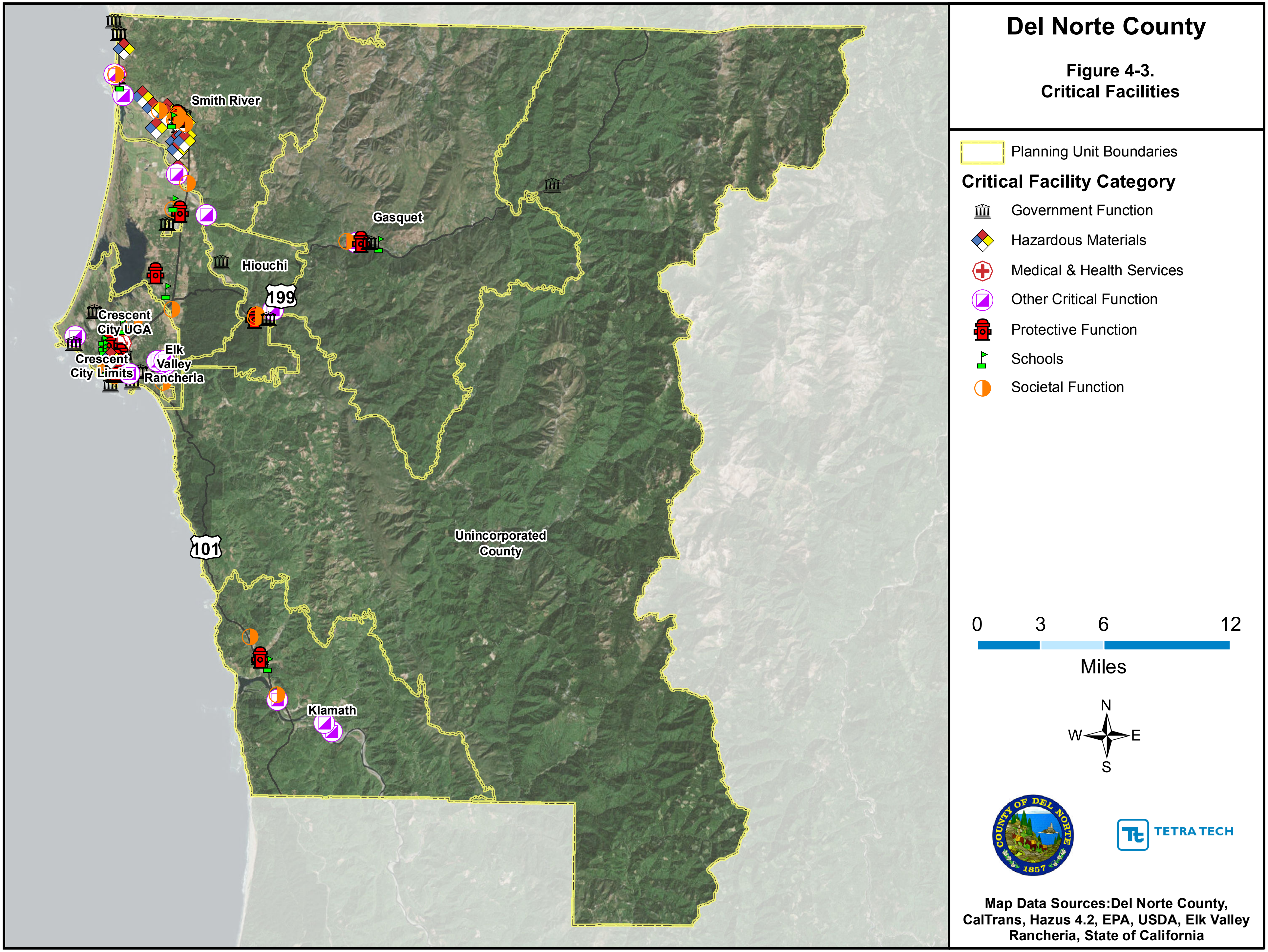
- A local (not state or federal) facility in either the public or private sector that is critical to the health and welfare of the population and that is especially important following hazard events, including but not limited to the following:

- Structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic and/or water-reactive materials
- Hospitals, nursing homes, and housing facilities likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a natural hazard event
- Mass gathering facilities that may be utilized as evacuation shelters
- Infrastructure such as roads, bridges and airports that provide sources for evacuation before, during and after natural hazard events
- Police stations, fire stations, government facilities, vehicle equipment and storage facilities, hardware stores and emergency operation centers that are needed for response activities before, during and after a natural hazard event
- Public and private utility facilities that are vital to maintaining and restoring normal services to damaged areas before, during and after natural hazard events.

Critical facilities and infrastructure were broken down into categories associated with their function:

- Critical facilities:
  - Medical and health services
  - Government function—Government functions are those associated with continuity of operations at the federal, state or local level.
  - Protective function—Protective functions are those associated with protecting the public and include police, fire and ambulance.
  - Schools
  - Societal function—Societal functions include facilities that aid society in dealing with the impacts of natural disasters.
  - Hazmat—Facilities with potentially hazardous materials
  - Other critical function—Other critical functions include all of those facilities that have been identified to provide critical functions, but do not fit into an assigned category.
- Critical infrastructure:
  - Bridges
  - Communications
  - Fuel Storage
  - Power
  - Wastewater
  - Water supply

The critical facilities and infrastructure identified for this plan are mapped on Figure 4-3 and Figure 4-4 and listed in Table 4-3 and Table 4-4.

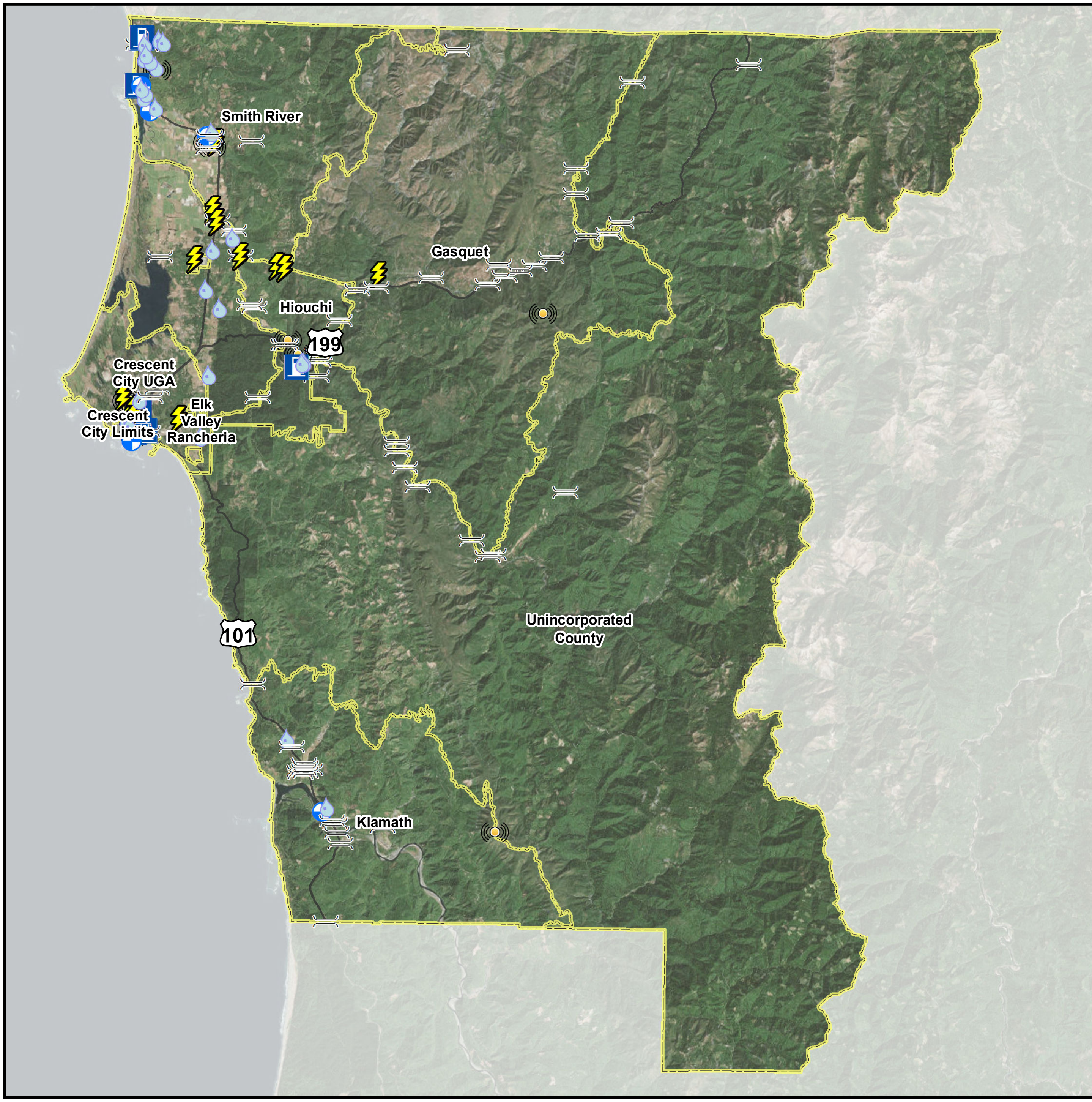


Del Norte County

Figure 4-3.
Critical Facilities

Del Norte County

Figure 4-4.
Critical Infrastructure



Planning Unit Boundaries

Critical Infrastructure Category

- Bridges
- Communication
- Fuel Storage
- Power
- Waste Water
- Water Supply

0 3 6 12
Miles

N
W E
S

Map Data Sources:Del Norte County, CalTrans, Hazus 4.2, EPA, USDA, Elk Valley Rancheria, State of California

Table 4-3. Planning Area Critical Facilities

Planning Unit	Number of Facilities							
	Medical & Health Services	Government Function	Protective Function	Schools	Societal Function	Hazmat	Other Critical Function	Total
Crescent City Limits	2	16	6	4	8	1	1	**38**
Crescent City UGA	2	4	0	3	7	0	1	**17**
Elk Valley Rancheria	0	1	0	1	0	0	6	**8**
Gasquet	0	1	1	1	1	0	1	**5**
Hiouchi	0	2	1	0	2	0	1	**6**
Klamath	0	1	1	1	2	0	3	**8**
Smith River	1	7	2	2	8	16	4	**40**
Unincorporated County	0	1	2	2	2	0	0	**7**
Total	**5**	**33**	**13**	**14**	**30**	**17**	**17**	**129**

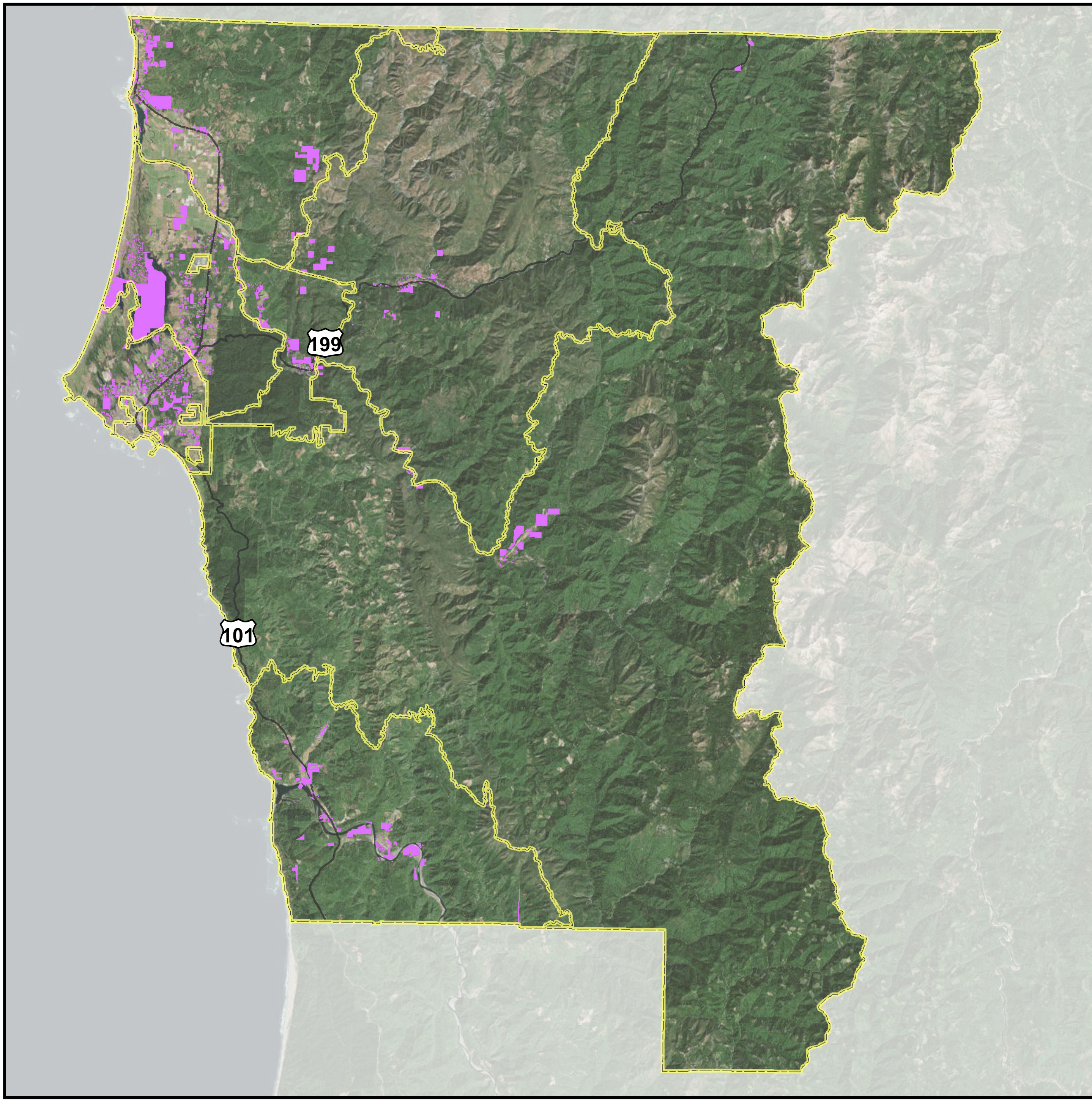
Table 4-4. Planning Area Critical Infrastructure

Planning Unit	Number of Facilities						
	Water Supply	Wastewater	Power	Fuel Storage	Communications	Bridges	Total
Crescent City Limits	1	1	2	3	2	0	**9**
Crescent City UGA	3	0	3	0	1	3	**10**
Elk Valley Rancheria	0	0	0	0	0	0	**0**
Gasquet	0	0	1	0	1	17	**19**
Hiouchi	2	0	3	1	2	9	**17**
Klamath	2	1	0	0	1	17	**21**
Smith River	12	4	2	2	3	11	**34**
Unincorporated County	5	0	1	0	0	15	**21**
Total	**25**	**6**	**12**	**6**	**10**	**72**	**131**

4.5.4 Future Trends in Development

The Del Norte County planning area has experienced a sporadic rate of growth over the past 30 years, due to the area's change from a timber-based economy to a tourism-based economy. It is anticipated that the growth rate will stabilize, with growth being low to moderate over the next 10 years. Considering these historical trends and future population projections, anticipated development trends for the planning area are considered low, consisting primarily of residential development with the exception of the Crescent City UGA (see Volume 2 for jurisdiction-specific growth trends). An assessment was performed to identify parcels that are currently undeveloped and therefore available to allow future growth. These parcels are shown on Figure 4-5 and listed by type in Table 4-5

Del Norte County is subject to state general planning law and the California Coastal Act. These processes govern land use policy making. The County and Crescent City have adopted general plans with their associated safety elements pursuant to these laws. This plan will work together with these programs to support wise land use in the future. Maintaining or enhancing the rich abundance of natural resources of Del Norte County is a high priority for its land use programs and managers.



Del Norte County

Figure 4-5.
Undeveloped Parcels

Planning Unit Boundaries
Undeveloped Parcels

0 3 6 12
Miles

N
W
E
S

Map Data Sources:Del Norte County, CalTrans, USDA, State of California

Table 4-5. Undeveloped Parcels in the Planning Area

	Number of Parcels
Undeveloped Commercial	168
Undeveloped Industrial	5
Undeveloped Land	478
Undeveloped Residential	2,980
Total Number of Parcels	**3,631**
Total Acres of Undeveloped Land	**10,887.6**

4.6 DEMOGRAPHICS

Some populations are at greater risk from hazard events because of decreased resources or physical abilities. Elderly people, for example, may be more likely to require additional assistance. Research has shown that people living near or below the poverty line, the elderly, women, children, ethnic minorities, renters, individuals with disabilities, and others with access and functional needs, all experience more severe effects from disasters than the general population. These vulnerable populations may vary from the general population in risk perception, living conditions, access to information before, during and after a hazard event, capabilities during an event, and access to resources for post-disaster recovery. Indicators of vulnerability—such as disability, age, poverty, and minority race and ethnicity—often overlap spatially and often in the geographically most vulnerable locations. Detailed spatial analysis to locate areas where there are higher concentrations of vulnerable community members would help to extend focused public outreach and education to these most vulnerable citizens.

4.6.1 Population Characteristics

Knowledge of the composition of the population and how it has changed in the past and how it may change in the future is needed for making informed decisions about the future. Information about population is a critical part of planning because it directly relates to land needs such as housing, industry, stores, public facilities and services, and transportation. The California Department of Finance estimated Del Norte County's population at 27,124 as of January 1, 2017, 49th in population out of 58 California counties. As of January 1, 2017, 24 percent of county residents (6,389) live in Crescent City, which is considered the economic center of Del Norte County (California Department of Finance, 2018a).

Population changes are useful socio-economic indicators. A growing population can indicate a growing economy, and a decreasing population may signify economic decline. Figure 4-6 shows California Department of Finance estimates for the population of Crescent City and the rest of the county from 2000 to 2017. The county population increased about 4 percent from 2000 to 2010 (from 27,507 to 28,610), then declined about 5 percent by 2017 (to 27,124). Similarly, Crescent City's population increased about 5 percent from 2000 to 2009 (from 7,347 to 7,698), then declined about 17 percent by 2017 (to 6,389).

4.6.2 Age Distribution

As a group, the elderly are more apt to lack the physical and economic resources necessary for response to hazard events and are more likely to suffer health-related consequences making recovery slower. Additionally, the elderly are more likely to live in assisted-living facilities where emergency preparedness occurs at the discretion of facility operators. These facilities are typically identified as "critical facilities" by emergency managers because they require extra notice to implement evacuation. Elderly residents living in their own homes may have more difficulty evacuating their homes and could be stranded in dangerous situations. This population group is more likely to need special medical attention, which may not be readily available during natural disasters due to isolation caused by the event. Specific planning attention for the elderly is an important consideration given the current aging of the American population.

Source: California Department of Finance, 2018 and 2018a

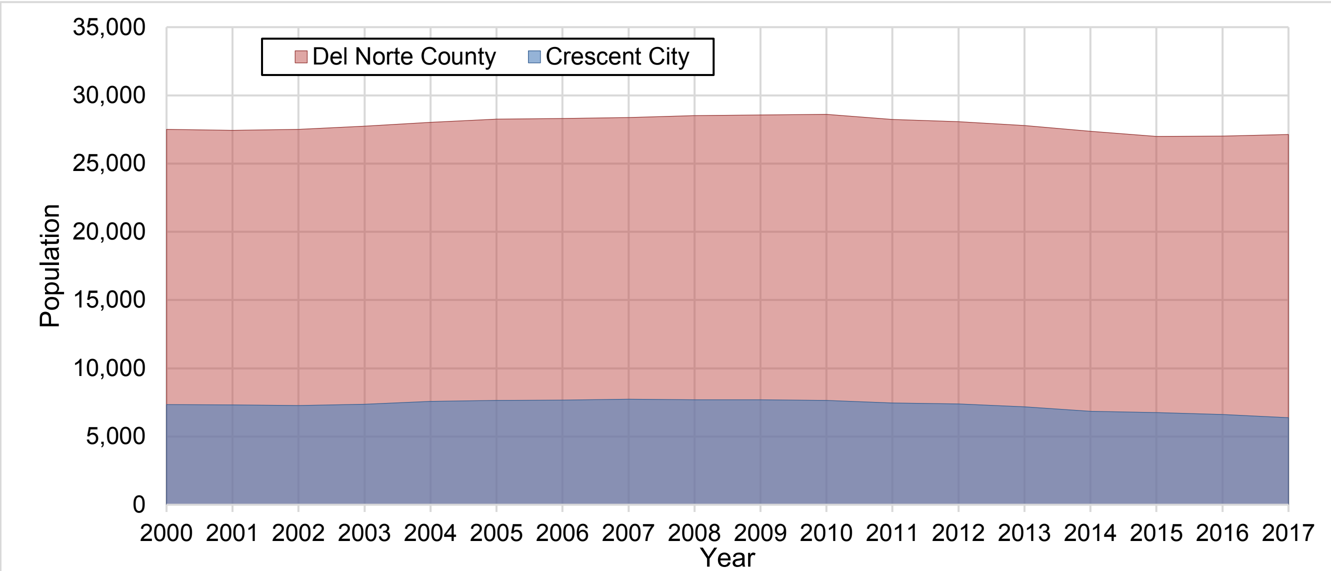


Figure 4-6. Population of Crescent City and Del Norte County

Children under 14 are particularly vulnerable to disaster events because of their young age and dependence on others for basic necessities. Very young children may additionally be vulnerable to injury or sickness; this vulnerability can be worsened during a natural disaster because they may not understand the measures that need to be taken to protect themselves from hazards.

The overall age distribution for the planning area is illustrated in Figure 4-7. Based on U.S. Census data, 15.2 percent of the planning area's population is 65 or older and 23.5 percent of the population is 19 or younger. According to U.S. Census data, 12.1 percent of the over-65 population have incomes below the poverty level. Of children under 18, 28.2 percent live below the poverty level.

Source: American Fact Finder, 2012-2016 American Community Survey 5-Year Estimates, 2018

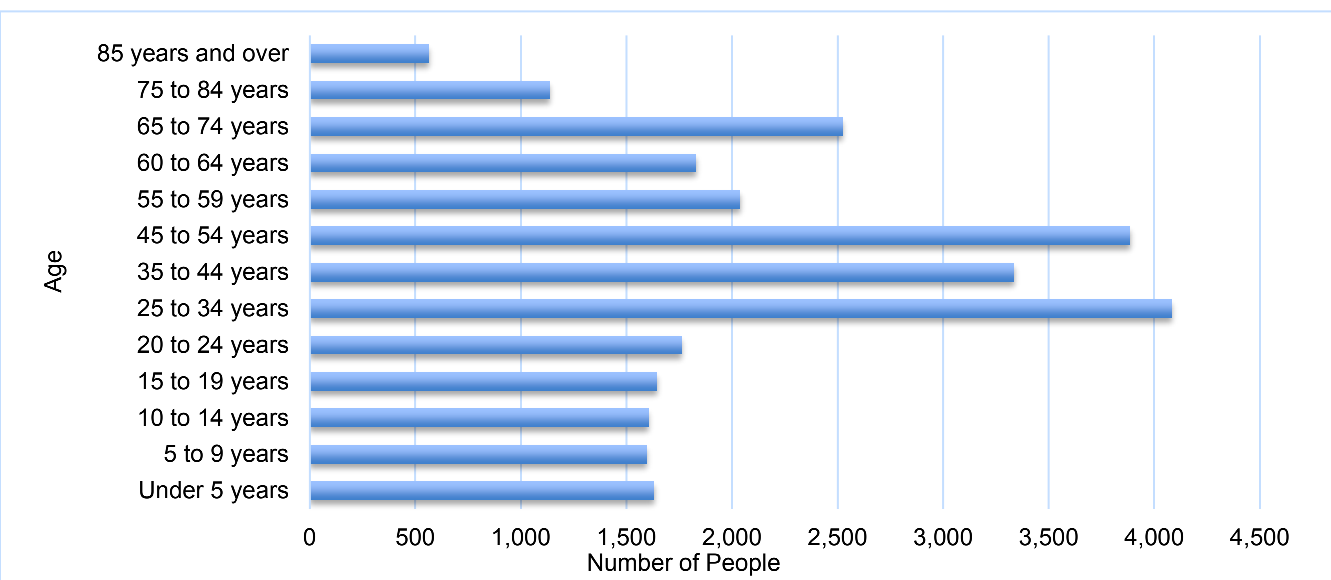


Figure 4-7. Planning Area Age Distribution

4.6.3 Race, Ethnicity and Language

Research shows that minorities are less likely to be involved in pre-disaster planning and experience higher mortality rates during a disaster event. Post-disaster recovery can be ineffective and is often characterized by cultural insensitivity. Since higher proportions of ethnic minorities live below the poverty line than the majority white population, poverty can compound vulnerability. According to the U.S. Census, the racial composition of the planning area is predominantly white, at about 78 percent. The largest minority populations are multi-racial at 8 percent and American Indian/Alaska Native at 7 percent. While not considered a separate race, the planning area has 19.3 percent Hispanic or Latino population. Figure 4-8 shows the racial distribution in the planning area.

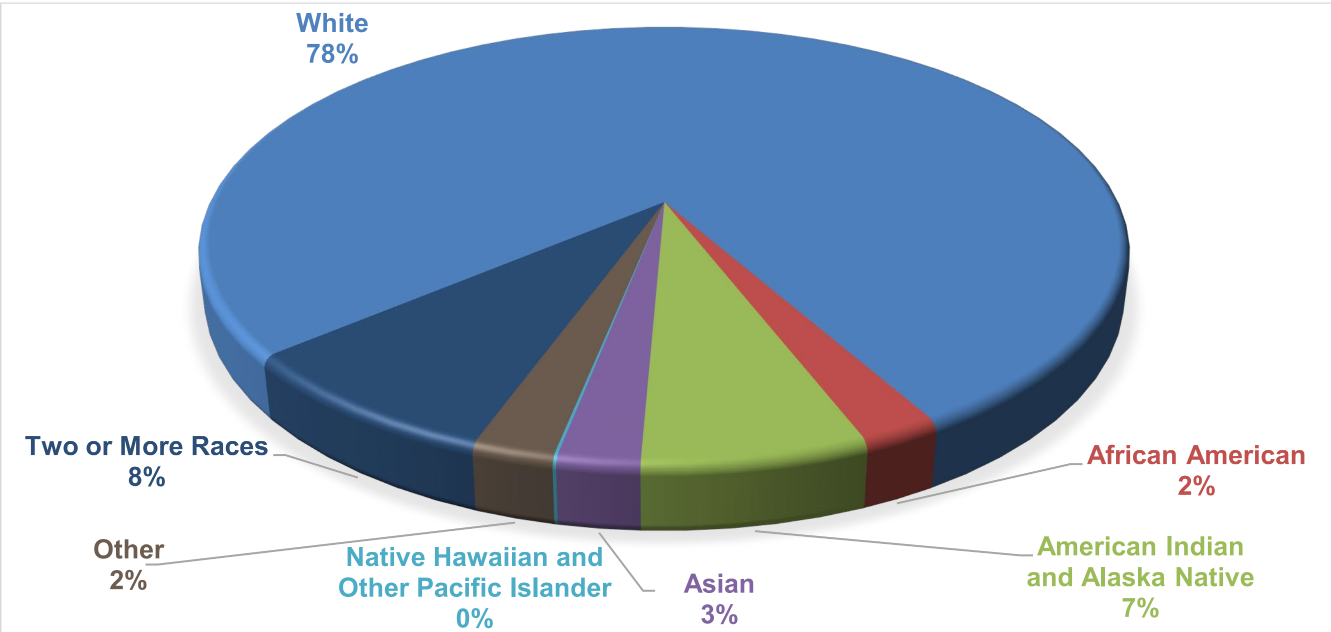


Figure 4-8. Planning Area Race Distribution

The planning area has a 5.7-percent foreign-born population. Other than English, the most commonly spoken language in the planning area is Spanish. The census estimates 4.3 percent of the residents speak English "less than very well."

4.6.4 Individuals with Disabilities or with Access and Functional Needs

The 2010 U.S. Census estimates that 54 million non-institutionalized Americans with disabilities live in the U.S. This equates to about one-in-five persons. Individuals with disabilities are more likely to have difficulty responding to a hazard event than the general population. Local government is the first level of response to assist these individuals, and coordination of efforts to meet their access and functional needs is paramount to life safety efforts. It is important for emergency managers to distinguish between functional and medical needs in order to plan for incidents that require evacuation and sheltering. Knowing the percentage of population with a disability will allow emergency management personnel and first responders to have personnel available who can provide services needed by those with access and functional needs. According to U.S. Census data, 50.2 percent of the over-65 population has disabilities of some kind, as well as 16.7 percent of those under 65.

4.7 ECONOMY

Del Norte County has experienced dramatic changes in its local economy as it has moved from a natural-resource-based economy to a service-sector economy. The timber industry declined dramatically between the early 1970s and mid-1990s, due largely to two critical factors: the creation and expansion of Redwood National Park and the institution of environmental regulations limiting logging activity. The county's timber mills are no longer operational and the timber that is cut from the forests is shipped elsewhere for processing. The Crescent City Harbor was once a dynamic seaport with a strong commercial fishing industry. A combination of declining resources and strict federal and state regulations has caused the fish catch to decline. The value of fish landed at the Crescent City harbor was $22.8 million in 2006 but only $12.8 million in 2014 (Del Norte Local Transportation Commission, 2016)

Government is the predominant industry, accounting for almost half of the total employment in the county. The county brought in Pelican Bay State Prison in 1990, which now accounts for more than 1,000 jobs and houses about 2,000 inmates. Annexation of the 270-acre prison into Crescent City increased the City's population sufficiently for it to be eligible for a number of grants.

The county's recreational resources attract visitors who spend time and money in the area. As of 2014, tourism expenditures in the county totaled $114 million and the industry employed nearly 1,000. Tourism is the leading industry in the continual transition from a resource production base to a diverse economic base. The largest growth in the next few years is projected to be in professional services (California Department of Transportation, 2017).

4.7.1 Income

In the United States, individual households are expected to use private resources to prepare for, respond to and recover from disasters to some extent. This means that households living in poverty are automatically disadvantaged when confronting hazards. Additionally, the poor typically occupy more poorly built and inadequately maintained housing. Mobile or modular homes, for example, are more susceptible to damage in earthquakes and floods than other types of housing. In urban areas, the poor often live in older houses and apartment complexes, which are more likely to be made of un-reinforced masonry, a building type that is particularly susceptible to damage during earthquakes. Furthermore, residents below the poverty level are less likely to have insurance to compensate for losses incurred from natural disasters. This means that residents below the poverty level have a great deal to lose during an event and are the least prepared to deal with potential losses. The events following Hurricane Katrina in 2005 illustrated that personal household economics significantly impact people's decisions on evacuation. Individuals who cannot afford gas for their cars will likely decide not to evacuate.

Based on U.S. Census Bureau estimates, per capita income in the planning area in 2016 was $20,282, and the median household income was $56,408. It is estimated that 12.9 percent of households receive an income between $100,000 and $149,999 per year and 6.2 percent of household incomes are above $150,000 annually. The Census estimates that 16.7 percent of all families in the planning area have incomes below the poverty level.

4.7.2 Industry, Businesses and Institutions

The planning area's economy is strongly based in education, services and health (27.9 percent of employed residents), followed by public administration (15.6 percent); arts, entertainment and recreation (14.5 percent); and retail trade (11.3 percent). Figure 4-9 shows the breakdown of industry types in the planning area.

The top employers in the planning area are as follows (America's Labor Market Information System (ALMIS) Employer Database, 2018 1st Edition and local information; listed alphabetically, not by size):

- Alexandre Family EcoDairy Farms
- City of Crescent City
- College of the Redwoods

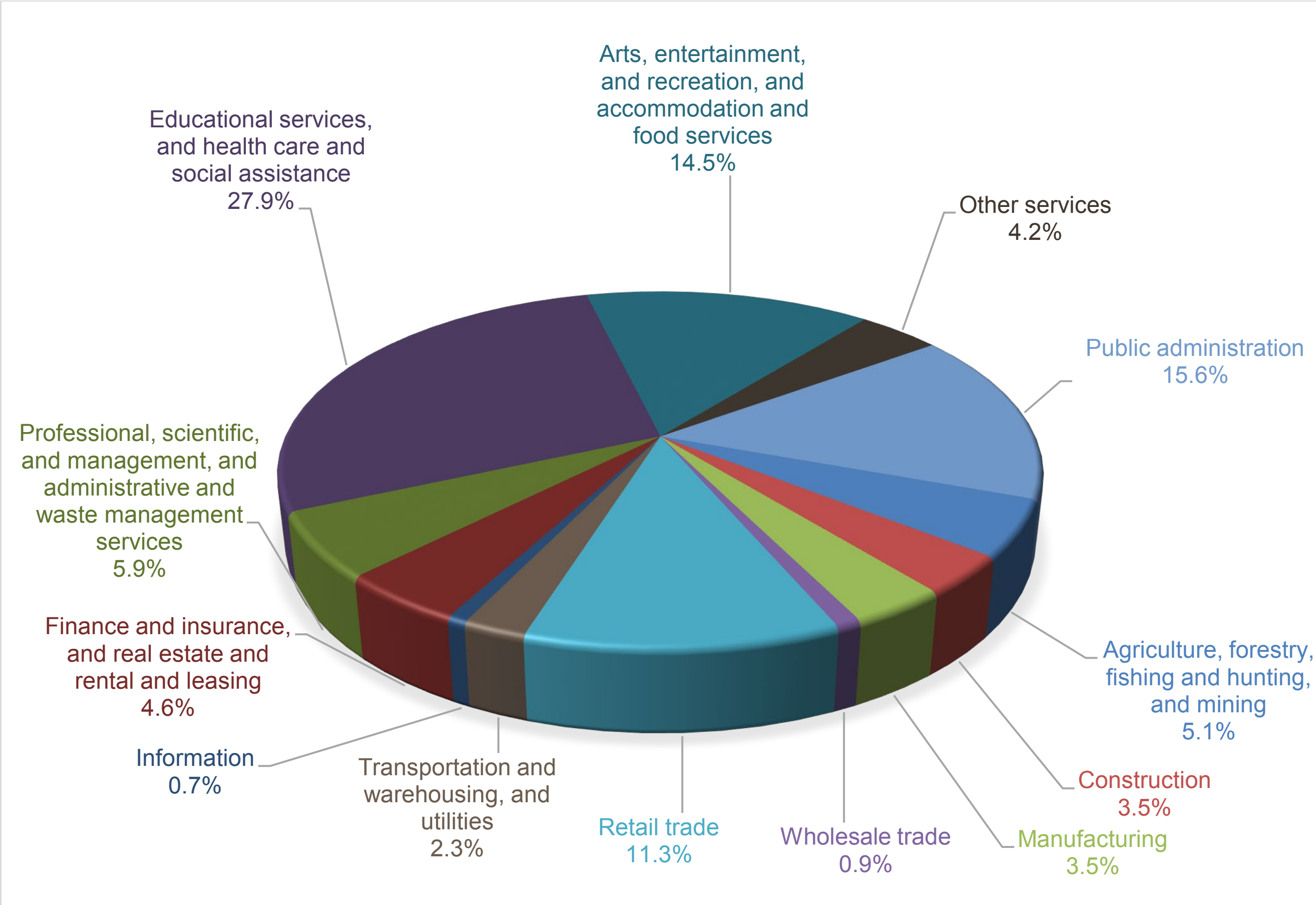


Figure 4-9. Industry in the Planning Area

- County of Del Norte
- Dahlstrom & Watt Bulb Farm, Inc.
- Del Norte Unified School District
- Elk Valley Rancheria
- Home Depot
- Safeway
- State of California
- Sutter Coast Hospital
- Tolowa Dee-ni' Nation
- Walmart
- Yurok Tribe

4.7.3 Employment Trends and Occupations

According to the American Community Survey, about 44.6 percent of the planning area's working-age population (16 and over) is in the labor force—41.7 percent of working-age men and 48.2 percent of working-age women.

Figure 4-10 compares California's and Del Norte County's unemployment trends from 2008 through 2016. The county's rate is consistently higher than the statewide average, but both followed a similar trend of rising for few years after the 2008-2009 recession and then falling steadily to the present.

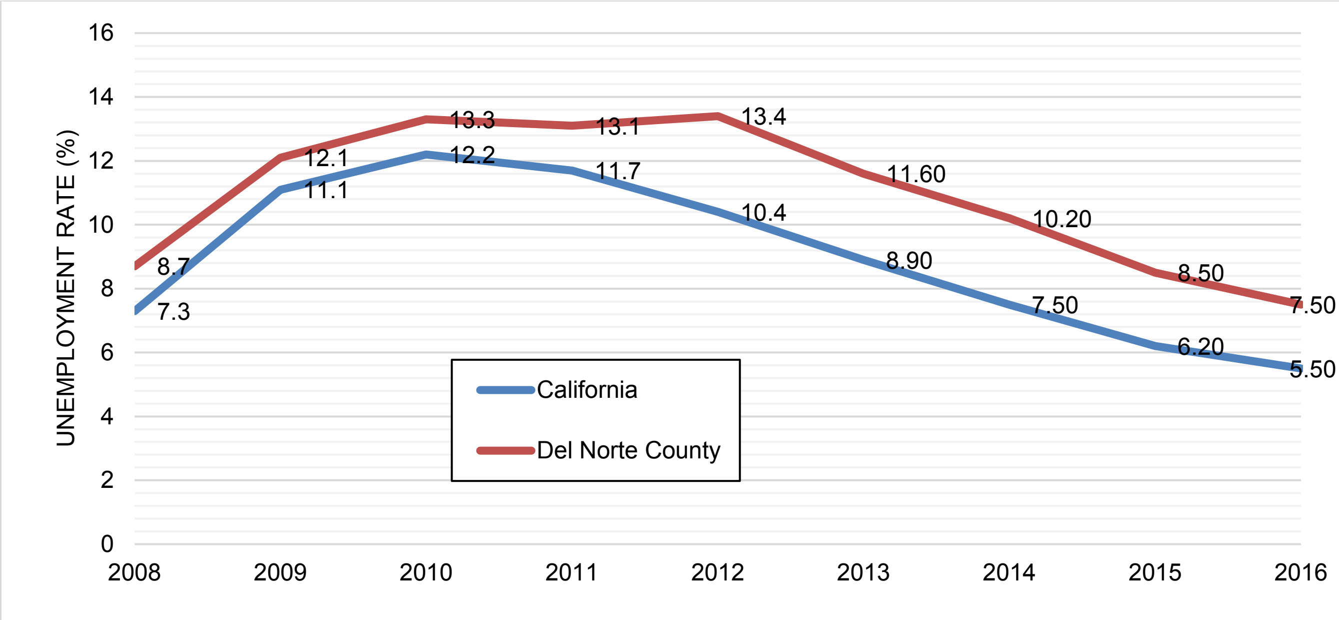


Figure 4-10. California and Del Norte County Unemployment Rate

Service occupations and management, business, science, and arts occupations make up 64 percent of the jobs in the planning area. Figure 4-11 shows the overall distribution of county employment by occupation class.

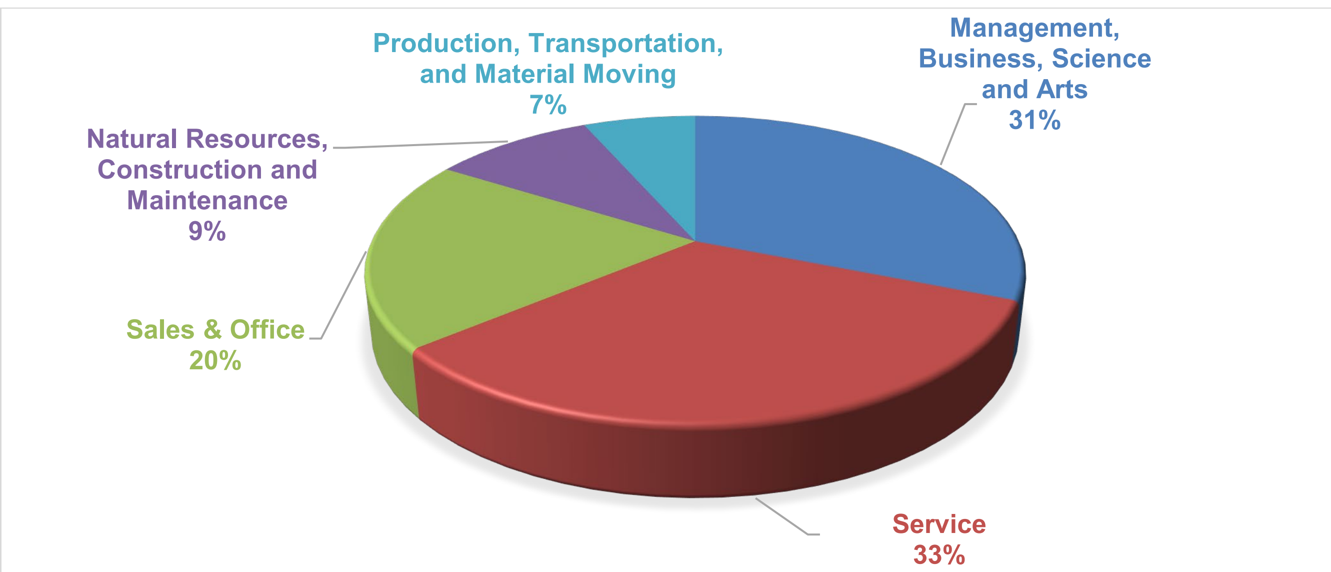


Figure 4-11. Occupations in the Planning Area

The U.S. Census estimates that over 68.9 percent of workers in the planning area commute alone (by car, truck or van) to work, and mean travel time to work is 35.3 minutes (the state average is 28 minutes).

5. REGULATIONS AND PROGRAMS

Existing regulations, agencies and programs at the federal, state and local level can support or impact hazard mitigation actions identified in this plan. Hazard mitigation plans are required to include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information as part of the planning process (44 CFR, Section 201.6(b)(3) and Section 201.7(c)(3)). Information presented in this section can be used to review local capabilities to implement the action plan this hazard mitigation plan presents. Individual review by each planning partner of existing local plans, studies, reports, and technical information is presented in the annexes in Volume 2.

5.1 RELEVANT FEDERAL AND STATE AGENCIES, PROGRAMS AND REGULATIONS

State and federal regulations and programs that need to be considered in hazard mitigation are constantly evolving. For this plan, a review was performed to determined which regulations and programs are currently most relevant to hazard mitigation planning. The findings are summarized in Table 5-1 and Table 5-2. Short descriptions of each program are provided in Appendix B.

Table 5-1. Summary of Relevant Federal Agencies, Programs and Regulations

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment	Wildfire Hazard	This strategy implementation plan prepared by federal and Western state agencies outlines measures to restore fire-adapted ecosystems and reduce hazardous fuels.
Americans with Disabilities Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Bureau of Indian Affairs	Wildland Fire Hazard	The Bureau’s Fire and Aviation Management National Interagency Fire Center provides wildfire protection, fire use and hazardous fuels management, and emergency rehabilitation on Indian forest and rangelands.
Bureau of Land Management	Wildland Fire Hazard	The Bureau funds and coordinates wildfire management programs and structural fire management and prevention on BLM lands.
Civil Rights Act of 1964	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Clean Water Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Community Development Block Grant Disaster Resilience Program	Action Plan Funding	This is a potential alternative source of funding for actions identified in this plan.
Community Rating System	Flood Hazard	This voluntary program encourages floodplain management activities that exceed the minimum National Flood Insurance Program requirements.

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
Disaster Mitigation Act	Hazard Mitigation Planning	This is the current federal legislation addressing hazard mitigation planning.
Emergency Relief for Federally Owned Roads Program	Action Plan Funding	This is a possible funding source for actions identified in this plan.
Emergency Watershed Program	Action Plan Funding	This is a possible funding source for actions identified in this plan.
Endangered Species Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Federal Energy Regulatory Commission Dam Safety Program	Dam Failure Hazard	This program cooperates with a large number of federal and state agencies to ensure and promote dam safety.
National Environmental Policy Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Federal Wildfire Management Policy and Healthy Forests Restoration Act	Wildland Fire Hazard	These documents mandate community-based collaboration to reduce risks from wildfire.
National Dam Safety Act	Dam Failure Hazard	This act requires a periodic engineering analysis of most dams in the country
National Fire Plan (2001)	Wildland Fire Hazard	This plan calls for joint risk reduction planning and implementation by federal, state and local agencies.
National Flood Insurance Program	Flood Hazard	This program makes federally backed flood insurance available to homeowners, renters, and business owners in exchange for communities enacting floodplain regulations
National Incident Management System	Action Plan Development	Adoption of this system for government, nongovernmental organizations, and the private sector to work together to manage incidents involving hazards is a prerequisite for federal preparedness grants and awards
National Park Service, Redwood National Park	Wildland Fire Hazard	Park staff provide wildland and structure fire protection and conduct wildfire management within the park.
Presidential Executive Order 11988 (Floodplain Management)	Flood Hazard	This order requires federal agencies to avoid long and short-term adverse impacts associated with modification of floodplains
Presidential Executive Order 11990 (Protection of Wetlands)	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable presidential executive orders.
U.S. Army Corps of Engineers Dam Safety Program	Dam Failure Hazard	This program is responsible for safety inspections of dams that meet size and storage limitations specified in the National Dam Safety Act.
U.S. Army Corps of Engineers Flood Hazard Management	Flood Hazard, Action Plan Implementation, Action Plan Funding	The Corps of Engineers offers multiple funding and technical assistance programs available for flood hazard mitigation actions
U.S. Fire Administration	Wildland Fire Hazard	This agency provides leadership, advocacy, coordination, and support for fire agencies and organizations.
U.S. Fish and Wildlife Service	Wildland Fire Hazard	This service’s fire management strategy employs prescribed fire throughout the National Wildlife Refuge System to maintain ecological communities.
U.S. Forest Service Six Rivers National Forest	Wildland Fire Hazard	Staff provide wildfire management primarily on National Forest lands.

Table 5-2. Summary of Relevant State Agencies, Programs and Regulations

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
AB 32: The California Global Warming Solutions Act	Action Plan Development	This act establishes a state goal of reducing greenhouse gas emissions to 1990 levels by 2020
AB 70: Flood Liability	Flood Hazard	A city or county may be required to partially compensate for property damage caused by a flood if it unreasonably approves new development in areas protected by a state flood control project
AB 162: Flood Planning	Flood Hazard	Cities and counties must address flood-related matters in the land use, conservation, and safety and housing elements of their general plans.
AB 2140: General Plans—Safety Element	Hazard Mitigation Planning	This bill enables state and federal disaster assistance and mitigation funding to communities with compliant hazard mitigation plans.
AB 2800: Climate Change—Infrastructure Planning	Action Plan Development	This act requires state agencies to take into account the impacts of climate change when developing state infrastructure.
Alquist-Priolo Earthquake Fault Zoning Act	Earthquake Hazard	This act restricts construction of buildings used for human occupancy on the surface trace of active faults.
California Coastal Management Program	Flood, Landslide, Tsunami and Wildland Fire Hazards	This program requires coastal communities to prepare coastal plans and requires that new development minimize risks to life and property in areas of high geologic, flood, and fire hazard.
California Department of Forestry and Fire Protection (CAL FIRE)	Wildland Fire Hazard	CAL FIRE has responsibility for wildfires in areas that are not under the jurisdiction of the Forest Service or a local fire organization.
California Department of Parks and Recreation	Wildland Fire Hazard	State Parks Resources Management Division has wildfire protection resources available to suppress fires on State Park lands.
California Department Water Resources	Flood Hazard	This state department is the state coordinating agency for floodplain management.
California Division of Safety of Dams	Dam Failure Hazard	This division monitors the dam safety program at the state level and maintains a working list of dams in the state.
California Environmental Quality Act	Action Plan Implementation	This act establishes a protocol of analysis and public disclosure of the potential environmental impacts of development projects. Any project action identified in this plan will seek full California Environmental Quality Act compliance upon implementation.
California Fire Alliance	Wildland Fire Hazard	The alliance works with communities at risk from wildfires to facilitate the development of community fire loss mitigation plans.
California Fire Plan	Wildland Fire Hazard	This plan's goal is to reduce costs and losses from wildfire through pre-fire management and through successful initial response.
California Fire Safe Council	Wildland Fire Hazard	This council facilitates the distribution of National Fire Plan grants for wildfire risk reduction and education.
California Fire Service and Rescue Emergency Mutual Aid Plan	Wildland Fire Hazard	This plan provides guidance and procedures for agencies developing emergency operations plans, as well as training and technical support.
California General Planning Law	Hazard Mitigation Planning	This law requires every county and city to adopt a comprehensive long-range plan for community development, and related laws call for integration of hazard mitigation plans with general plans.
California Multi-Hazard Mitigation Plan	Hazard Mitigation Planning	Local hazard mitigation plans must be consistent with their state's hazard mitigation plan.
California Residential Mitigation Program	Earthquake Hazard	This program helps homeowners with seismic retrofits to lessen the potential for damage to their houses during an earthquake.

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
California State Building Code	Action Plan Implementation	Local communities must adopt and enforce building codes, which include measures to improve buildings' ability to withstand hazard events.
Disadvantaged and Low-Income Communities Investments	Action Plan Funding	This is a potential source of funding for actions located in disadvantaged or low-income communities.
Governor's Executive Order S-13-08 (Climate Impacts)	Action Plan Implementation	This order includes guidance on planning for sea level rise in designated coastal and floodplain areas for new projects.
Office of the State Fire Marshal	Wildland Fire Hazard	This office has a wide variety of fire safety and training responsibilities.
Senate Bill 97: Guidelines for Greenhouse Gas Emissions	Action Plan Implementation	This bill establishes that greenhouse gas emissions and the effects of greenhouse gas emissions are appropriate subjects for California Environmental Quality Act analysis.
Senate Bill 379: General Plans: Safety Element—Climate Adaptation	Action Plan Implementation	This bill requires cities and counties to include climate adaptation and resiliency strategies in the safety element of their general plans.
Senate Bill 1000: General Plan Amendments—Safety and Environmental Justice Elements	Action Plan Implementation	Under this bill, review and revision of general plan safety elements are required to address only flooding and fires (not climate adaptation and resilience), and environmental justice is required to be included in general plans.
Senate Bill 1241: General Plans: Safety Element—Fire Hazard Impacts	Wildfire Hazard	This bill requires cities and counties to make findings regarding available fire protection and suppression services before approving a tentative map or parcel map.
Standardized Emergency Management System	Action Plan Implementation	Local governments must use this system to be eligible for state funding of response-related personnel costs.

5.2 LOCAL PLANS, REPORTS AND CODES

Plans, reports and other technical information were identified and provided directly by participating jurisdictions and stakeholders or were identified through independent research by the planning consultant. These documents were reviewed to identify the following:

- Existing jurisdictional capabilities.
- Needs and opportunities to develop or enhance capabilities, which may be identified within the local mitigation strategies.
- Mitigation-related goals or objectives, considered during the development of the overall goals and objectives.
- Proposed, in-progress, or potential mitigation projects, actions and initiatives to be incorporated into the updated jurisdictional mitigation strategies.

The following local regulations, codes, ordinances and plans were reviewed in order to develop complementary and mutually supportive goals, objectives, and mitigation strategies that are consistent across local and regional planning and regulatory mechanisms:

- General plans (housing elements, safety elements)
- Building codes
- Zoning and subdivision ordinances
- NFIP flood damage prevention ordinances
- Stormwater management plans

- Emergency management and response plans
- Land use and open space plans
- Climate action plans.
- Community wildfire protection plans
- Tribal hazard mitigation plans.

5.3 LOCAL CAPABILITY ASSESSMENT

All participating jurisdictions compiled an inventory and analysis of existing authorities and capabilities called a "capability assessment." A capability assessment creates an inventory of a jurisdiction's mission, programs and policies, and evaluates its capacity to carry them out. This assessment identifies potential gaps in the jurisdiction's capabilities.

The planning partnership views all core jurisdictional capabilities as fully adaptable to meet a jurisdiction's needs. Every code can be amended, and every plan can be updated. Such adaptability is itself considered to be an overarching capability. If the capability assessment identified an opportunity to add a missing core capability or expand an existing one, then doing so has been selected as an action in the jurisdiction's action plan, which is included in the individual annexes presented in Volume 2 of this plan.

Capability assessments for each planning partner are presented in the jurisdictional annexes in Volume 2. The sections below describe the specific capabilities evaluated under the assessment.

5.3.1 Legal and Regulatory Capabilities

Jurisdictions have the ability to develop policies and programs and to implement rules and regulations to protect and serve residents. Local policies are typically identified in a variety of community plans, implemented via a local ordinance, and enforced through a governmental body.

Jurisdictions regulate land use through the adoption and enforcement of zoning, subdivision and land development ordinances, building codes, building permit ordinances, floodplain, and stormwater management ordinances. When effectively prepared and administered, these regulations can lead to hazard mitigation.

5.3.2 Fiscal Capabilities

Assessing a jurisdiction's fiscal capability provides an understanding of the ability to fulfill the financial needs associated with hazard mitigation projects. This assessment identifies both outside resources, such as grant-funding eligibility, and local jurisdictional authority to generate internal financial capability, such as through impact fees.

5.3.3 Administrative and Technical Capabilities

Legal, regulatory, and fiscal capabilities provide the backbone for successfully developing a mitigation strategy; however, without appropriate personnel, the strategy may not be implemented. Administrative and technical capabilities focus on the availability of personnel resources responsible for implementing all the facets of hazard mitigation. These resources include technical experts, such as engineers and scientists, as well as personnel with capabilities that may be found in multiple departments, such as grant writers.

5.3.4 NFIP Compliance

Flooding is the costliest natural hazard in the United States and, with the promulgation of recent federal regulation, homeowners throughout the country are experiencing increasingly high flood insurance premiums.

Community participation in the NFIP opens up opportunity for additional grant funding associated specifically with flooding issues. Assessment of the jurisdiction's current NFIP status and compliance provides planners with a greater understanding of the local flood management program, opportunities for improvement, and available grant funding opportunities.

5.3.5 Public Outreach Capability

Regular engagement with the public on issues regarding hazard mitigation provides an opportunity to directly interface with community members. Assessing this outreach and education capability illustrates the connection between the government and community members, which opens a two-way dialogue that can result in a more resilient community based on education and public engagement.

5.3.6 Participation in Other Programs

Other programs, such as the Community Rating System, StormReady, and Firewise USA, enhance a jurisdiction's ability to mitigate, prepare for, and respond to natural hazards. These programs indicate a jurisdiction's desire to go beyond minimum requirements set forth by local, state and federal regulations in order to create a more resilient community. These programs complement each other by focusing on communication, mitigation, and community preparedness to save lives and minimize the impact of natural hazards on a community.

5.3.7 Development and Permitting Capability

Identifying previous and future development trends is achieved through a comprehensive review of permitting since completion of the previous plan and in anticipation of future development. Tracking previous and future growth in potential hazard areas provides an overview of increased exposure to a hazard within a community.

5.3.8 Adaptive Capacity

An adaptive capacity assessment evaluates a jurisdiction's ability to anticipate impacts from future conditions. By looking at public support, technical adaptive capacity, and other factors, jurisdictions identify their core capability for resilience against issues such as sea level rise. The adaptive capacity assessment provides jurisdictions with an opportunity to identify areas for improvement by ranking their capacity high, medium or low.

5.3.9 Integration Opportunity

The assessment looked for opportunities to integrate this mitigation plan with the legal/regulatory capabilities identified. Capabilities were identified as integration opportunities if they can support or enhance the actions identified in this plan or be supported or enhanced by components of this plan. Planning partners considered actions to implement this integration as described in their jurisdictional annexes.

Del Norte County Operational Area Hazard Mitigation Plan

PART 2—RISK ASSESSMENT

6. IDENTIFIED HAZARDS OF CONCERN AND RISK ASSESSMENT METHODOLOGY

Risk assessment is the process of estimating the potential loss of life, personal injury, economic injury, and property damage resulting from identified hazards. The process focuses on the following elements:

- **Hazard identification**—Use all available information to determine what types of hazards may affect a jurisdiction, how often they can occur, and their potential severity.
- **Exposure identification—**Estimate the total number of people and properties in the jurisdiction that are likely to experience a hazard event if it occurs.
- **Vulnerability identification and loss estimation**—Assess the impact of hazard events on the people, property, environment, economy and lands of the region, including estimates of the cost of potential damage or cost that can be avoided by mitigation.

The risk assessment for this hazard mitigation plan evaluates the risk of natural hazards prevalent in the planning area and meets requirements of the Disaster Mitigation Act (44 CFR, Section 201.6(c)(2) and Section 201.7(c)(2)). To protect individual privacy and the security of critical facilities, information on properties assessed is presented in aggregate, without details about specific individual personal or public properties.

6.1 IDENTIFIED HAZARDS OF CONCERN

The Steering Committee considered the full range of natural hazards that could affect the planning area and then listed hazards that present the greatest concern. The process incorporated a review of state and local hazard planning documents as well as information on the frequency of, magnitude of, and costs associated with hazards that have struck the planning area or could do so. Anecdotal information regarding natural hazards and the perceived vulnerability of the planning area's assets to them was also used. Based on the review, this plan addresses the following hazards of concern (presented in alphabetical order; the order of listing does not indicate the hazards' relative severity):

- Climate change
- Dam failure
- Drought
- Earthquake
- Flooding
- Landslide
- Severe weather
- Tsunami
- Wildland Fire

In addition to these hazards of concern, for which complete risks assessments were performed, the Steering Committee identified hazardous materials spills as a hazard of interest for review. A discussion of this hazard is provided, but a full risk assessment was not conducted.

6.2 RISK ASSESSMENT TOOLS

6.2.1 Mapping

National, state, and county databases were reviewed to locate available spatially based data relevant to this planning effort. Maps were produced using geographic information system (GIS) software to show the spatial extent of hazards when such datasets were available. These maps are included in the hazard profile chapters of this document and the jurisdiction-specific annexes in Volume 2.

6.2.2 Modeling

Overview

In 1997, FEMA developed the standardized Hazards U.S. (Hazus) computer simulation model to estimate losses caused by earthquakes and identify areas that face the highest risk and potential for loss. Hazus was later expanded into a multi-hazard methodology with additional capabilities to estimate potential losses from hurricanes and floods.

Hazus is a GIS-based software program that provides a wide range of inventory data, such as demographics, building stock, critical facilities, transportation elements, and utilities. The program maps and displays hazard data and the results of damage and economic loss estimates for buildings and infrastructure. Its advantages include the following:

- Provides a consistent methodology for assessing risk across geographic and political entities.
- Provides a way to save data so that they can readily be updated as population, inventory, and other factors change and as mitigation planning efforts evolve.
- Facilitates review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.
- Supports grant applications by calculating benefits using FEMA definitions and terminology.
- Produces hazard data and loss estimates that can be used in communication with local stakeholders.
- Is administered by the local government and can be used to manage and update a hazard mitigation plan throughout its implementation.

Levels of Detail for Evaluation

Hazus provides default data for inventory, vulnerability, and hazards; these default data can be supplemented with local data to provide a more refined analysis. The model can carry out three levels of analysis, depending on the level of detail of information about the planning area:

- **Level 1**—All of the information needed to produce an estimate of losses is included in the software's default data. These data are derived from national databases and describe in general terms the characteristic parameters of the planning area.
- **Level 2**—More accurate estimates of losses require more detailed information about the planning area. To produce Level 2 estimates of losses, detailed information is required about local geology, hydrology, hydraulics, and building inventory, as well as data about utilities and critical facilities. This information is needed in a GIS format.
- **Level 3**—This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the planning area.

6.3 RISK ASSESSMENT APPROACH

The risk assessments in this plan describe the risks associated with each identified hazard of concern. The following steps were used to assess the risk of each hazard:

- **Identify and profile each hazard**—The following information is given for each hazard:
  - A summary of past events that have impacted the planning area
  - Geographic areas most affected by the hazard
  - Event frequency estimates
  - Severity estimates
  - Warning time likely to be available for response.
- **Determine exposure to each hazard**—Exposure was assessed by overlaying hazard maps with an inventory of structures, facilities, and systems to decide which of them would be exposed to each hazard.
- **Assess the vulnerability of exposed facilities**—Vulnerability of exposed structures and infrastructure was evaluated by interpreting the probability of occurrence of each event and assessing structures, facilities, and systems that are exposed to each hazard. Tools such as GIS and Hazus were used for this assessment for the flood, earthquake, and tsunami hazards. Outputs similar to those from Hazus were generated for other hazards, using data generated through GIS.

6.3.1 Earthquake, Flood and Tsunami

The following hazards were evaluated using Hazus (v. 4.0):

- **Flood**—A Level 2 user-defined analysis was performed for general building stock in flood zones and for critical facilities and infrastructure. Current flood mapping for the planning area was used to delineate flood hazard areas and estimate potential losses from the 1-percent-annual-chance and 0.2-percent-annual-chance flood events. To estimate damage that would result from a flood, Hazus uses pre-defined relationships between flood depth at a structure and resulting damage, with damage given as a percent of total replacement value. Curves defining these relationships have been developed for damage to structures and for damage to typical contents within a structure. By inputting flood depth data and known property replacement cost values, dollar-value estimates of damage were generated.
- **Tsunami**—A modified Level 2 analysis was run using the flood methodology described above.
- **Earthquake**—A Level 2 analysis was performed to assess earthquake vulnerability for three scenario events and one probabilistic event:
  - Big Lagoon-Bald Mountain Fault M7.9 scenario.
  - Cascadia Subduction Zone M9.0 scenario.
  - Trinidad Fault Zone Alt 1 M7.5 scenario.
  - The standard Hazus 100-year probabilistic event.

6.3.2 All Other Assessed Hazards

Historical datasets were not adequate to model future losses for most of the hazards of concern. However, areas and inventory susceptible to some of the hazards of concern were mapped by other means and exposure was evaluated. A qualitative analysis was conducted using the best available data and professional judgment. The risk assessment for drought was more limited and qualitative than the assessment for the other hazards of concern because drought does not affect structures.

6.4 SOURCES OF DATA USED

6.4.1 Building Data

Replacement cost values and structure information derived from parcel and tax assessor data provided by Del Norte County were loaded into Hazus. The tax assessor digital data contained parcel use descriptions only, all other information of structures was available only in hard copy format. Default values were used for the remaining structure attributes required for the Hazus analyses. The default values for square footage were based on the use description (Hazus occupancy class) and may vary significantly from the actual square footage, especially for non-residential structures. When available, an updated inventory was used in place of the Hazus defaults for critical facilities and infrastructure.

6.4.2 Cost Data

Replacement cost is the cost to replace the entire structure with one of equal quality and utility. Replacement cost is based on industry-standard cost-estimation models published in *RS Means Square Foot Costs* (RS Means, 2017). It is calculated for each structure by multiplying the structure's footprint area by the RS Means cost per square foot for structures with the identified Hazus occupancy class (multi-family residential or commercial retail trade). Since the default footprint areas for non-residential structures are likely overestimated, the replacement costs for these structures are also likely overestimated.

6.4.3 Hazus Data Inputs

The following hazard datasets were used for the Hazus Level 2 analysis conducted for the risk assessment:

- **Flood**—The effective Digital Flood Insurance Rate Map (DFIRM) for the planning area was used to delineate flood hazard areas and estimate potential losses from the 1-percent-annual-chance and 0.2-percent-annual-chance flood events. The DFIRM is effective as of November 26, 2010 with the latest incorporated Letter of Map Revision dated November 29, 2010. Using the DFIRM floodplain boundaries and the U.S. Geological Survey's 10-meter digital elevation model, flood depth grids were generated and integrated into the Hazus model.
- **Tsunami**—Tsunami inundation zone data from the California Department of Conservation website (California Department of Conservation, 2017) was used in combination with the USGS 10-meter digital elevation model to develop a tsunami depth grid that was integrated into the Hazus model.
- **Earthquake**—Earthquake maps and probabilistic data prepared by the USGS were used for the analysis of the earthquake hazard. A National Earthquake Hazard Reduction Program (NEHRP) soils map from the California Department of Conservation and landslide susceptibility data from the California Geological Survey were also integrated into the Hazus model.

6.4.4 Other Local Hazard Data

Locally relevant information on hazards was gathered from a variety of sources. Frequency and severity indicators include past events and the expert opinions of geologists, emergency management specialists, and others. Data sources for specific hazards were as follows:

- **Climate Change**—Sea level rise data were provided by NOAA (NOAA, 2018). Sea level rises of 1 foot and 4 feet above current mean higher high water were used for the exposure analysis.
- **Dam Failure**—Dam failure inundation area data covering multiple counties for Copco No. 1, Iron Gate, and Trinity dams were originally acquired from Humboldt County for its 2013 Hazard Mitigation Plan (Humboldt County, 2014).

- **Landslide**—California data on susceptibility to deep-seated landslides was provided by the California Geological Survey.
- **Severe Storm**—No GIS format severe storm area datasets were identified for Del Norte County.
- **Wildland fire**—Fire severity data was acquired from California Department of Forestry and Fire Protection (CAL FIRE, 2012).

6.4.5 Data Source Summary

Table 6-1 summarizes the data sources used for the risk assessment for this plan.

Table 6-1. Hazus Model Data Documentation

Data	Source	Date	Format
Property parcel data[a]	Del Norte County	2017	Digital (GIS) format
Building information (limited to use code and address)	Del Norte County	2017	Digital (tabular) format
Building replacement cost	RS Means	2017	Paper format. Updated RS Means
Population data	FEMA Hazus version 4.0	2010	Digital (GIS and tabular) format
Effective Digital Flood Insurance Rate Map	FEMA	2010	Digital (GIS) format
Dam failure inundation areas	Humboldt County	Unknown	Digital (GIS) format
Tsunami Inundation Map for Emergency Planning	CA Department of Conservation website (produced by CA Emergency Management Agency, CA Geological Survey, and University of Southern California – Tsunami Research Center)	2009	Digital (GIS) format
Earthquake Maps	USGS Earthquake Hazards Program website	2016-17	Digital (GIS) format
NEHRP Soils	CA Department of Conservation	2008	Digital (GIS) format
Susceptibility to Deep-Seated Landslides in California	CA Geological Survey	2011	Digital (GIS) format
California Fire Hazard Severity Zone Maps for State Responsibility Areas	CAL FIRE	2007	Digital (GIS) format
Sea Level Rise Data: 1- to 6-Foot Sea Level Rise Inundation Extent	NOAA Office for Coastal Management	2012	Digital (GIS) format
10-meter Digital Elevation Model	U.S. Geological Survey	2013	Digital (GIS) format
Default critical facilities data	FEMA Hazus version 4.2	Unknown	Digital (GIS) format
Toxic Release Inventory (TRI) facilities from the Facility Registry Service (FRS) database	U.S. Environmental Protection Agency	2016	Digital (GIS) format
Local and State bridges	CA Department of Transportation	2015	Digital (GIS) format
Facility information provided by planning partners	Smith River Fire Protection District, Smith River Community Services District, Elk Valley Rancheria, Del Norte County, Crescent City, Crescent City Harbor District, Crescent Fire Protection District, Gasquet Community Services District, Klamath Community Services District, Big Rock Community Services District	Various	Digital (GIS and tabular) format

a. Parcel description categories were used to identify undeveloped parcels in the planning area. They may include some parcels that belong to tribes and are not under the jurisdiction of the City of Crescent City or Del Norte County.

6.5 LIMITATIONS

Loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct a study
- Incomplete or outdated inventory, demographic or economic parameter data
- The unique nature, geographic extent, and severity of each hazard
- Mitigation measures already employed
- The amount of advance notice residents have to prepare for a specific hazard event.

These factors can affect loss estimates by a factor of two or more. Therefore, potential exposure and loss estimates are approximate and should be used only to understand relative risk. Over the long term, Del Norte County will collect additional data to assist in estimating potential losses associated with other hazards.

7. DAM FAILURE

7.1 GENERAL BACKGROUND

7.1.1 Definition and Classification of Dams

A dam is an artificial barrier that has the ability to store water, wastewater, or liquid-borne materials for many reasons—flood control, human water supply, irrigation, livestock water supply, energy generation, containment of mine tailings, recreation, or pollution control. Many dams fulfill a combination of these functions. They are an important resource in the United States (ASDSO, 2013). In California, dams are regulated by the State of California Division of Safety of Dams. Additional regulatory oversight of dams is cited in Chapter 5 and described in Appendix B.

The California Water Code (Division 3) defines a dam as any artificial barrier, together with appurtenant works, that does or may impound or divert water, and that either:

- Is 25 feet or more in height from the natural bed of the stream or watercourse at the downstream toe of the barrier (or from the lowest elevation of the outside limit of the barrier if it is not across a stream channel or watercourse) to the maximum possible water storage elevation; or
- Has an impounding capacity of 50 acre-feet or more.

Dams can be classified according to their purpose, the construction material or methods used, their slope or cross-section, the way they resist the force of the water pressure, or the means used for controlling seepage. Materials used to construct dams include earth, rock, tailings from mining or milling, concrete, masonry, steel, timber, plastic, rubber, and combinations of these.

7.1.2 Causes of Dam Failure

Dam failures in the United States typically occur in one of four ways:

- Overtopping of the primary dam structure, which accounts for 34 percent of all dam failures, can occur due to inadequate spillway design, settlement of the dam crest, blockage of spillways, and other factors.
- Foundation defects due to differential settlement, slides, slope instability, uplift pressures, and foundation seepage can also cause dam failure. These account for 30 percent of all dam failures.
- Failure due to piping and seepage accounts for 20 percent of all failures. These are caused by internal erosion due to piping and seepage, erosion along hydraulic structures such as spillways, erosion due to animal burrows, and cracks in the dam structure.
- Failure due to problems with conduits and valves, typically caused by the piping of embankment material into conduits through joints or cracks, constitutes 10 percent of all failures.

The remaining 6 percent of U.S. dam failures are due to miscellaneous causes. Many dam failures in the United States are secondary results of other disasters. The prominent causes are earthquakes, landslides, extreme storms, massive snowmelt, equipment malfunction, structural damage, foundation failures, and sabotage (ASDSO, 2016).

7.1.3 Planning Requirements

All of the dams whose inundation areas may impact the planning area have emergency action plans (EAPs) on file. The State of California updated its requirements regarding EAPs via Senate Bill 92, which became effective in June 2017. High-hazard dam owners must submit EAPs to Cal OES for approval by January 1, 2019. The EAPs must include the following (California Government Code Section 8589.5; Cal OES, 2018):

- Emergency notification flow charts
- Information on a four-step response process
- Description of agencies' roles and actions in response to an emergency incident
- Description of actions to be taken in advance of an emergency
- Inundation maps
- Additional information such as revision records and distribution lists.

After approval by Cal OES, dam owners must send the approved EAP to relevant stakeholders. Local public agencies may then adopt emergency procedures that incorporate the information in the EAP in a manner that conforms to local needs and includes methods and procedures for alerting and warning the public and other response and preparedness related items (State of California, 2018) These updates to emergency procedures have been made in the Del Norte planning area.

7.2 HAZARD PROFILE

7.2.1 Past Events

No known failures have occurred on dams that impact Del Norte County. However, according to the 2013 *State of California Multi-Hazard Mitigation Plan*, there have been nine failures of federally regulated dams elsewhere in the state since 1950. Overtopping caused two of the nine dam failures in the state, and the others were caused by seepage or leaks. The most catastrophic event was the failure of the St. Francis Dam in Los Angeles County, which failed in 1928 and killed an estimated 450 people.

The state's most recent dam emergency occurred in February 2017 when the Oroville Dam in Butte County was on the verge of overflow. The dam's concrete spillway was damaged by erosion and a massive hole developed. The auxiliary spillway was used to prevent overtopping of the dam, and it experienced erosion problems also. Evacuation orders were issued in advance of a potential large uncontrolled release of water from Lake Oroville, but such a release did not occur. After this incident, state officials ordered that flood-control spillways be re-inspected on 93 California dams with potential geologic, structural or performance issues that could jeopardize their ability to safely pass a flood event. The dams to be re-inspected include the Iron Gate Dam, whose failure would impact the Del Norte planning area (California Division of Safety of Dams, 2018). At the time of this plan update, the status of this re-inspection is unknown; however, many dam owners responded to the order immediately.

7.2.2 Location

There are no dams located in Del Norte County that meet height and/or impound thresholds for jurisdiction under the State of California or federal programs; however, there may be dams in the planning area that fall below these regulatory thresholds (State of California Division of Safety of Dams, 2017). Dams outside of the planning area have inundation areas that extend into the southern portion of the planning area along the Klamath River. Table 7-1 lists the dams that could impact portions of Del Norte County if they were to fail.

Table 7-1. Dams with Inundation Areas Impacting Del Norte County

	Copco No. 1	Copco No. 2	Iron Gate	Trinity
County	Siskiyou	Siskiyou	Siskiyou	Trinity
Water Course	Klamath River	Klamath River	Klamath River	Trinity River
Owner	PacifiCorp	PacifiCorp	PacifiCorp	U.S. Bureau of Reclamation
Year Built	1922	1925	1962	1962
Crest Elevation (feet)	2,613.00	2,484.00	2,343.00	2,395.00
Dam Type	Gravity	Gravity	Earth and Rock	Earth
Crest Length (feet)	415	148	745	2,450
Height (feet)	132	37	188	458
Storage Capacity (acre-feet)	77,000	55	58,000	2,447,650
Use	Storage, Diversion, Power	Diversion, Power	Storage, Regulation, Power	Multi-Purpose, Irrigation, Recreation, Power
Last Inspection Date	7/29/2015	9/18/2013	7/30/2015	1/14/2015
Emergency Action Plan Last Revision Date	21/15/2015	12/15/2005	7/27/2010	10/28/2014

Source: U.S. Army Corps of Engineers, National Inventory of Dams, 2018

Figure 7-1 shows the planning area dam failure inundation zone, consisting of the individual inundation areas for the Copco No. 1, Iron Gate and Trinity dams. Copco No. 2 is a relatively small dam that is located between Copco No. 1 and Iron Gate. It is assumed that the maximum extent of a failure of this dam is captured in the inundation zone presented. The combined inundation zone covers 8,298 acres—about 1 percent of Del Norte County. Because the dam failure inundation zone used for the evaluation of exposure and vulnerability in this risk assessment is the combined area of inundation for all the dams whose failure would impact the planning area, it does not represent any one failure event.

7.2.3 Frequency

Dam failure events are infrequent and usually coincide with events that cause them, such as earthquakes, landslides and excessive rainfall and snowmelt. Although the recent Oroville event raised public concern about dam failure, the probability of such failures remains low in today's regulatory environment. No recorded failures have occurred on dams that impact the planning area, so no estimate of frequency or probability of future occurrence can be developed based on the historical record.

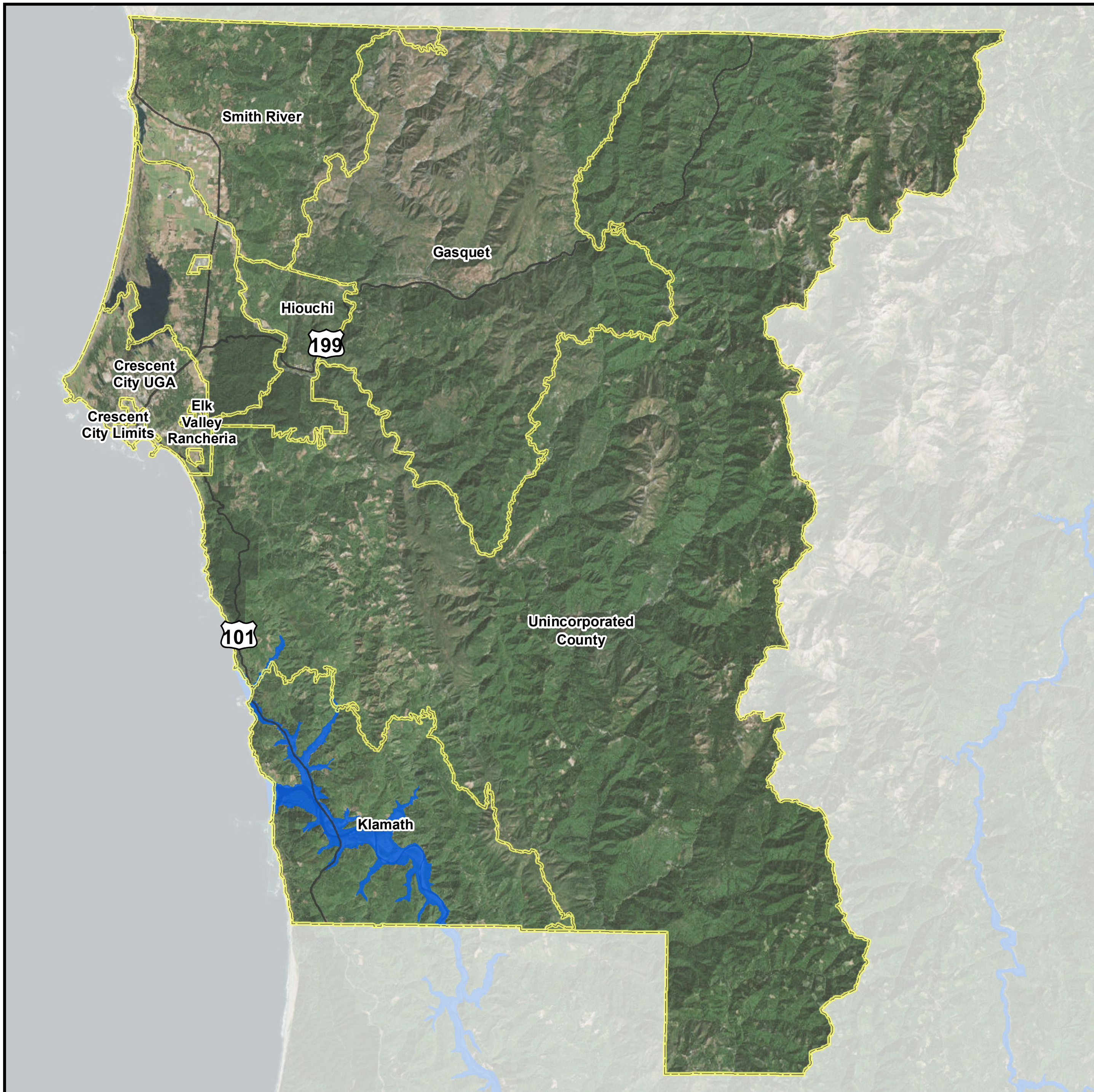
All dams face a "residual risk" of failure, which represents the risk that conditions may exceed those for which the dam was designed. For example, dams may be designed to withstand a probable maximum precipitation, defined as "theoretically, the greatest depth of precipitation for a given duration that is physically possible over a given storm area at a particular geographical location at a certain time of the year" (Taylor, 2006). The chance of occurrence of a precipitation event of a greater magnitude than that represents residual risk for such dams. This in turn represents a theoretical probability of future occurrence for a dam failure event, though the probability of an event exceeding the assumed maximum is not generally calculated as part of dam design.

7.2.4 Severity

Dam failure can be catastrophic to all life and property downstream. California's Division of Safety of Dams has developed a hazard potential classification system for state-jurisdiction dams, as shown on Table 7-2. This system is modified from federal guidelines, which recommend three-tier classification. The California system adds a fourth hazard classification of "extremely high." Dams classified as extremely high hazard may impact highly populated areas or critical infrastructure, or have short evacuation warning times (California Division of Safety of Dams, 2017). All dams listed in Table 7-1 are classified as high hazard in this system.

Del Norte County

Figure 7-1.
Dam Inundation Areas



Map Data Sources:Del Norte County, CalTrans, Hazus 4.2, EPA, USDA, CalOES, State of California

Table 7-2. State of California Downstream Hazard Potential Classification

Hazard Category	Direct Loss of Life	Economic, Environmental, and Lifeline Losses
Low	None expected	Low and principally limited to dam owner's property
Significant	None expected	Yes
High	Probable (one or more expected)	Yes, but not necessary for this classification
Extremely High	Considerable	Yes, major impacts to critical infrastructure or property

Source: California Division of Safety of Dams, 2017a

7.2.5 Warning Time

Advance Warning of Failure

Warning time for dam failure varies depending on the cause of the failure. Events of extreme precipitation or massive snowmelt can be predicted in advance, so evacuations can be planned with sufficient time. In the event of a structural failure due to earthquake, there may be no or limited warning time. The USGS Earthquake Hazards Program has several dam-safety related earthquake programs, including dam-specific earthquake monitoring programs in California to help monitor safety concerns following seismic events.

Time for Failure to Occur

The process of the dam failure affects warning time. Earthen dams do not tend to fail completely or instantaneously. 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. The time of breach formation ranges from a few minutes to a few hours.

Time After Failure Before Downstream Areas Are Affected

The warning time for dam failure on the Trinity and Klamath Rivers before the resulting floodwaters reach the planning area will be approximately 7 hours. The number of people to be alerted and evacuated can vary tremendously. There may be few persons along the river in the winter months when only permanent residents are apt to be present, and there may be many persons in the summer when many seasonal cabins are occupied and there are fishermen and campers along all the rivers (Crescent City/Del Norte County, 2010).

Another factor that must be considered is the initial flow in the river when the failure occurs. The initial flow is normally very low on all the rivers from May through October. During the winter, the initial flow is much higher and at times may even be equal to or greater than flood stage. This wide variation in initial flow has a significant impact on the areas that must be evacuated.

7.3 SECONDARY HAZARDS

Dam failure can cause secondary hazards of landslides, bank erosion, and destruction of downstream habitat.

7.4 EXPOSURE

A quantitative assessment of exposure to the dam failure hazard was conducted using the inundation mapping shown in Figure 7-1 and the asset inventory developed for this plan (see Section 6.3). Detailed results are provided in Appendix C and summarized below.

7.4.1 Population

The estimated population living in the dam failure inundation zone is 1,152; all of this population is located in the Klamath Planning Unit. The exposed population represents 86 percent of the Klamath Planning Unit population and 4 percent of the total planning area population. In addition to populations living in the inundation zone, there could be a significant number of people recreating in the inundation zone, especially during summer.

7.4.2 Property

An estimated 416 structures are in the dam inundation zone, all of them in the Klamath Planning Unit. The total estimated replacement value of exposed structures and contents is more than $775 million, which is more than 91 percent of the estimated total replacement value of the Klamath Planning Unit and 5 percent of the total replacement value of the planning area. Figure 7-2 shows the types of structures located in the dam failure inundation zone. Most (88 percent) are residential. These 365 structures represent about 5 percent of all residential structures in the planning area and 86 percent of all residential structures in the Klamath Planning Unit.

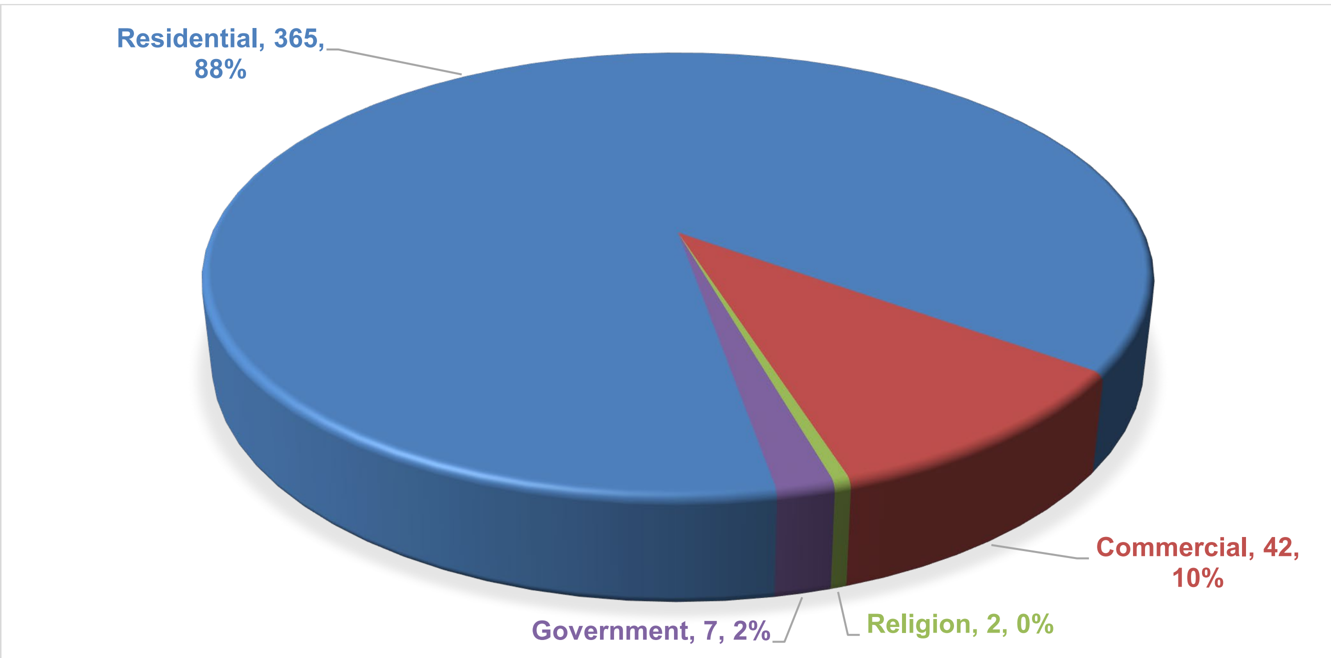


Figure 7-2. Structures in the Dam Failure Inundation Area by Land Use Type

7.4.3 Critical Facilities

Figure 7-3 shows critical facilities located in the dam inundation zone by facility type. The total count of critical facilities and infrastructure in the dam failure inundation zone (28) represents 11 percent of the planning area total of 260. In the Klamath Planning Unit, critical facilities in the inundation zone include almost all of the total critical facilities there (27 of 29), as shown in Figure 7-4.

The major roads in the planning area that pass through the dam failure inundation zone are State Highway 169 and U.S. Highway 101. Some portions of these roads may be built above the flood level, and other portions may function as levees to prevent flooding. Still, in severe flood events, especially with high velocity flows, these roads can be blocked or damaged and bridges can be washed out, significantly disrupting travel through the planning area. Of the 17 bridges in the dam inundation zone in the planning area, seven are owned by the County and 10 are owned by Caltrans.

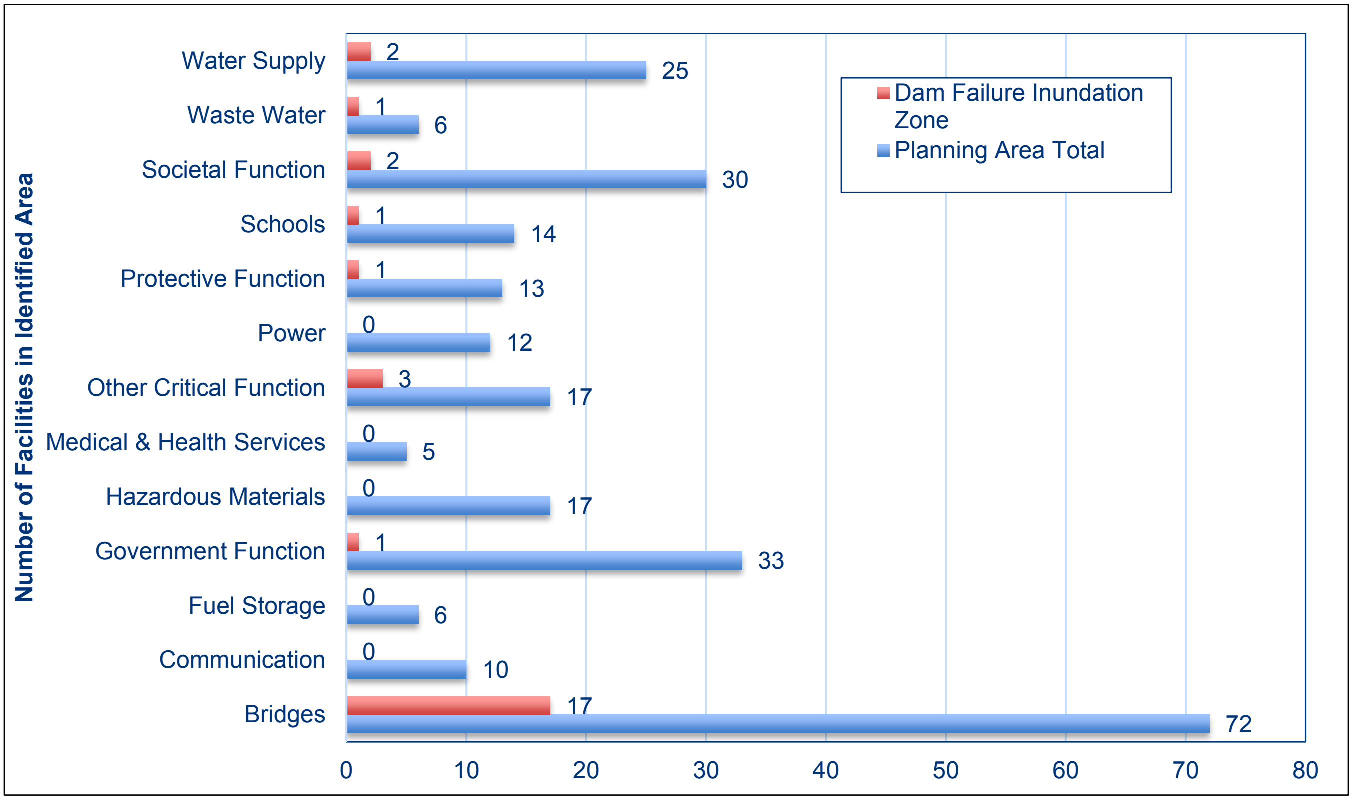


Figure 7-3. Critical Facilities and Infrastructure in Dam Failure Inundation Zone and Countywide

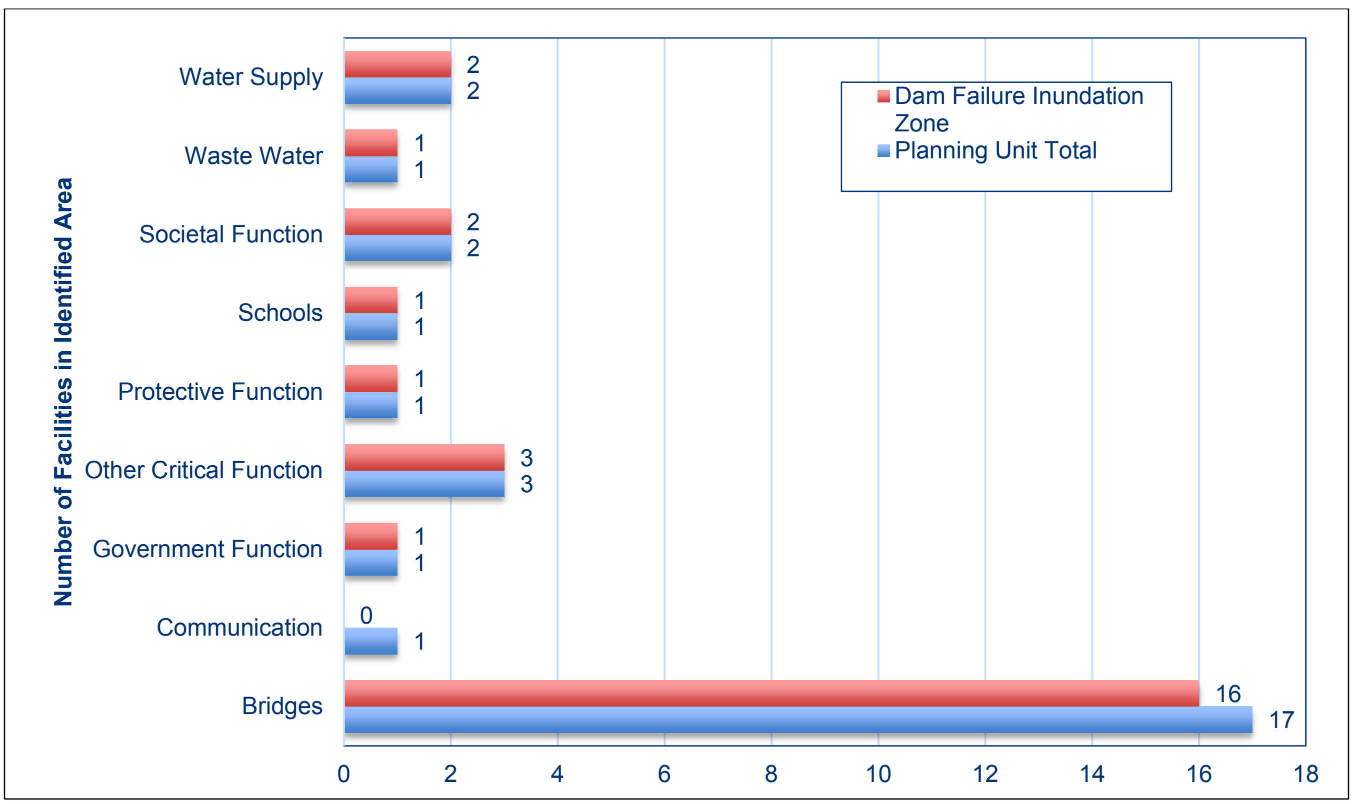


Figure 7-4. Klamath Critical Facilities and Infrastructure in Dam Failure Inundation Zone and Total Planning Unit

7.4.4 Environment

All natural features and wildlife in the dam inundation zone are at risk from the dam failure hazard. The dam inundation zone may include critical habitat for two endangered species: the marbled murrelet and the northern spotted owl (U.S. Fish and Wildlife Service, 2018).

7.5 VULNERABILITY

7.5.1 Population

Vulnerable populations are all populations downstream from dam failures that are incapable of escaping the area before floodwaters arrive. This population includes the elderly and young who may be unable to get themselves out of the inundation area. The vulnerable population also includes those who would not have adequate warning from a television, radio emergency warning system, siren, or cell phone alert.

7.5.2 Property

Vulnerable properties are those closest to the dam inundation zone. These properties would experience the largest, most destructive surge of water. Low-lying areas are also vulnerable since they are where the dam waters would collect. Properties in the dam inundation zone that are built to National Flood Insurance Program (NFIP) minimum construction standards may have some level of protection against dam inundation, depending on the velocity and elevation of the inundation waters. These properties also are more likely to have flood insurance. In the Klamath Planning Unit, there are estimated to be 352 structures that are in the dam inundation zone but outside of special flood hazard areas where NFIP minimum construction standards apply.

The value of property losses would depend on mitigation measures in place and the amount of water impounded by the dam at the time of failure. Estimates were developed to indicate the loss that would occur if landslide damage were equal to 10, 50 or 100 percent of the exposed property value, as follows:

- Damage equal to 10 percent of exposed property—$77 million (1 percent of total replacement value)
- Damage equal to 50 percent of exposed property —$387 million (3 percent of total replacement value)
- Damage equal to 100 percent of exposed property —$775 million (5 percent of total replacement value).

7.5.3 Critical Facilities

Transportation routes are vulnerable to dam inundation and have the potential to be wiped out, creating isolation issues and significant disruption to travel along the Pacific coast, including all roads, railroads and bridges in the path of the dam inundation. Those that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge. Utilities such as overhead power lines, cable and phone lines in the inundation zone could also be vulnerable. If phone lines were lost, significant communication issues may occur in the planning area due to limited cell phone reception in many areas. In addition, emergency response would be hindered due to the loss of transportation routes as well as some protective-function facilities located in the inundation zone. Recovery time to restore many critical functions after an event may be lengthy, as wastewater, potable water, and other community facilities are located in the dam inundation zone.

7.5.4 Environment

The environment would be vulnerable to a number of risks in the event of dam failure. The inundation could introduce foreign elements into local waterways, resulting in destruction of downstream habitat and detrimental effects on many species of animals, especially endangered species such as the tidewater goby.

7.6 FUTURE TRENDS IN DEVELOPMENT

Land use in the Klamath Planning Unit and unincorporated areas exposed to the dam inundation hazard is governed by the Del Norte County General Plan (2003). The General Plan does not include any specific discussion on land use requirements related to the dam failure hazard; however, there are regulations imposed on development in the planning area's special flood hazards areas (1-percent-annual-chance flood hazard). Although the dam inundation zone is larger than the special flood hazard areas, some level of protection may exist depending on the difference in flood heights and velocities between these two flood event types.

There are estimated to be 370 undeveloped parcels that intersect the dam failure inundation zone in the planning area. Future development of these parcels could expose more people and property to risk from the dam failure hazard. Most of the undeveloped parcels (283 parcels; 76 percent of the total) are designated for residential development (see Figure 7-5). The total land area of the parcels that fall within the mapped inundation zone is 951 acres (9 percent of total undeveloped acreage in the planning area), which means that there are likely to be areas of these parcels where houses and other structures could be placed that would locate them outside of the dam inundation zone.

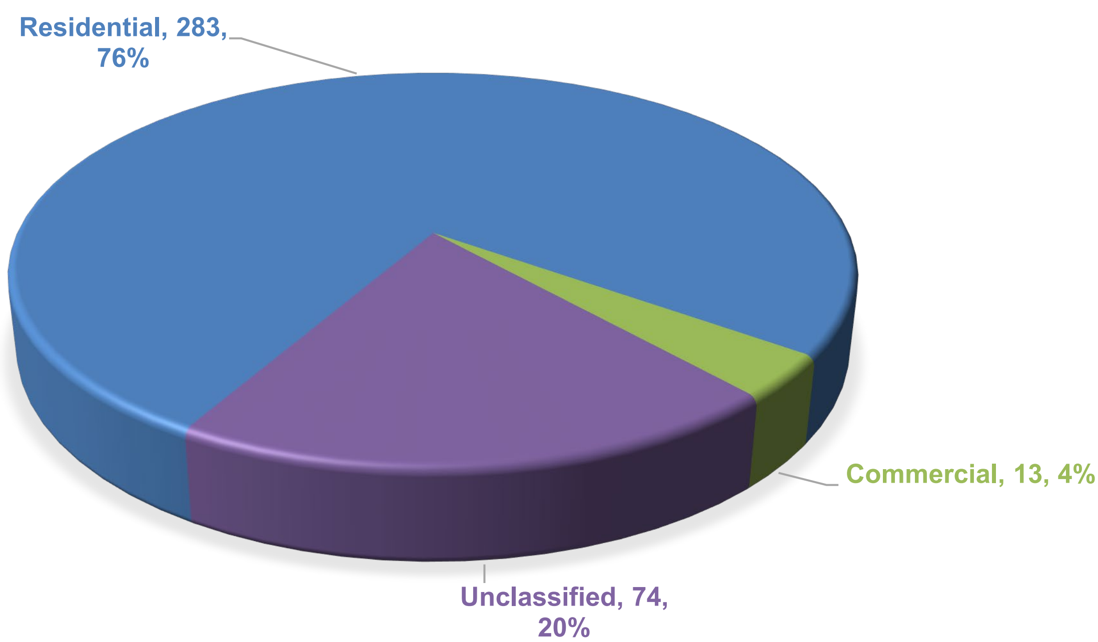


Figure 7-5. Undeveloped Parcels in the Dam Failure Inundation Area by Land Use Type

7.7 SCENARIO

In a worst-case scenario, a shallow-fault-generated earthquake with a magnitude of 7.5 could lead to liquefaction of the ground soils where the dams that impact the planning area are located, causing the dams to fail. This could occur without warning in the middle of the night when residents and campers along the river are asleep and unprepared to evacuate. A human-caused failure such as a terrorist attack also could trigger a catastrophic failure of one of the dams.

7.8 ISSUES

The most significant issue associated with dam failure involves the properties and populations in the inundation zone. Flooding as a result of a dam failure would significantly impact these areas. There is often limited warning time for dam failures, which are frequently associated with other natural hazard events such as earthquakes, landslides or severe weather. Important issues associated with the dam failure hazard include the following:

- There may be dams located in the planning area that do not meet regulatory thresholds for jurisdiction under State of California or federal programs.
- Dam infrastructure may require repair and improvement to withstand climate change impacts, such as changing in the timing and intensity of rain events.
- It is unknown if any issues were identified for the spillway of the Iron Gate dam as a result of inspection orders issued after the Oroville Dam event in 2017.
- A significant number of the structures located in the dam inundation zone are located outside of special flood hazard areas, meaning that they are not constructed to withstand floodwaters and are less likely to be covered by flood insurance. Even structures that have been designed with flood hazards in mind may not be able to withstand the height and velocity of flow from a dam failure event.
- California law requires that a property's location in a dam inundation be disclosed to a seller if the seller or the seller's agent has knowledge of the property's location within the hazard area or if the local jurisdiction has compiled a list of parcels that are in the inundation area and has posted at the offices of the county recorder, county assessor, and county planning agency a notice that identifies the location of the list. It is unknown if this list has been compiled for the planning area.
- The vast majority of exposure to the dam failure hazard is within the Klamath Planning Unit. The current Del Norte General Plan does not discuss risk to this area from the dam failure hazard in its Safety Element.
- More than 90 percent of the critical facilities in the Klamath Planning Unit are believed to be located in the dam inundation zone. This could cause significant delays in recovery if an event were to occur.
- In the event of a dam failure that interrupted land line phone service, significant issues with communication could occur.
- Most dam failure mapping required at federal levels requires determination of the probable maximum flood. While the probable maximum flood represents a worst-case scenario, it is generally the event with the lowest probability of occurrence. For non-federal-regulated dams, mapping of dam failure scenarios that are less extreme than the probable maximum flood but have a higher probability of occurrence can be valuable to emergency managers and community officials downstream of these facilities. This type of mapping can illustrate areas potentially impacted by more frequent events to support emergency response and preparedness.
- The concept of residual risk associated with structural flood control projects should be considered in the design of capital projects and the application of land use regulations.
- Addressing security concerns and the need to inform the public of the risk associated with dam failure is a challenge for public officials.

8. DROUGHT

8.1 GENERAL BACKGROUND

Drought is a significant decrease in water supply relative to what is typical in a given location. It is a normal phase in the climate cycle of most regions, originating from a deficiency of precipitation over an extended period of time, usually a season or more. This leads to a water shortage for some activity, group or environmental sector.

Droughts are climatic patterns that occur over long periods of time as the result of many causes. Global weather patterns that produce persistent, upper-level high-pressure systems along the West Coast result in warm, dry air and reduced precipitation. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depends on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of global weather systems.

8.1.1 Monitoring and Categorizing Drought

The National Oceanic and Atmospheric Administration (NOAA) has developed several indices to measure drought impacts and severity and to map their extent and locations:

- The ***Palmer Crop Moisture Index*** measures short-term drought on a weekly scale to quantify impacts on agriculture.
- The ***Palmer Z Index*** measures short-term drought on a monthly scale.
- The ***Palmer Drought Severity Index*** measures the duration and intensity of long-term weather patterns. The intensity of drought in a given month is dependent on current weather plus the cumulative patterns of previous months. Weather patterns can change quickly, and the Palmer Drought Severity Index can respond fairly rapidly.
- The ***Palmer Hydrological Drought Index***, quantifies hydrological effects (reservoir levels, groundwater levels, etc.), which take longer to develop and last longer. This index responds more slowly to changing conditions than the Palmer Drought Index.
- The ***Standardized Precipitation Index*** considers only precipitation. In the Standardized Precipitation Index, an index of zero indicates the median precipitation amount; the index is negative for drought and positive for wet conditions. The Standardized Precipitation Index is computed for time scales ranging from one month to 24 months.

Maps of these indices show drought conditions nationwide at a given point in time. They are not necessarily indicators of any given area's long-term susceptibility to drought. The most current versions of the maps at the time of this plan's preparation are shown on Figure 8-1 through Figure 8-5.

The U.S. Drought Monitor categorizes droughts by impact type and intensity. Impact type indicates whether a drought in a given area is short-term or long-term. Short-term is generally less than six months and impacts are expected on agriculture and grasslands. Long-term drought is typically longer than 6 months and impacts are seen on hydrology and ecology in the area impacted. The intensity of a drought is categorized on a scale of 0 to 4, where 0 is abnormally dry and 4 is exceptional drought.

Source: U.S. Drought Portal, 2018

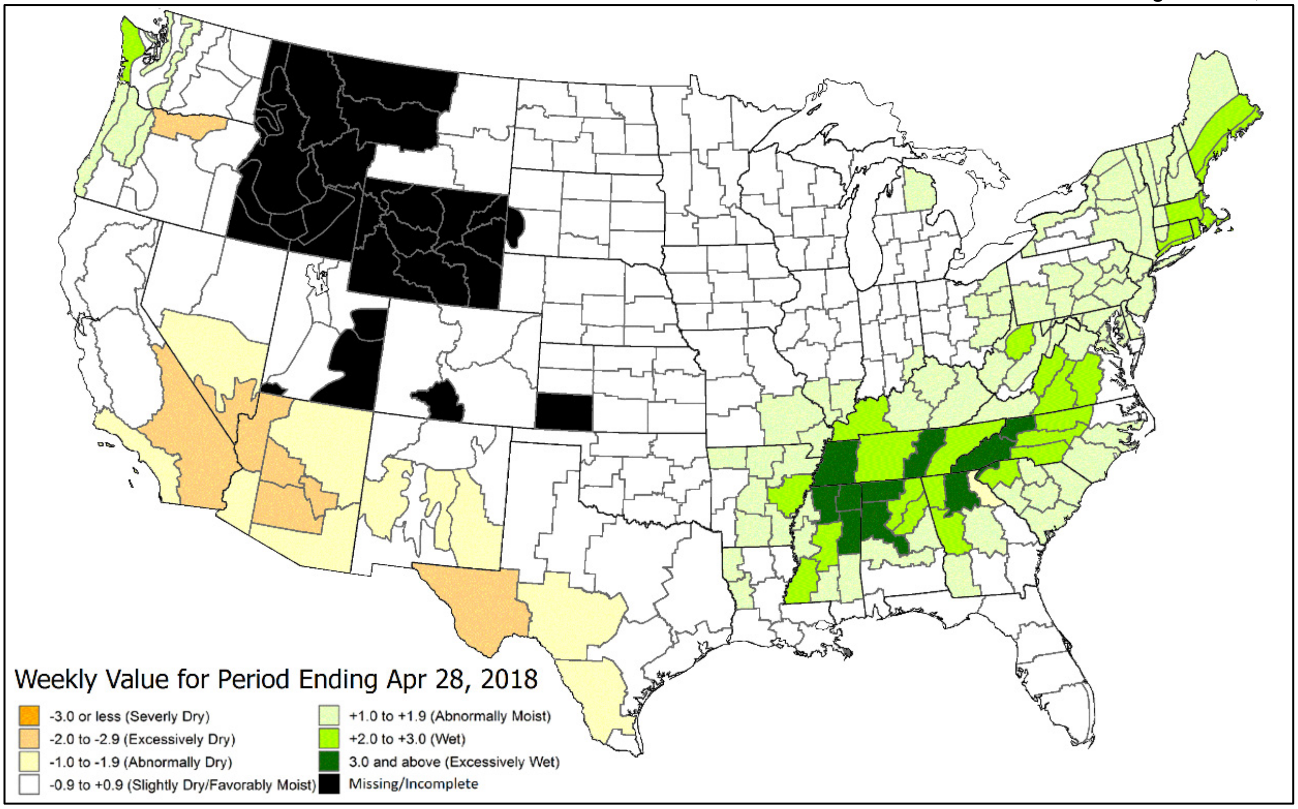


Figure 8-1. Palmer Crop Moisture Index for Week Ending April 28, 2018

Source: National Center for Environmental Information, 2018

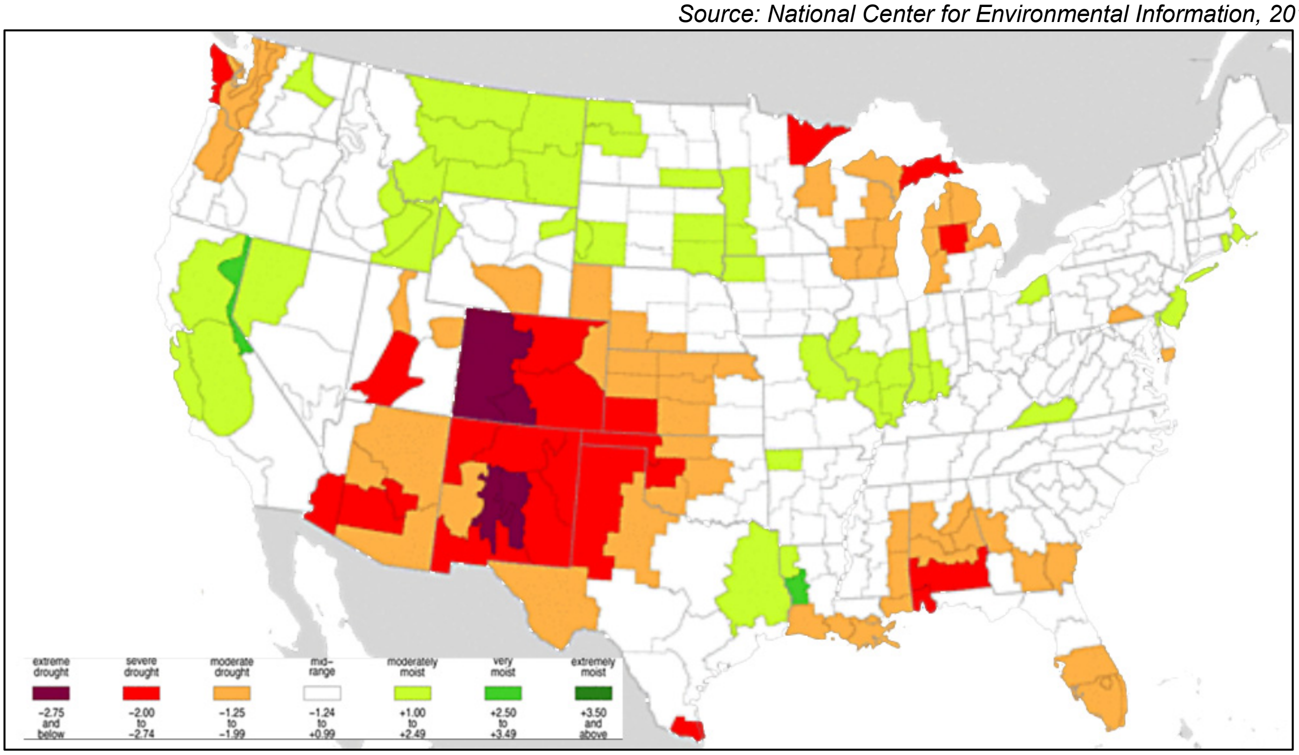


Figure 8-2. Palmer Z Index Short-Term Drought Conditions (March 2018)

Source: NOAA, NWS. 2018

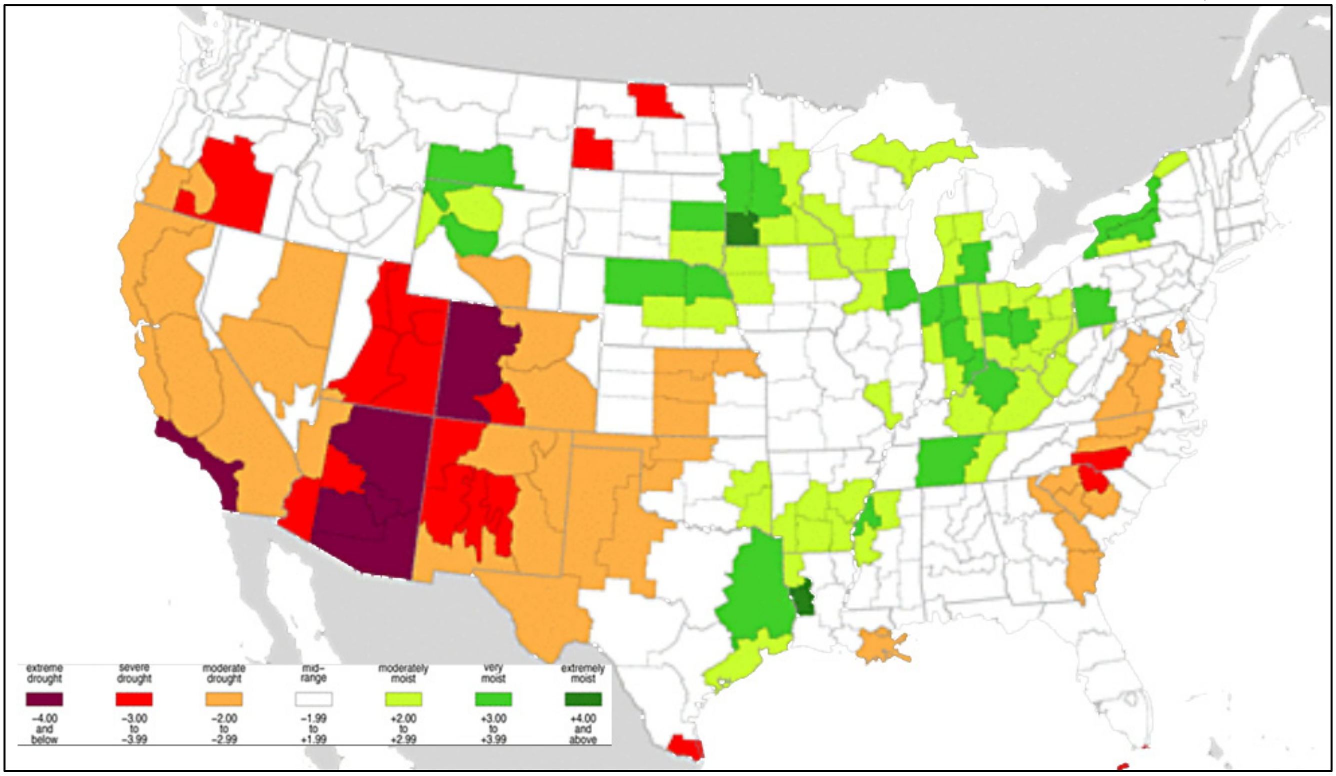


Figure 8-3. Palmer Drought Severity Index (March 2018)

Source: NOAA, NWS. 2018

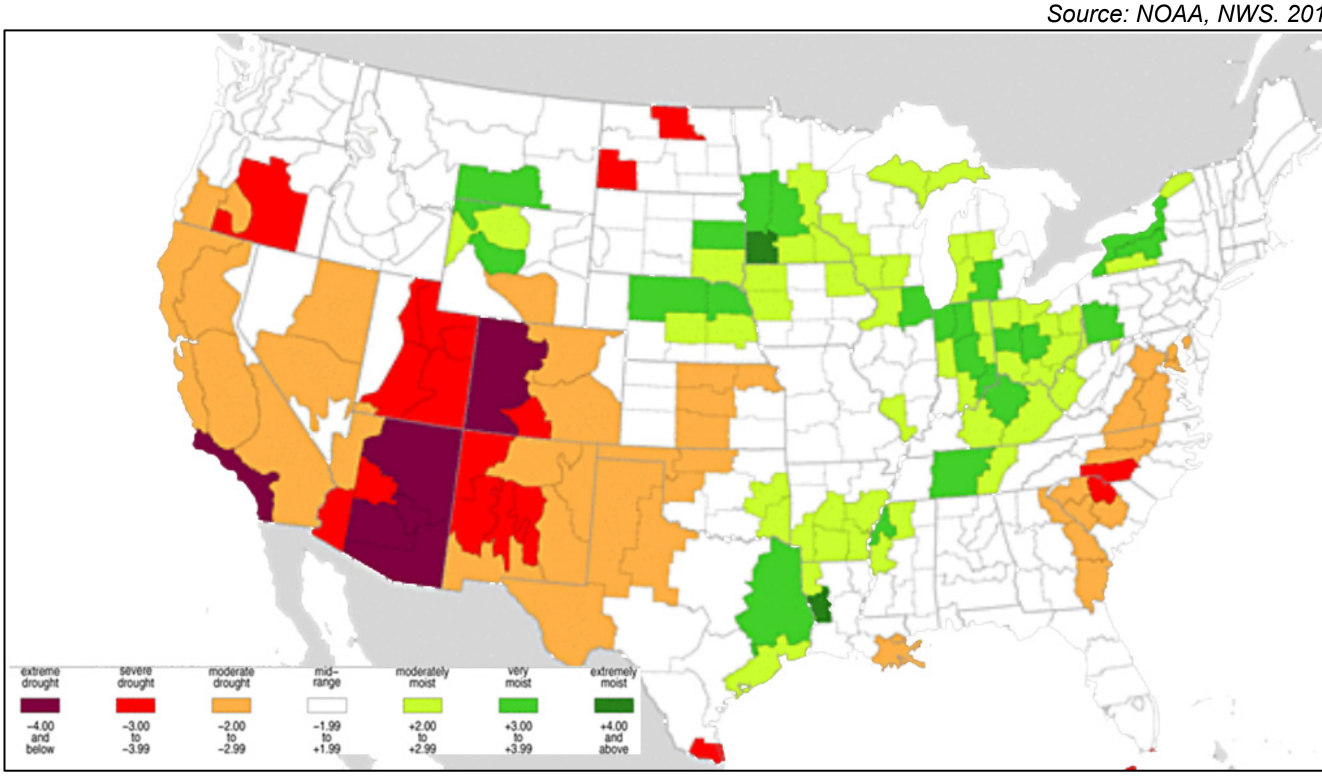


Figure 8-4. Palmer Hydrological Drought Index (March 2018)

Source: National Center for Environmental Information, 2018a

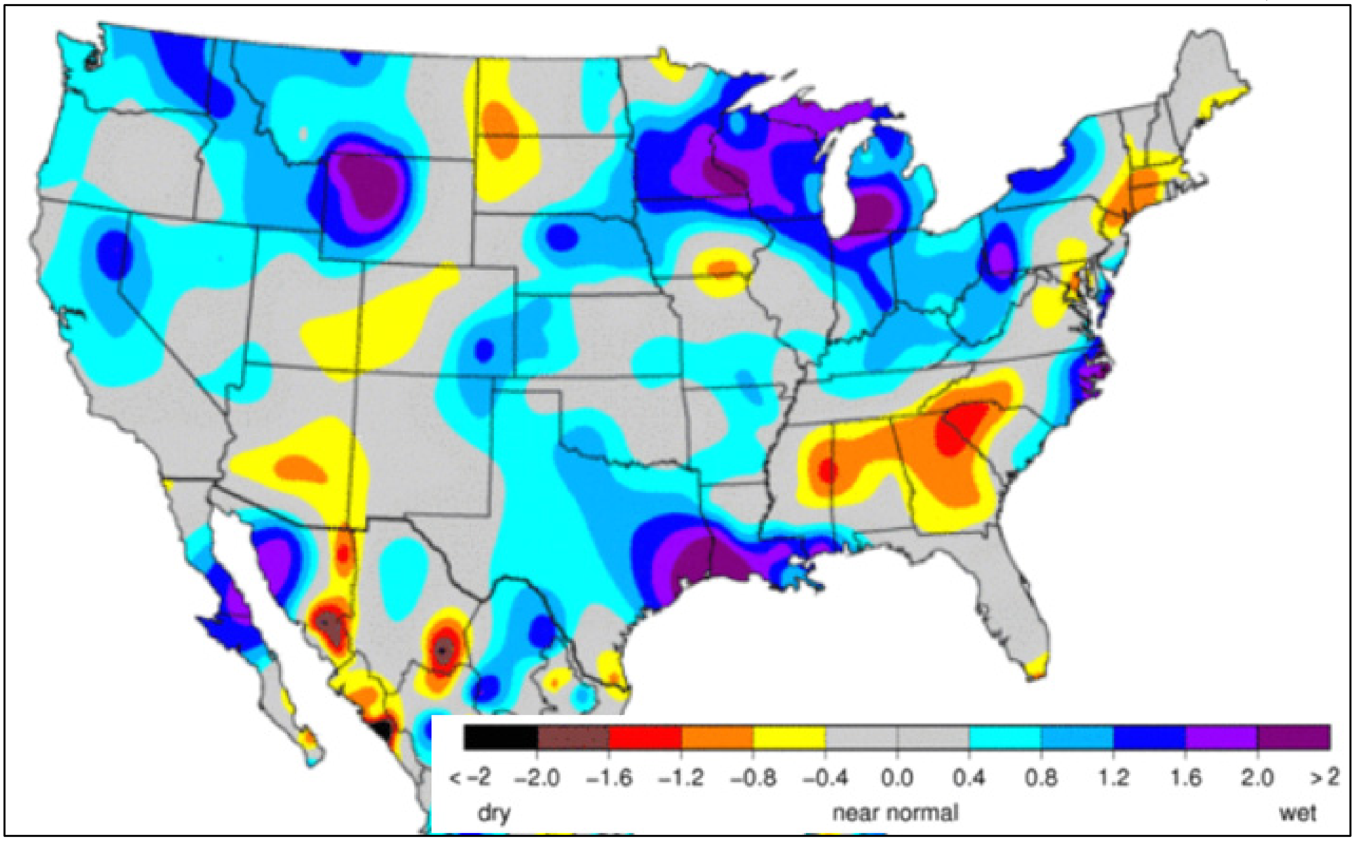


Figure 8-5. 24-Month Standardized Precipitation Index Ending March 2018

8.1.2 Local Water Supply

Much of Del Norte County is located in the Klamath River Basin, which is bounded by the state border to the north, the Pacific Ocean to the west, Redwood Creek and Mad River hydrological units to the south and Sacramento valley to the east. The planning area is part of the North Coast Resource Partnership, which in 2014 published the *North Coast Regional Water Management Plan*. The North Coast Region includes four entire counties, including Del Norte, as well as major portions of two counties and smaller portions of four other counties.

Water supply in the planning area comes from both surface water and groundwater sources. Surface water in the North Coast Region is extremely dependent on precipitation and resources are currently overallocated. There are three groundwater basins providing water supply: Smith River Plain, Lower Klamath River Valley, and Prairie Creek Area. The amount of groundwater varies with precipitation, infiltration and annual withdrawals. From 2005 to 2010, groundwater accounted for 35 percent of the region's overall water supply; groundwater represents a larger portion of the water supply for many of the region's rural communities. There are estimated to be fewer than 1,300 wells in Del Norte County and six water supply and/or wastewater service providers in the planning area: Bertsch-Oceanview Community Services District; Crescent City Water District; Gasquet Community Services District; Klamath Community Services District; Smith River Community Services District; and Yurok Tribe (North Coast Resource Partnership, 2014).

8.1.3 California Drought Response

During critically dry years, the California State Water Resources Control Board can mandate conservation by water users and agencies to address statewide water shortages. Table 8-1 lists State Drought Management Program stages mandated to water right holders.

Table 8-1. State Drought Management Program

Drought Stage	State Mandated Customer Demand Reduction	Rate Impacts
Stage 0 or 1	<10%	Normal rates
Stage 2	10 to 15%	Normal rates; Drought surcharge
Stage 3	15 to 20%	Normal rates; Drought surcharge
Stage 4	>20%	Normal rates, Drought surcharge

8.2 HAZARD PROFILE

8.2.1 Past Events

Periods of Drought in California

The California water code does not include a statutory definition of drought; however, references to drought in state code generally relate to issues of water shortage (California Code of Regulations (CCR), 2017). California Department of Water Resources hydrologic data from the early 1900s shows multi-year droughts from 1912 to 1913, 1918 to 1920, 1922 to 1924, and 1928 to 1934 (CA DWR, 2017). Subsequent prolonged droughts in California have all impacted the planning area to some degree:

- **2012 to 2017 Drought—**California's last drought set several records for the state. The period from 2012 to 2014 ranked as the driest three consecutive years for statewide precipitation. Calendar year 2014 set new records for statewide average temperatures and for record-low water allocations from the State Water Project and the federal Central Valley Project. Calendar year 2013 set minimum annual precipitation records for many communities. Detailed executive orders and regulations addressed water conservation and management. The statewide drought emergency was lifted in April 2017.
- **2007 to 2009 Drought**—The state 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 state proclaimed a state of emergency for the entire state as severe drought continued. The largest court-ordered water restriction in state history (at the time) was imposed.
- **1987 to 1992 Drought** —California received precipitation well below average levels for four consecutive years. While the Central Coast was most affected, the Sierra Nevada range in Northern California and the Central Valley counties were also affected. During this drought, only 56 percent of average runoff for the Sacramento Valley was received. In 1991, the State Water Project sharply decreased deliveries to water suppliers. By February 1991, all 58 counties in California were experiencing drought. Urban areas as well as agricultural areas were impacted.
- **1976 to 1977 Drought**—California had a severe drought due to lack of rainfall during the winters of 1976 and 1977. 1977 was the driest period on record in California at that time, with the previous winter recorded as the fourth driest in California's hydrological history at that time. The cumulative impact led to widespread water shortages and severe water conservation measures statewide. Only 37 percent of the average Sacramento Valley runoff was received. Over $2.6 billion in crop damage was recorded in 31 counties. FEMA declared a drought emergency (Declaration 3023-EM) on January 20, 1977 for 58 California counties; however, Del Norte County was not included in this declaration.

Agriculture-Related Drought Disasters

The U.S. Department of Agriculture (USDA) Farm Service Agency provides assistance for agriculture-related losses resulting from drought, flood, fire, freeze, tornadoes, pest infestation, and other natural disasters. The U.S. Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to them. Between 2012 and 2017, the period for which data is available, Del Norte County was included in drought-related USDA declarations in 2012, 2013, 2014, 2015, and 2016 (USDA Farm Services Agency, 2018).

8.2.2 Location

Drought is a regional phenomenon that has the potential to impact the entire planning area. A drought affects all aspects of the environment and the community simultaneously and has the potential to directly or indirectly impact every person in the planning area as well as adversely affect the local economy.

8.2.3 Frequency

Historical drought data for the planning area indicate there have been four significant multi-year droughts in the last 40 years (1976 to 2017), amounting to a severe drought every 10 to 11 years on average. The planning area has also been included in USDA drought disaster declarations in six of the past seven years. Drought has a high probability of occurrence in the planning area.

8.2.4 Severity

Drought can have a widespread impact on the environment and the economy, although it typically does not result in loss of life or damage to structures, as do other natural disasters. The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. Vulnerability of an activity to drought depends on its water demand and the water supplies available to meet the demand.

National Drought Mitigation Center Impact Categories

The National Drought Mitigation Center uses three categories to describe likely drought impacts:

- **Economic Impacts**—These impacts of drought cost people (or businesses) money. Farmers' crops are destroyed; low water supply necessitates spending on irrigation or drilling of new wells; water-related businesses (such as sales of boats and fishing equipment) may experienced reduced revenue.
- **Environmental Impacts**—Plants and animals depend on water. When a drought occurs, their food supply can shrink and their habitat can be damaged.
- **Social Impacts**—Social impacts include public safety, health, conflicts between people when there is not enough water to go around, and changes in lifestyle.

Drought Impact Reporter

The National Drought Mitigation Center developed the Drought Impact Reporter in response to the need for a national drought impact database for the United States. Information comes from a variety of sources: on-line, drought-related news stories and scientific publications, members of the public who visit the website and submit a drought-related impact for their region, members of the media, and staff of government agencies. The database is being populated beginning with the most recent impacts and working backward in time.

The Drought Impact Reporter indicates 78 impacts from drought that specifically affected Del Norte County from 2008 through April 2018 (Drought Impact Reporter, 2018). Most (85 percent) are based on media reports. The following are the reported numbers of impacts by category (some incidents are assigned to more than one impact category):

- Agriculture—29
- Business and Industry—5
- Energy—3
- Fire—9
- Plants and Wildlife—18
- Relief, Response, and Restrictions—39
- Society and Public Health—25
- Tourism and Recreation—7
- Water Supply and Quality—39

The following are Drought Impact Reporter summaries of notable incidents that impacted Del Norte County within the past five years (Drought Impact Reporter, 2018):

- **February 16, 2018**—The U.S. Bureau of Reclamation is asking for public comments to determine how best to balance its obligations to protect fish species and also make sure that Klamath Basin irrigators and water districts have access to water in what is shaping up to be a dry year. (Eureka Times-Standard)
- **February 13, 2018**—The California State Water Resources Control Board was considering regulations that would make seven particular wasteful water practices a crime, including activities such as over-watering lawns and irrigating street medians. (Orange County Register)
- **March 6, 2017**—The 2017 fishing season does not look to be good for California salmon anglers because estimated numbers of adult fall-run Chinook salmon off the coast were very low. Roughly 54,200 adult fish from the Klamath River are swimming off the Pacific Coast, some of the lowest numbers on record and just a fraction of the count in 2016 when 142,000 fish returned. (The Sacramento Bee)
- **January 12, 2017**—California's trees, stressed and worn from years of drought, have fallen and killed two people during the past month. Many of the trees seemed strong and sturdy, but give way amid heavy rains and winds. A woman was killed on Jan. 7 in Northern California when a tree collapsed on a golf course. (Orange County Register)
- **August 26, 2015**—A federal judge in Fresno denied a request for a temporary restraining order to block emergency water releases to protect Klamath River salmon from low, warm river flows. The Westlands Water District and San Luis & Delta-Mendota Water Authority sought the order. The judge felt that the water districts were not likely to win their lawsuit, which claims that the U.S. Bureau of Reclamation has no authority to release the water and should have done a more thorough study of the possible environmental harms. The bureau began releasing water for salmon from a reservoir on the Trinity River on Aug. 21. (The Sacramento Bee)
- **July 1, 2015**—Drought and water use by illegal marijuana cultivators along the North Coast was the topic of a meeting of the Joint Committee on Fisheries and Aquaculture. Marijuana growers divert billions of gallons of water, reducing flows for North Coast fisheries and salmon-rearing creeks. (San Jose Mercury News)
- **June 30, 2015**—Parched Northern California suffered three dozen small wildfires over the June 27-28 weekend. Numerous lightning strikes sparked the fires, the largest of which grew to 4 acres. (San Francisco Chronicle)
- **May 25, 2015**—Nearly all of the juvenile chinook salmon in the Klamath River in northern California were infected with a deadly parasite that thrives when the river is warm and low. Additional water releases would wash parasite-laden worms down the river, but water stored in the Klamath Basin reservoirs was already set aside for endangered sucker fish and threatened coho salmon. The Klamath Fish Health Advisory Team say that a major fish kill is likely. Roughly 6 million juvenile Chinook were

being held at the Iron Gate fish hatchery with the hope that conditions will improve and the fish can be released. (Porterville Recorder)

- **February 4, 2015**—Some California residents in the North Coast region faced mandatory water restrictions requiring a cut of 50 percent and achieved some of the lowest per capita water usages in the state. Redwood Valley residents, for example, must use no more than 50 gallons daily. (Los Angeles Times)

8.2.5 Warning Time

Predicting drought depends on the ability to forecast precipitation and temperature. Scientists at this time do not know how to predict drought more than a month in advance for most locations. Only generalized warning can take place due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions.

Determination of when drought begins is based on impacts on water users and assessments of available water supply, including water stored in reservoirs or groundwater basins. Different water agencies have different criteria for defining drought. Some issue drought watch or drought warning announcements.

8.3 SECONDARY HAZARDS

The secondary hazard most commonly associated with drought is wildland fire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. In addition, lack of sufficient water resources can stress trees and other vegetation, making them more vulnerable to infestation from pests, which in turn, can make them more vulnerable to ignition. Millions of board feet of timber have been lost, and in many cases erosion occurred, which caused serious damage to aquatic life, irrigation, and power production by heavy silting of streams, reservoirs, and rivers.

8.4 EXPOSURE

All people, property, and environmental features in the planning area are exposed to drought hazard. Drought can affect a wide range of economic, environmental, and social activities. Its impacts can span many sectors of the economy because water is integral to the ability to produce goods and provide services. The impacts can reach well beyond the area undergoing physical drought.

8.5 VULNERABILITY

8.5.1 Population

The entire population of Del Norte County is vulnerable to drought events. Drought can affect people’s health and safety, including health problems related to low water flows, poor water quality, or dust. Droughts can also lead to loss of human life (National Drought Mitigation Center, 2017). 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 (Centers for Disease Control and Prevention, 2012).

8.5.2 Property

No structures will be directly affected by drought conditions, though some structures may become vulnerable to wildland fires, which are more likely following years of drought. Droughts can have significant impacts on other types of property such as landscaped areas and economically important natural resources. Drought causes the most significant economic impacts on industries that use water or depend on water for their business, most notably agriculture and related sectors (forestry, fisheries, and waterborne activities), power plants, and oil refineries. In addition to losses in yields in crop and livestock production, drought is associated with increased insect infestations, plant diseases, and wind erosion. Drought can lead to other losses because so many sectors are affected—losses that include reduced income for farmers and reduced business for retailers and others who provide goods and services to farmers. This leads to unemployment, increased credit risk for financial institutions, capital shortfalls, and loss of tax revenue. Prices for food, energy, and other products may also increase as supplies decrease.

8.5.3 Critical Facilities

Critical facilities as defined for this plan will continue to be operational during a drought. Critical facility features such as landscaping may not be maintained due to limited water resources, but the risk to critical facility core functions is low.

8.5.4 Environment

Drought generally does not affect groundwater sources as quickly as surface water supplies, but groundwater supplies generally take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when stream flows are lowest.

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 some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes and vegetation. However, many species will eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

8.6 FUTURE TRENDS IN DEVELOPMENT

Land use planning is directed by general plans adopted under California's General Planning Law. Both the Del Norte County and Crescent City general plans have policies related to water supply and delivery. In addition, water providers in the planning area have plans and programs in place to balance competing needs for water resources within the planning area.

8.7 SCENARIO

A multi-year drought that impacts the entire west or the State of California, similar to the 2012 to 2017 drought, is the worst-case scenario for the planning area. The 2012-2017 drought and the wildland fires and floods that followed it caused extensive damage to natural systems. If another severe drought occurs before these systems have a chance to recover, it could exacerbate the stress already placed on existing planning area water resources.

8.8 ISSUES

The planning team has identified the following drought-related issues:

- The probability of drought frequencies and durations may increase due to climate change.
- The promotion of active water conservation even during non-drought periods should be encouraged.
- The planning area should plan for frequent droughts or multi-year droughts that can limit the ability to successfully recover from one drought and prepare for the next—particularly considering the longevity of the 2012 to 2017 drought.
- Surface water resources in the North Coast region are already overallocated and are causing stress between competing users such as agricultural uses and the ecosystem needs, particular for threatened or endangered species in the planning area.
- If tension increases over surface water, additional drawn-downs to groundwater supplies may occur.

9. EARTHQUAKE

9.1 GENERAL BACKGROUND

An earthquake is the vibration of the earth's surface following a release of energy in the earth's crust. This energy can be generated by a sudden dislocation of the crust or by a volcanic eruption. Most destructive quakes are caused by dislocations of the crust. The crust may first bend and then, when the stress exceeds the strength of the rocks, break and snap to a new position. In the process of breaking, vibrations called "seismic waves" are generated. These waves travel outward from the source of the earthquake at varying speeds.

Geologists have found that earthquakes tend to reoccur along faults, which are zones of weakness in the earth's crust. Even if a fault zone has recently experienced an earthquake, there is no guarantee that all the stress has been relieved. Another earthquake could still occur. In fact, relieving stress along one part of a fault may increase it in another part.

California is seismically active because of movement of the North American Plate, east of the San Andreas Fault, and the Pacific Plate to the west, which includes the state's coastal communities. Movement of the tectonic plates against one another creates stresses that build as the rocks are gradually deformed. The rock deformation, or strain, is stored in the rocks as elastic strain energy. When the strength of the rock is exceeded, rupture occurs along a fault. The rocks on opposite sides of the fault slide past each other as they spring back into a relaxed position. The strain energy is released partly as heat and partly as elastic waves called seismic waves. The passage of these seismic waves produces the ground shaking in earthquakes.

Faults are more likely to have future earthquakes on them if they have more rapid rates of movement, have had recent earthquakes along them, experience greater total displacements, and are aligned so that movement can relieve the accumulating tectonic stresses. Geologists classify faults by their relative hazards. "Active" faults, which represent the highest hazard, are those that have ruptured to the ground surface during the Holocene period (about the last 11,000 years). "Potentially active" faults are those that displaced layers of rock from the Quaternary period (the last 1,800,000 years) (California Department of Conservation, 2003).

Determining if a fault is "active" or "potentially active" depends on geologic evidence, which may not be available for every fault. Nearly all the movement between the two plates, and therefore the majority of the seismic hazards, are on the well-known active faults. However, inactive faults, where no displacements have been recorded, also have the potential to reactivate or experience displacement along a branch sometime in the future. An example of a fault zone that has been reactivated is the Foothills Fault Zone. The zone was considered inactive until evidence of an earthquake (approximately 1.6 million years ago) was found near Spenceville, California. Then, in 1975, an earthquake occurred on another branch of the zone near Oroville, California (now known as the Cleveland Hills Fault). The State Division of Mines and Geology indicates that increased earthquake activity throughout California may cause tectonic movement along currently inactive fault systems.

9.1.1 Earthquake Classifications

Earthquakes are typically classified in one of two ways: By the amount of energy released, measured as magnitude; or by the impact on people and structures, measured as intensity.

Magnitude

An earthquake's magnitude is a measure of the energy released at the source of the earthquake. Magnitude is commonly expressed by ratings on the moment magnitude scale (M_W), the most common scale used today (USGS, 2017a). This scale is based on the total moment release of the earthquake (the product of the distance a fault moved and the force required to move it). The scale is as follows:

- Great—Mw > 8
- Major—Mw = 7.0 – 7.9
- Strong—Mw = 6.0 – 6.9
- Moderate—Mw = 5.0 – 5.9
- Light—Mw = 4.0 – 4.9
- Minor—Mw = 3.0 – 3.9
- Micro—Mw < 3

Intensity

The most commonly used intensity scale is the modified Mercalli intensity scale. Ratings of the scale as well as the perceived shaking and damage potential for structures are shown in Table 9-1. The modified Mercalli intensity scale is generally represented visually using shake maps, which show the expected ground shaking at any given location produced by an earthquake with a specified magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region, depending on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust. A shake map shows the variation of ground shaking in a region immediately following significant earthquakes (for technical information about shake maps see USGS, 2018).

Table 9-1. Mercalli Scale and Peak Ground Acceleration Comparison

Modified Mercalli Scale	Perceived Shaking	Potential Structure Damage		Estimated PGA[a] (%g)
		Resistant Buildings	Vulnerable Buildings	
I	Not Felt	None	None	<0.17%
II-III	Weak	None	None	0.17% - 1.4%
IV	Light	None	None	1.4% - 3.9%
V	Moderate	Very Light	Light	3.9% - 9.2%
VI	Strong	Light	Moderate	9.2% - 18%
VII	Very Strong	Moderate	Moderate/Heavy	18% - 34%
VIII	Severe	Moderate/Heavy	Heavy	34% - 65%
IX	Violent	Heavy	Very Heavy	65% - 124%
X – XII	Extreme	Very Heavy	Very Heavy	>124%

a. PGA = peak ground acceleration. Measured in percent of g, where g is the acceleration of gravity

Sources: USGS, 2008; USGS, 2010

9.1.2 Ground Shaking

The ground experiences acceleration as it shakes during an earthquake. The peak ground acceleration (PGA) is the largest acceleration recorded by a monitoring station during an earthquake. PGA is a measure of how hard the earth shakes in a given geographic area. It is expressed as a percentage of the acceleration due to gravity (%g). Horizontal and vertical PGA varies with soil or rock type. Earthquake hazard assessment involves estimating the annual probability that certain ground accelerations will be exceeded, and then summing the annual probabilities over a time period of interest.

National maps of earthquake shaking hazards provide information for creating and updating seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities and land use planning. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown et al., 2001). The USGS updated the National Seismic Hazard Maps in 2014. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps. The 2014 map, shown in Figure 9-1, represents the best available data as determined by the USGS.

Source: USGS, 2014

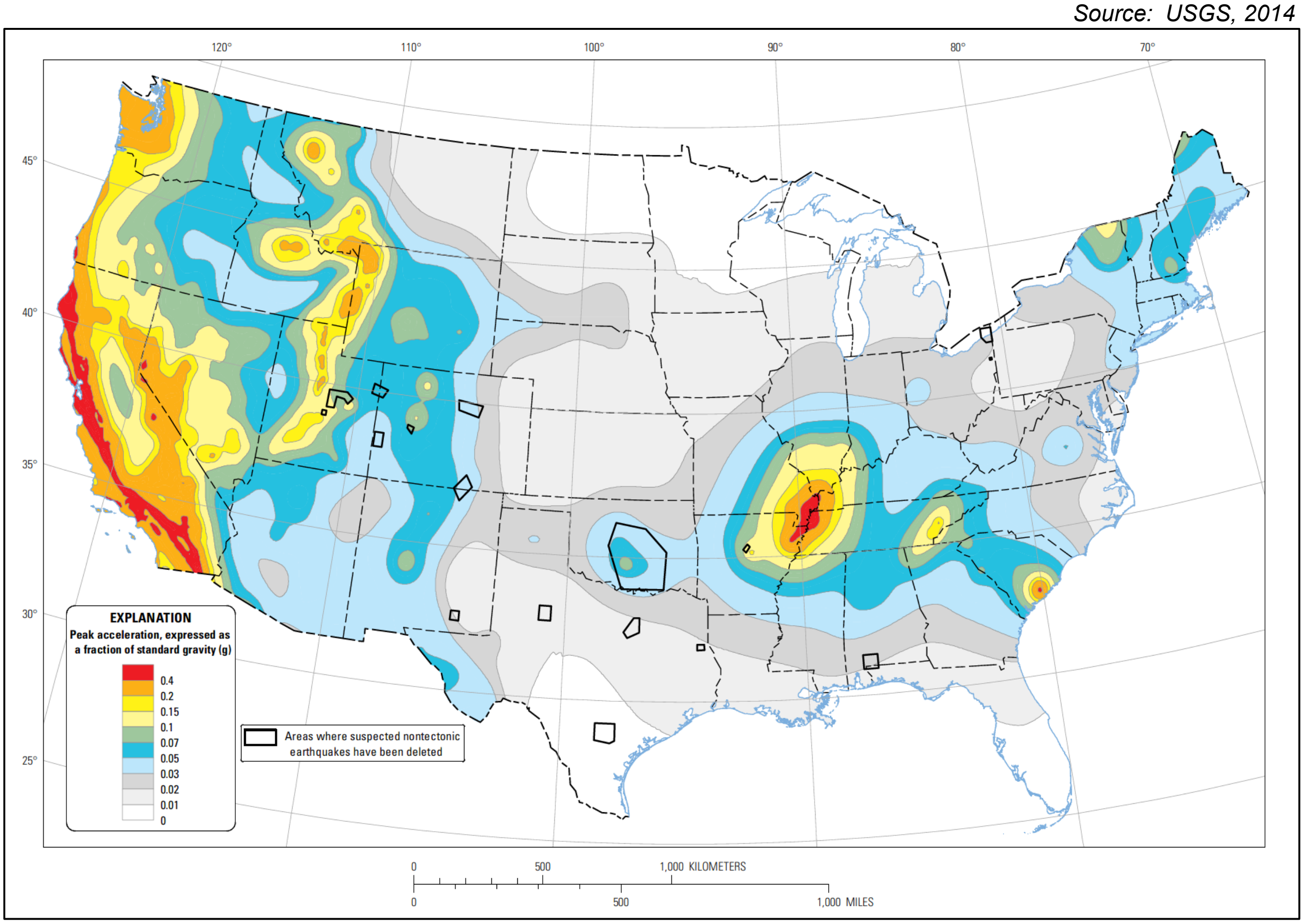


Figure 9-1. Peak Acceleration (%g) with 10% Probability of Exceedance in 50 Years

Building codes that include seismic provisions specify the horizontal force due to lateral acceleration that a building should be able to withstand during an earthquake. The determination of how great a force a structure should be able to withstand is based on probabilistic seismic mapping of the area. Such mapping identifies the probability of a given magnitude of ground shaking occurring over a specified time period. A common probabilistic rating used for building design is the level of ground shaking that has a 10 percent probability of being equaled or exceeded in a 50-year period.

Buildings, bridges, highways and utilities built to meet modern seismic design requirements are typically able to withstand earthquakes better, with less damage and disruption. PGA values are directly related to these lateral forces that could damage “short period structures” (e.g. single-family dwellings). Longer-period response components determine the lateral forces that damage larger structures with longer natural periods (apartment buildings, factories, high-rises, bridges). Table 9-1 lists damage potential and perceived shaking by PGA factors, compared to the Mercalli scale.

9.1.3 Liquefaction and Soil Types

Soil liquefaction occurs when water-saturated sands, silts or gravelly soils are shaken so violently that the individual grains lose contact with one another and float freely in the water, turning the ground into a pudding-like liquid. Building and road foundations lose load-bearing strength and may sink into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people. A program called the National Earthquake Hazard Reduction Program (NEHRP) creates maps based on soil characteristics to help identify locations subject to liquefaction. Table 9-2 summarizes NEHRP soil classifications. NEHRP Soils B and C typically can sustain ground shaking without much effect, dependent on the earthquake magnitude. The areas that are commonly most affected by ground shaking have NEHRP Soils D, E and F (see SCEC, 2018 for general information on NEHRP soils data). In general, these areas are also most susceptible to liquefaction.

Table 9-2. NEHRP Soil Classification System

NEHRP Soil Type	Description	Mean Shear Velocity to 30 m (m/s)
A	Hard Rock	1,500
B	Firm to Hard Rock	760-1,500
C	Dense Soil/Soft Rock	360-760
D	Stiff Soil	180-360
E	Soft Clays	< 180
F	Special Study Soils (liquefiable soils, sensitive clays, organic soils, soft clays >36 m thick)	

9.2 HAZARD PROFILE

9.2.1 Past Events

The planning area has not experienced an earthquake event that has resulted in a federal disaster declaration for the County. However, the M7.2 Cape Mendocino event, which struck on April 25, 1992, and resulted in a federal disaster declaration for Humboldt County (DR-943) was felt within the area. Table 9-3 lists seismic events with a magnitude of 5.0 or larger that were felt within the planning area since 2000.

9.2.2 Location

Fault Locations

California has thousands of known faults, but only some are known to be active and pose significant hazards. The USGS maintains a map of information on faults that show evidence of seismic activity with the past 1.6 million years (the Quaternary period), as well as a database of faults that is searchable by location.

Table 9-3. Recent Earthquakes Magnitude 5.0 or Larger felt within Del Norte county

Date	Magnitude	Epicenter Location		
		Distance	Direction	Nearest City
July 29, 2017	5.1	136 km	SW	Ferndale, CA
March 10, 2014	6.8	129 km	NW	Ferndale, CA
February 13, 2012	5.6	76 km	SSE	Weitchpec, CA
January 1, 2010	6.5	129 km	SSW	Ferndale, CA (offshore)
February 26, 2007	5.4	51 km	W	Ferndale, CA
July 16, 2006	5.0	6 km	WNW	Punta Gorda, CA
March 25, 2006	5.0	3 km	WNW	Punta Gorda, CA
June 14, 2005	7.2	156 km	W	Trinidad, CA
August 15, 2003	5.3	121 km	WNW	Ferndale, CA
June 17, 2002	5.27	37 km	W	Eureka, CA
September 20, 2001	5.10	80 km	WNW	Punta Gorda, CA
January 13, 2001	5.19	92 km	WNW	Ferndale, CA
March 16, 2000	5.59	N/A	N/A	Offshore Punta Gorda, Point Mendocino

Source: Earthquake Catalogs, Northern California Earthquake Data Center, 2007; Earthquake Catalog, USGS, 2018a

The USGS database shows two Class A faults within the planning area: Bald Mountain-Big Lagoon and Lost Man. Class A faults are those where "Geologic evidence demonstrates the existence of a Quaternary fault of tectonic origin, whether the fault is exposed for mapping or inferred from liquefaction or other deformational features (USGS, 2018b)."

Faults outside the planning area also can impact its people, property, and economy. A rupture in the Cascadia Subduction Zone, for example, would have considerable impacts on the planning area (Pacific Northwest Seismic Network, 2018). This is the 600-mile-long offshore zone, from northern Vancouver Island to Cape Mendocino, where the Juan de Fuca plate is being subducted below the North American plate. Similarly, an earthquake in the nearby fault zone around Trinidad in Humboldt County likely would affect the planning area.

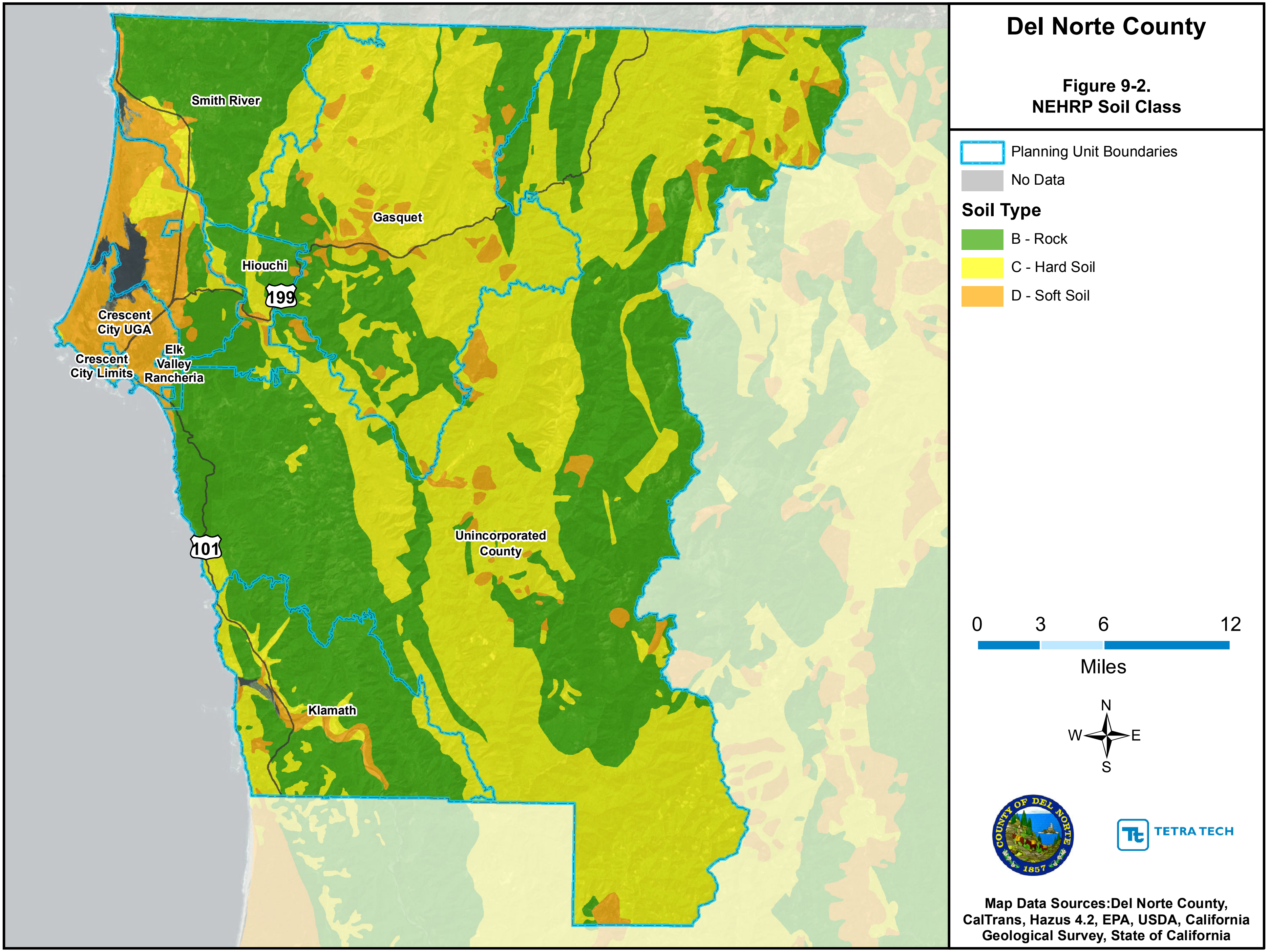
NEHRP Soil Type Mapping

Figure 9-2 shows NEHRP soil classifications in the planning area. Liquefaction mapping for the planning area is not available.

9.2.3 Frequency

California experiences hundreds of earthquakes each year, most with minimal damage and magnitudes below 3.0. Generally, only two or three events large enough to cause moderate damage (magnitude 5.5 or higher) occur each year. Del Norte County is susceptible to regular earthquake activity, as evidenced by the five seismic events with a magnitude of 5.5 or higher experienced from 2000 through 2018 (see Table 9-3). Since 2000, the planning area has been impacted by a magnitude 5.5 or greater event every 3.6 years, on average.

Scientists have developed earthquake forecast models that estimate the magnitude, location and likelihood of earthquake fault ruptures throughout the State. The most recent model, the Uniform California Earthquake Rupture Forecast, provides estimates of events and repeat times for regions in California (Field et al., 2015). Table 9-4 shows the estimates for the Northern California region. These estimates do not account for an earthquake on the Cascadia Subduction Zone that would impact the planning area.



Del Norte County

Figure 9-2. NEHRP Soil Class

Table 9-4. Earthquake Forecast for Northern California

Magnitude (Greater than or equal to)	Average Repeat Time (years)	30-Year Likelihood of One or More Events	Readiness[a]
5	0.24	100%	1.0
6	2.4	100%	1.0
6.7	12	95%	1.0
7	25	76%	1.1
7.5	92	28%	1.0
8	645	5%	1.1

a. Readiness indicates that factor by which likelihoods are currently elevated, or lower, because of the length of time since the most recent large earthquake.

Source: Field et al., 2015

Locally, the probability of a magnitude-7.5 or greater event over a 30-year time is 0.11 percent for Subsection 3 of the Trinidad fault zone and 0.69 percent for Subsection 8 of the Big Lagoon-Bald Mountain fault zone. The recurrence interval for a megathrust event on the Cascadia Subduction zone is 400 to 600 years on average, although recurrences appear to be irregular. The probability of a magnitude-9.0 earthquake in the subduction zone over the next 50 years is estimated to be about 10 percent (Cascadia Region Earthquake Workgroup, 2013).

9.2.4 Severity

The severity of an earthquake can be expressed in terms of intensity or magnitude (see Section 9.1.1). the State of California Department of Conservation probabilistic ground shaking maps, based on current information about fault zones, show the PGA that has a certain probability of being exceeded in a 50-year period. The northern California area, including Del Norte County, is in a moderate-risk area, with a 10-percent probability in a 50-year period of ground shaking from a seismic event exceeding 40 percent of gravity in some part of the County. Figure 9-3 shows the expected peak horizontal ground accelerations for this probability.

9.2.5 Warning Time

There is no current reliable way to predict the day or month that an earthquake will occur at any given location. Research is being done with warning systems that use the low energy waves that precede major earthquakes. These potential warning systems give approximately 40 seconds notice that a major earthquake is about to occur. The warning time is very short but it could allow for someone to get under a desk, step away from a hazardous material they are working with, or shut down a computer system.

9.3 SECONDARY HAZARDS

Earthquakes can cause disastrous landslides. River valleys are vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils. Earthen dams and levees are highly susceptible to seismic events, and the impacts of their eventual failures can be considered secondary risk exposure to earthquakes. Depending on the location, earthquakes can also trigger tsunamis. Additionally, fires can result from gas lines or power lines that are broken or downed during the earthquake. It may be difficult to control a fire, particularly if the water lines feeding fire hydrants are also broken.

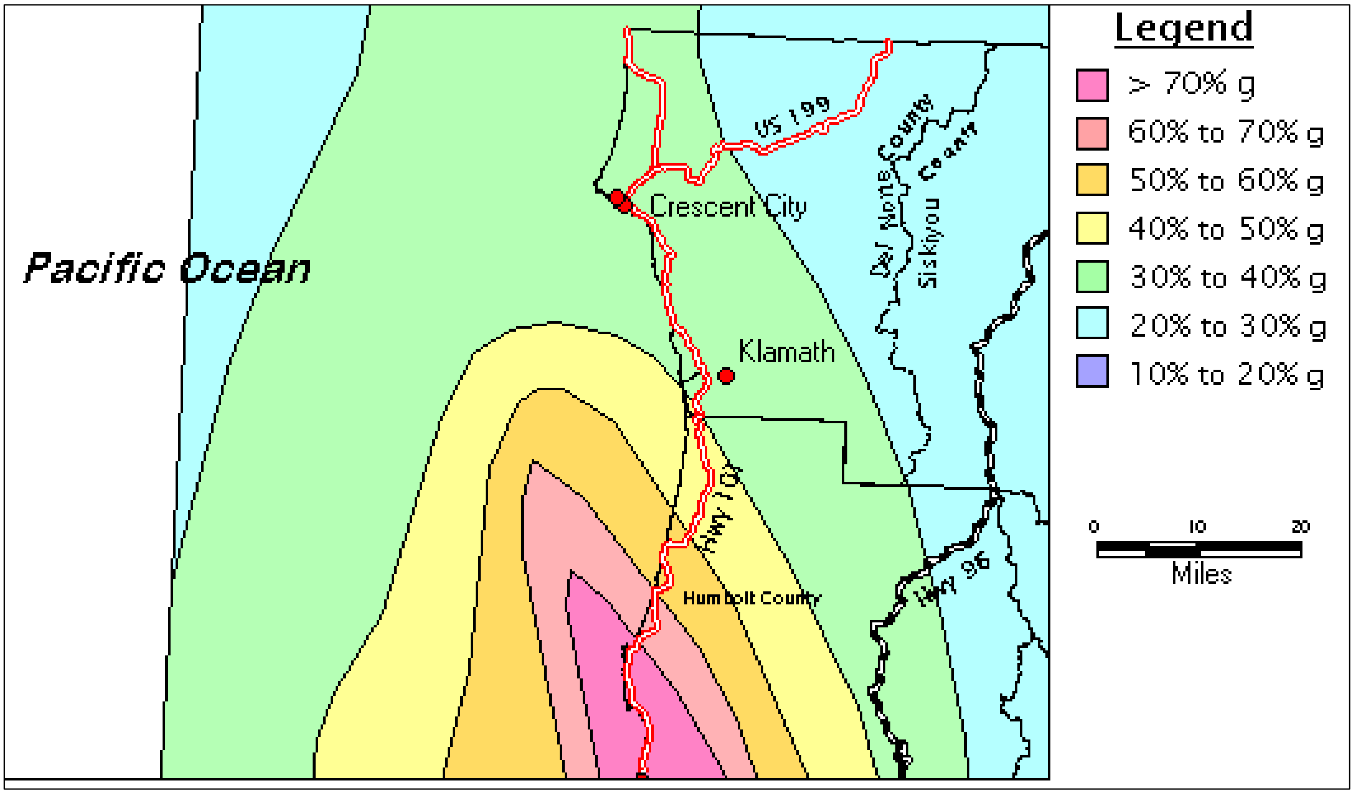


Figure 9-3. Peak Horizontal Acceleration with 10% Probability of Exceedance in 50 Years

9.4 EXPOSURE

9.4.1 Population

The entire population of the planning area is potentially exposed to some degree to direct damage from earthquakes or indirect impacts such as business interruption, road closures, and loss of function of utilities.

9.4.2 Property

There are estimated to be 8,776 buildings in the planning area. The majority of these buildings (91 percent) are residential use. All buildings are considered to be exposed to the earthquake hazard.

9.4.3 Critical Facilities and Infrastructure

Since the entire planning area has exposure to the earthquake hazard, all 260 critical facilities and infrastructure components are considered to be exposed. The breakdown of the numbers and types of facilities is presented in Table 4-3 and Table 4-4.

9.4.4 Environment

The entire planning area is exposed to the earthquake hazard, including all natural resources, habitat and wildlife.

9.5 VULNERABILITY

Earthquake vulnerability data was generated using a Hazus analysis. Three USGS event scenarios were modeled:

- Big Lagoon-Bald Mountain M7.9—A magnitude 7.9 earthquake on the Big Lagoon-Bald Mountain fault with an epicenter 13 miles south of Crescent City (see Figure 9-4 and Figure 9-5)
- Trinidad Alt 1 M7.5—A magnitude 7.5 earthquake on the Trinidad fault with an epicenter 43 miles south-southeast of Crescent City (see Figure 9-4 and Figure 9-6)
- Cascadia M9.0—A magnitude 9.0 earthquake on the Cascadia Subduction Zone fault with an epicenter 278 miles north-northwest of Crescent City (see Figure 9-4 and Figure 9-7)

In addition, standard Hazus 100-year probabilistic mapping for the planning area was assessed. Probabilistic maps are not based on a specific earthquake event magnitude or location; instead, they show the ground acceleration at each point that has a given chance of being exceeded in any given year, regardless of the earthquake source. The 100-year probabilistic earthquake map shows the acceleration with a 1-percent chance of being exceeded in a given year (see Figure 9-8).

The analysis results are summarized in the sections below, and more detailed information, broken down by planning unit, can be found in Appendix C. The results of this analysis are likely to significantly underestimate risk, due to limitations in the modeling parameters:

- There is no liquefaction data available for the planning area, so damage estimates do not consider potential structural issues pertaining to liquefiable soils
- All critical facilities are assumed to have been built to high code standards. This may not be the case, especially for older facilities.
- The Hazus model does not take into account the extreme duration of shaking expected during a Cascadia Subduction Zone event. Some models estimate that ground shaking will occur for up to five minutes.

9.5.1 Population

Residents of High Risk Areas

The degree of vulnerability is dependent on many factors, including the age and construction type of the structures people live in, the soil type their homes are constructed on, their proximity to fault location, etc. There are estimated to be 24,947 people in over 8,440 households living on NEHRP D soils in the planning area. This is about 87 percent of the total population.

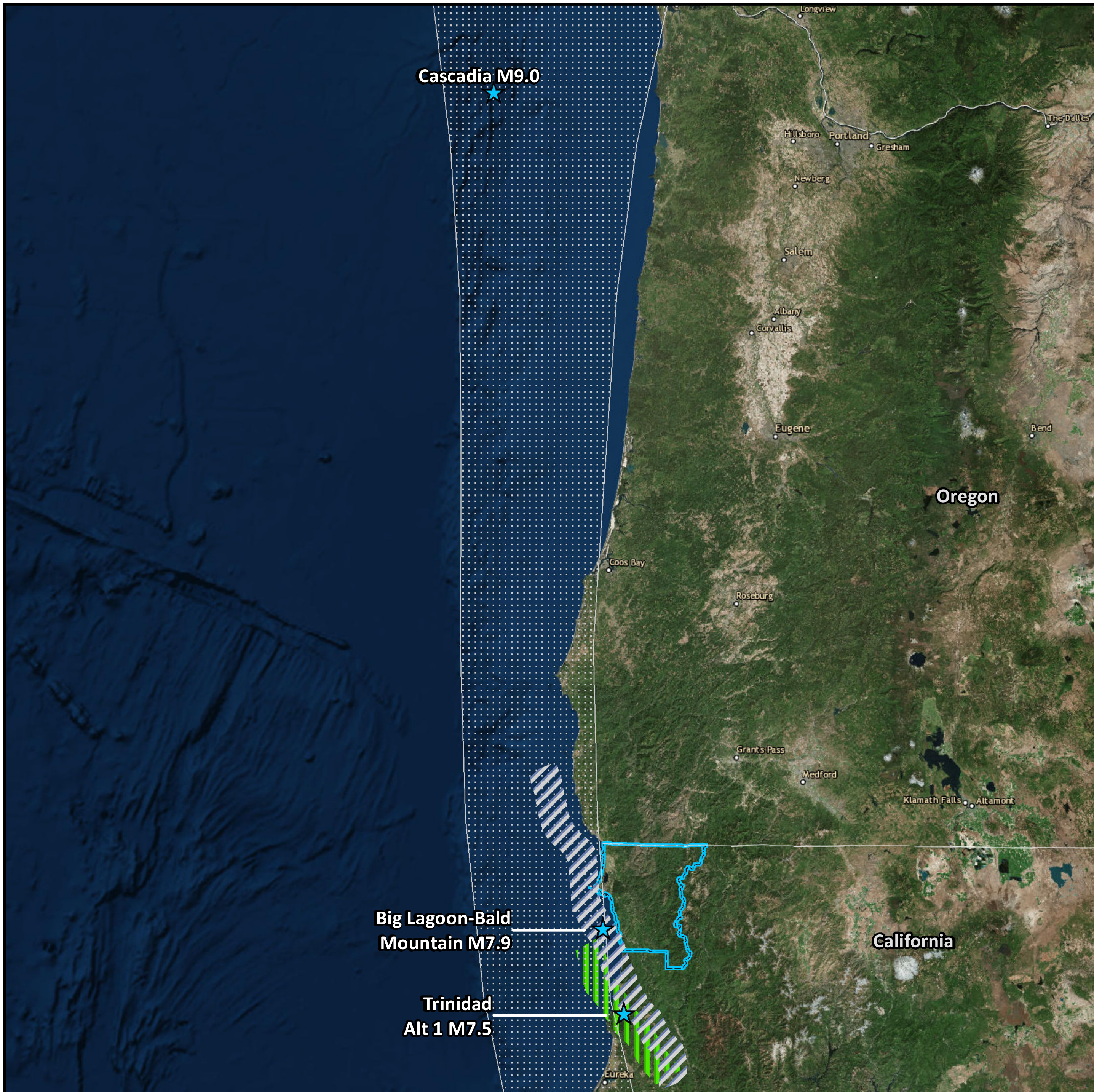
Susceptible Population Groups

Two groups are particularly vulnerable to earthquake hazards:

- **Population Below Poverty Level**—An estimated 5,047 households in NEHRP D soils areas have household incomes less than $50,000 per year. This is about 60 percent of all households located on NEHRP D soils. These households may lack the financial resources to improve their homes to prevent or mitigate earthquake damage. Economically disadvantaged residents are also less likely to have insurance to compensate for losses incurred during earthquakes.
- **Population Over 65 Years Old**—An estimated 3,287 residents in areas of NEHRP D soils are over 65 years old. This is about 13 percent of all residents in these areas of NEHRP D soils. This population group is vulnerable because they are more likely to need special medical attention, which may not be available due to isolation caused by earthquakes. Elderly residents also have more difficulty leaving their homes during earthquake events and could be stranded in dangerous situations.

Del Norte County

**Figure 9-4.
Earthquake Scenario Faults and Epicenters**



Del Norte County

Earthquake Scenario Epicenters

Cascadia Fault Zone

Big Lagoon - Bald Mountain Fault Zone

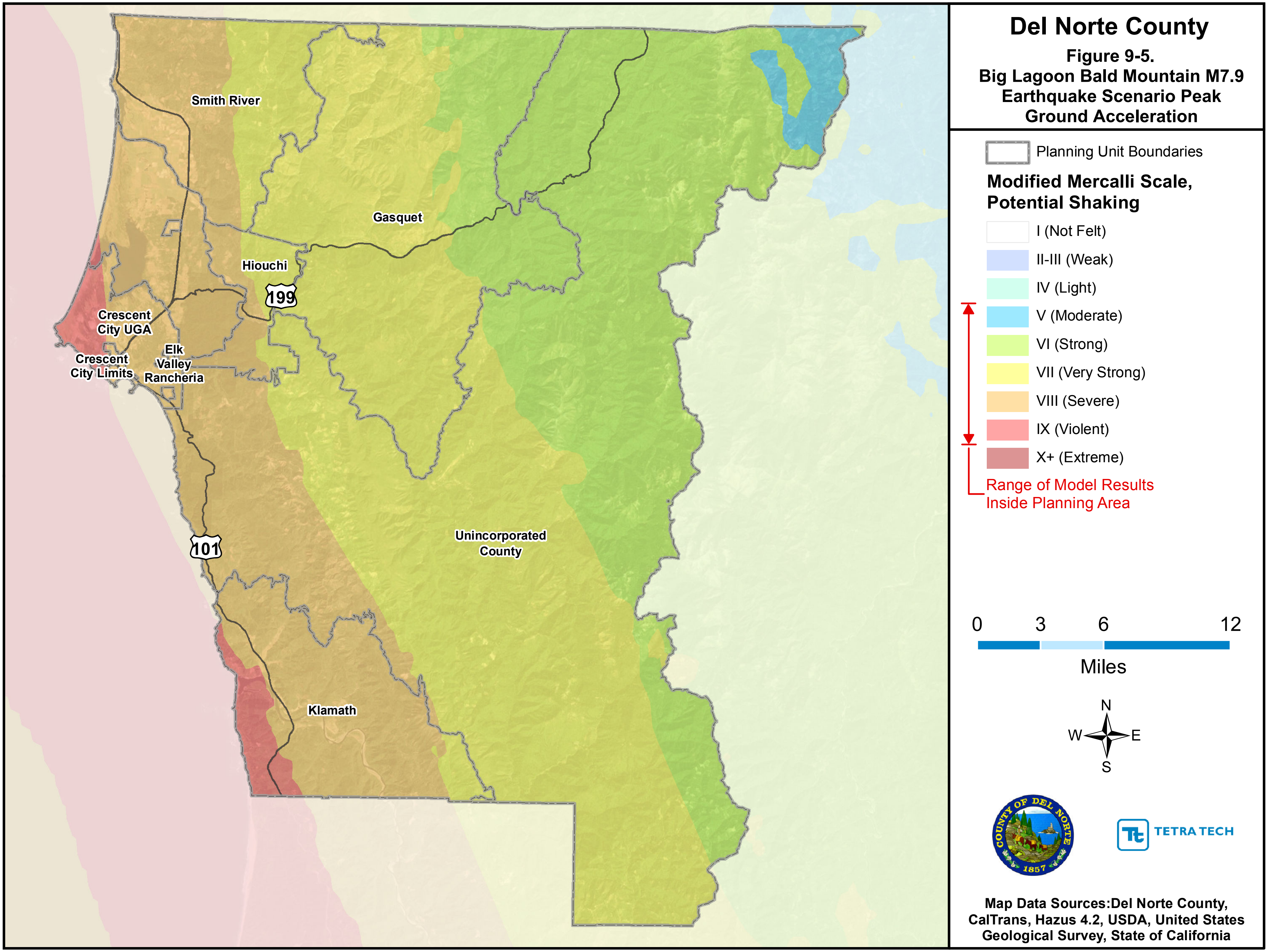
Trinidad Fault Zone

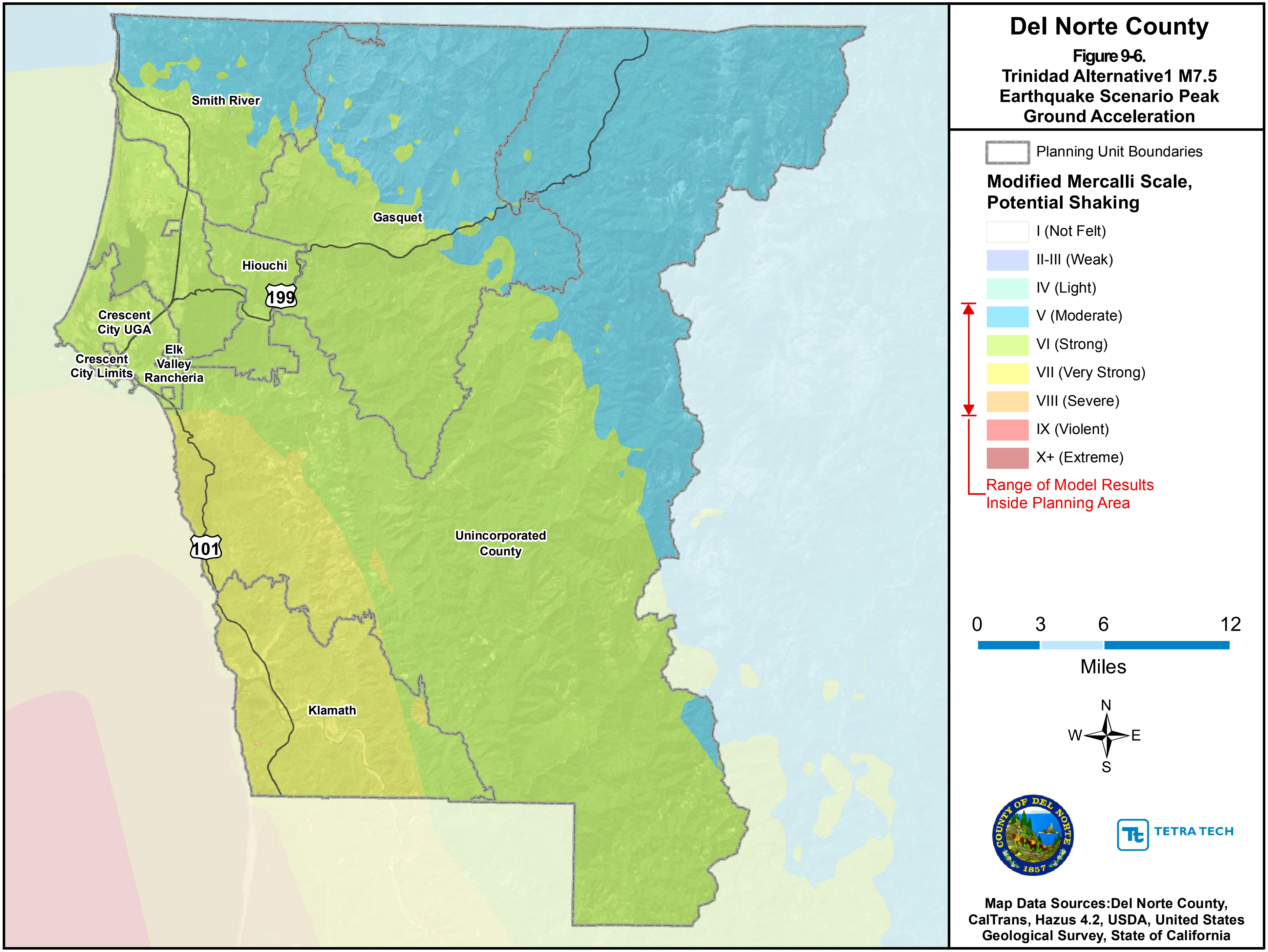
0 25 50 100

Miles

N
W E
S

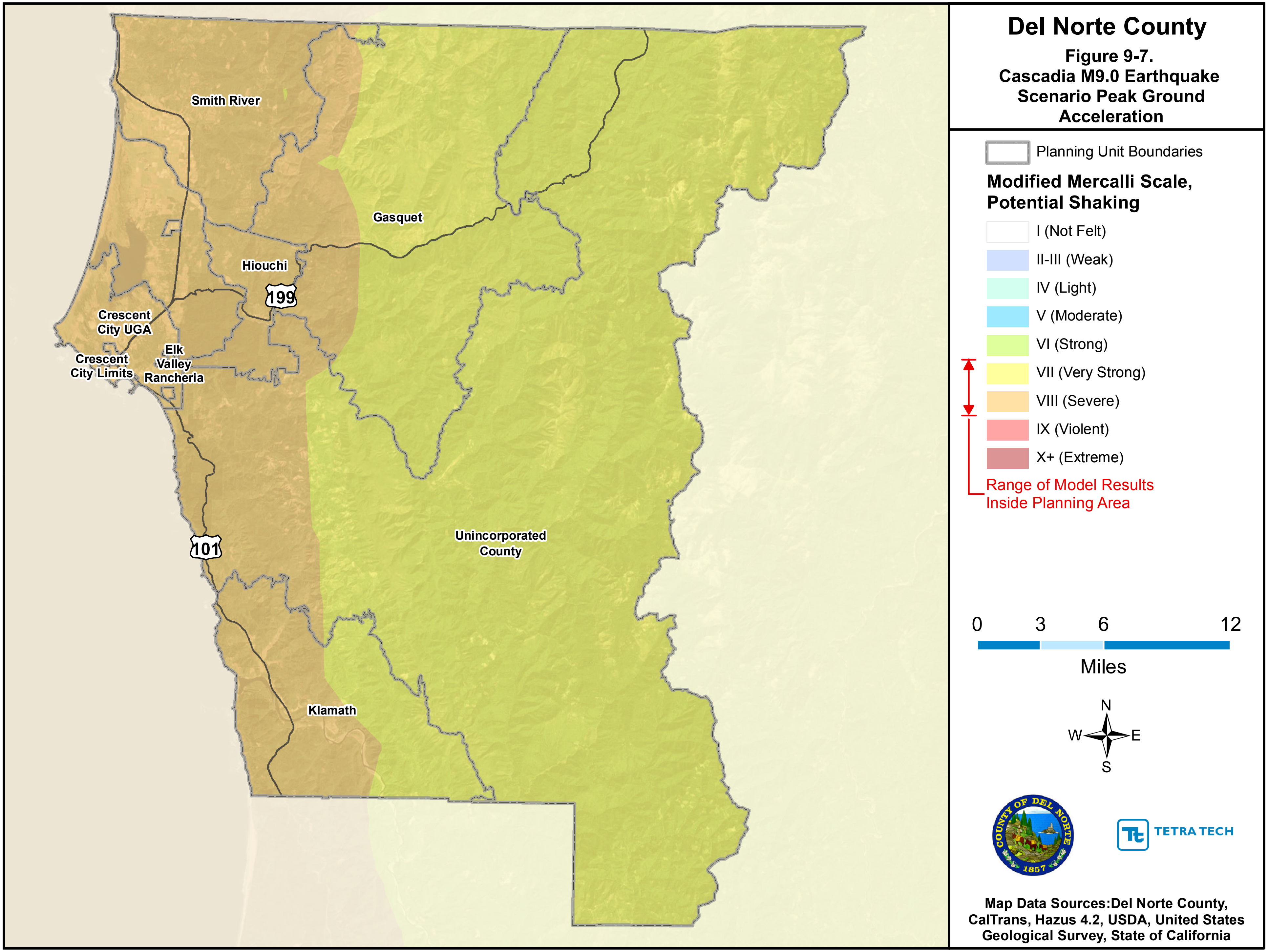
Map Data Sources:Del Norte County, CalTrans, Hazus 4.2, USDA, United States Geological Survey, State of California


Del Norte County
Figure 9-5.
Big Lagoon Bald Mountain M7.9 Earthquake Scenario Peak Ground Acceleration
Planning Unit Boundaries
Modified Mercalli Scale, Potential Shaking
I (Not Felt)
II-III (Weak)
IV (Light)
V (Moderate)
VI (Strong)
VII (Very Strong)
VIII (Severe)
IX (Violent)
X+ (Extreme)
Range of Model Results Inside Planning Area
0 3 6 12
Miles
N
W
E
S
Smith River
Gasquet
Hiouchi
199
Crescent City UGA
Elk Valley Rancheria
Crescent City Limits
101
Unincorporated County
Klamath
TETRA TECH
Map Data Sources:Del Norte County, CalTrans, Hazus 4.2, USDA, United States Geological Survey, State of California



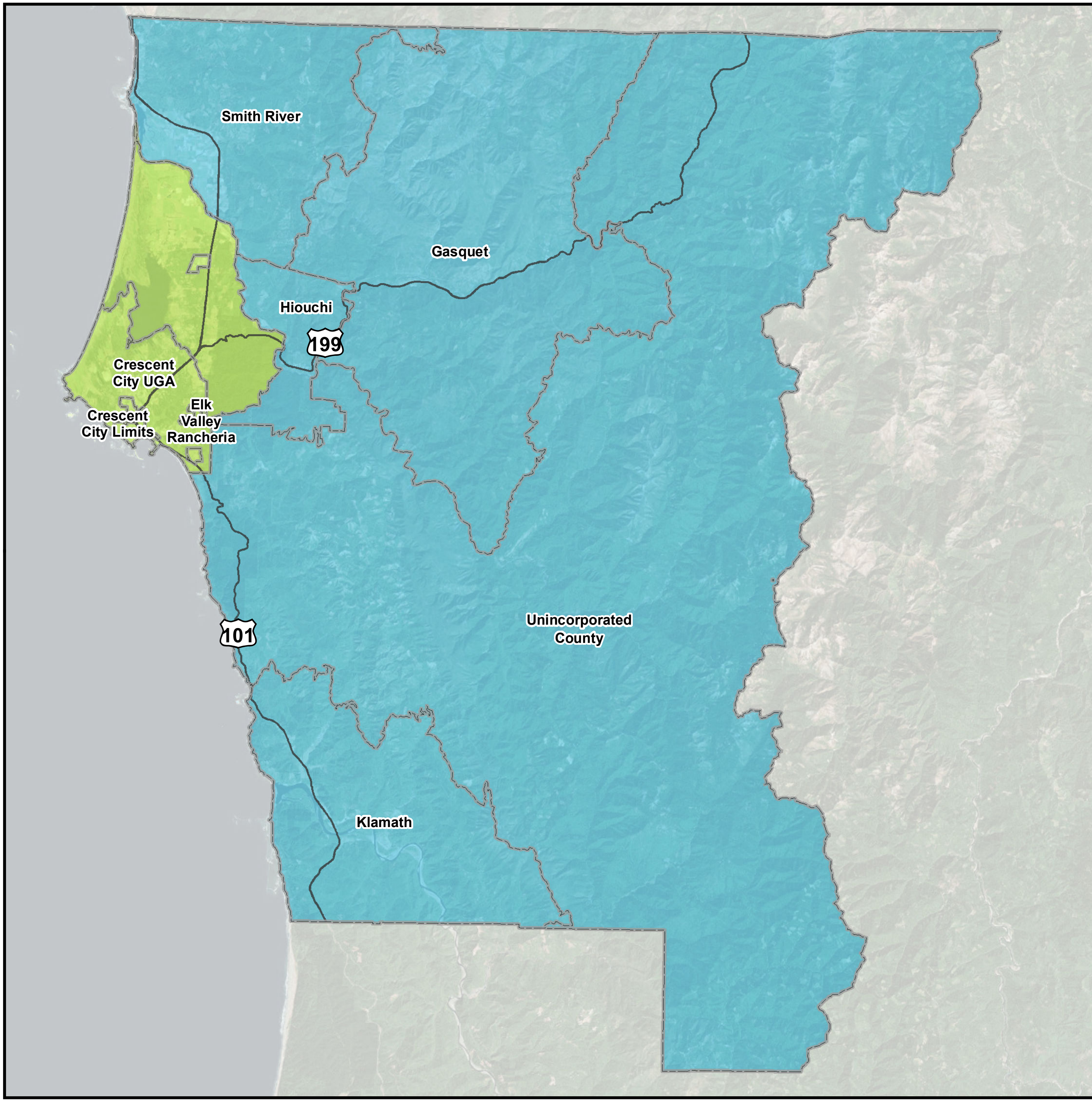
Del Norte County

Figure 9-6.
Trinidad Alternative1 M7.5 Earthquake Scenario Peak Ground Acceleration


Del Norte County
Figure 9-7.
Cascadia M9.0 Earthquake
Scenario Peak Ground
Acceleration
Planning Unit Boundaries
Modified Mercalli Scale,
Potential Shaking
I (Not Felt)
II-III (Weak)
IV (Light)
V (Moderate)
VI (Strong)
VII (Very Strong)
VIII (Severe)
IX (Violent)
X+ (Extreme)
Range of Model Results
Inside Planning Area
0
3
6
12
Miles
N
W
E
S
TETRA TECH
Map Data Sources:Del Norte County,
CalTrans, Hazus 4.2, USDA, United States
Geological Survey, State of California
Smith River
Gasquet
Hiouchi
199
Crescent
City UGA
Elk
Valley
Rancheria
Crescent
City Limits
Unincorporated
County
101
Klamath

Del Norte County

Figure 9-8.
100-Year Probabilistic Peak Ground Acceleration



Planning Unit Boundaries

Modified Mercalli Scale, Potential Shaking

- I (Not Felt)
- II-III (Weak)
- IV (Light)
- V (Moderate)
- VI (Strong)
- VII (Very Strong)
- VIII (Severe)
- IX (Violent)
- X+ (Extreme)

Range of Model Results Inside Planning Area

0 3 6 12
Miles

N W E S

TETRA TECH

Map Data Sources:Del Norte County, CalTrans, Hazus 4.2, USDA, United States Geological Survey, State of California

Estimated Impacts on Persons and Households

Hazus estimated impacts on persons and households in the planning area for the four selected earthquake scenarios as summarized in Table 9-5.

Table 9-5. Estimated Earthquake Impact on Persons

	Displaced Households		Persons Requiring Short-Term Shelter	
Scenario	Number	% of Total	Number	% of Total
100 Year Probabilistic	1	Less than 0.1%	1	Less than 0.1%
Big Lagoon-Bald Mountain M7.9	656	2%	479	2%
Trinidad Alt 1 M7.5	8	Less than 0.1%	5	Less than 0.1%
Cascadia M9.0	402	1%	297	1%

9.5.2 Property

Liquefaction Potential

The estimated number of structures located in high liquefaction potential areas was not available for this assessment due to a lack of liquefaction area mapping for the planning area.

Building Age

Table 9-6 identifies significant milestones in building and seismic code requirements that directly affect the structural integrity of development. Using U.S. Census estimates of housing stock age, estimates were developed of the number of housing units constructed before each of these dates. Approximately 25 percent of the planning area's housing units were constructed after the Uniform Building Code was amended in 1994 to include seismic safety provisions. The number of housing units built before 1933 when there were no building permits, inspections, or seismic standards is unknown. Many of the housing units in the planning area are detached, single-family residences of wood construction, which generally perform well during earthquake events.

Table 9-6. Age of Housing Units in Planning Area

Time Period	Number of Current Planning Area Housing Units Built in Period	% of Total Housing Units	Significance of Time Frame
Pre-1933	Unknown	Unknown	Before 1933, there were no explicit earthquake requirements in building codes. State law did not require local governments to have building officials or issue building permits.
1933-1940	607	5%	In 1940, the first strong motion recording was made.
1941-1960	2,193	19%	In 1960, the Structural Engineers Association of California published guidelines on recommended earthquake provisions.
1961-1975	2,123	19%	In 1975, significant improvements were made to lateral force requirements.
1976-1994	3,528	31%	In 1994, the Uniform Building Code was amended to include provisions for seismic safety.
1994 – present	2,876	25%	Seismic code is currently enforced.
Total	**11,326**	**100%**	

Note: Number and percent estimates are approximation as housing unit age information does not correspond directly with the time periods indicated. In addition, there are significant margins of error associated with the Census estimates.

Source: 2016 American Community Survey, Del Norte County, California

Unreinforced Masonry Buildings

Unreinforced masonry buildings are constructed from materials such as adobe, brick, hollow clay tiles, or other masonry materials and do not contain an internal reinforcing structure, such as rebar in concrete or steel bracing for brick. Unreinforced masonry poses a significant danger during an earthquake because the mortar holding masonry together is typically not strong enough to withstand significant earthquakes. The brittle composition of these buildings can break apart and fall away or buckle, potentially causing a complete collapse of the building. The number of unreinforced masonry structure in the planning area is unknown.

9.5.3 Loss Potential

Table 9-7 summarizes Hazus estimates of earthquake damage in the planning area for the four scenarios. The debris estimate includes only structural debris; it does not include additional debris that may accumulate, such as from trees. In addition, these estimates do not include losses that would occur from any local tsunamis or fires stemming from an earthquake.

Table 9-7. Estimated Impact of Earthquake Scenario Events in the Planning Area

	Structure Debris		Damage	
Earthquake Scenario Event	Tons	Truckloads	Structure + Contents Damage	% of Total Value
100-year probabilistic	34,198	1,368	$96.7 million	1%
Big Lagoon-Bald Mountain M7.9	1,780,532	71,221	$4.41 billion	29%
Trinidad Alt 1 M7.5	64,273	2,571	$186 million	1%
Cascadia Subduction Zone M9.0	931,756	37,270	$2.18 billion	14%

9.5.4 Critical Facilities and Infrastructure

A Hazus analysis was conducted on critical facilities and infrastructure in the planning area for the two most likely scenarios: the 100-year probabilistic scenario and the M9.0 Cascadia Subduction Zone scenario.

Level of Damage

Hazus classifies the vulnerability of critical facilities to earthquake damage in five categories: no damage, slight damage, moderate damage, extensive damage, or complete damage. The model was used to assign a probability of each damage state to every critical facility in the planning area. The results for the 100-year probabilistic event scenario indicated that no damage was expected to any critical facilities or infrastructure. The results for the Cascadia Subduction Zone event are summarized in Table 9-8.

Hazardous Materials

Hazardous material releases from fixed facilities and transportation-related releases can occur during an earthquake event. Vital transit corridors such as U.S. Highways 101 and 199 can be disrupted during an earthquake, which can result in the release of hazardous materials that are being transported along these corridors to the surrounding environment. Facilities holding hazardous materials are of particular concern because of possible isolation of populations surrounding them. There are 17 known facilities in the planning area that handle materials considered to be hazardous. During an earthquake event, structures storing these materials could rupture and leak into the surrounding area, or river, having a disastrous effect on the environment.

Table 9-8. Estimated Damage to Critical Facilities from M9.0 Cascadia Subduction Zone Scenario

Category	# of Critical Facilities	Number of Facilities with 50% or Greater Probability of Achieving Damage Level				
		None	Slight	Moderate	Extensive	Complete
Critical Facilities						
Government Functions	33	1	32	0	0	0
Hazardous Materials Facilities	17	0	17	0	0	0
Medical & Health Services	5	1	4	0	0	0
Other Critical Functions	17	2	15	0	0	0
Protective Functions	13	0	13	0	0	0
School Facilities	14	11	3	0	0	0
Societal Functions	30	0	29	1	0	0
Critical Infrastructure						
Bridges	72	19	53	0	0	0
Communication	10	0	10	0	0	0
Fuel Storage	6	1	5	0	0	0
Power	12	0	12	0	0	0
Wastewater	6	0	6	0	0	0
Water Supply	25	0	23	2	0	0
Total	**260**	**35**	**222**	**3**	**0**	**0**

Note: the results of this assessment are likely to significantly underestimate risk due to the limitation in modeling discussed in Section 9.5

Roads

There are many roads that cross earthquake-prone soils in the planning area. These soils have the potential to be significantly damaged during an earthquake event. Access to major roads is crucial to life and safety after a disaster event as well as to response and recovery operations. The following major roads in the planning area pass through NEHRP D soils areas:

- State Highway 169
- State Highway 197
- U.S. Highway 101
- U.S. Highway 199

Bridges

Earthquake events can significantly impact bridges. These are important because they often provide the only access to some neighborhoods. Bridges often follow floodplain boundaries, which typically have soft soils, and thus, are considered vulnerable to earthquakes. A key factor in the degree of vulnerability is the age of the facility and the type of construction, which help indicate the standards to which the facility was built. The Hazus analysis indicated that more than 50 bridges in the planning area would experience slight damage following a Cascadia Subduction Zone event. Slight damage for bridges is considered to be damage that requires only cosmetic repair. Due to the limitations of the analysis however, it is likely that at least some bridges in the planning area would experience more severe damage and would not be passable until repairs could be conducted.

Water and Sewer Infrastructure

Water and sewer infrastructure would likely suffer considerable damage in the event of an earthquake. This is hard to analyze due to the amount of infrastructure and the fact that water and sewer infrastructure are usually linear easements, which are not modeled in Hazus. Without further analysis of individual components of the system, it should be assumed that these systems are exposed to potential breakage and failure.

9.5.5 Environment

Environmental problems as a result of an earthquake can be numerous. Secondary hazards will likely have some of the most damaging effects on the environment. Earthquake-induced landslides can significantly damage 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. Streams fed by groundwater wells can dry up because of changes in underlying geology.

9.6 FUTURE TRENDS IN DEVELOPMENT

Land use in the planning area will be directed by general plans adopted under California's General Planning Law. The safety elements of the general plans establish standards and plans for the protection of the community from hazards, including seismic hazards. The information in this plan provides a tool to ensure that there is no increase in exposure in areas of high seismic risk. Development in the planning area will be regulated through building standards and performance measures so that the degree of risk will be reduced. The geologic hazard portions of the planning area are heavily regulated under California's General Planning Law. The International Building Code establishes provisions to address seismic risk.

9.7 SCENARIO

Based on history and geology, the Del Norte County planning area will be frequently impacted by earthquakes. The worst-case scenario is a higher-magnitude event (7.5 or higher) with an epicenter within 50 miles of Del Norte County. Earthquakes of this magnitude or higher could lead to massive structural failure of property on soils prone to liquefaction. Building and road foundations would lose load-bearing strength. Injuries could occur from debris, such as parapets and chimneys that could topple or be shaken loose and fall on those walking or driving below. Levees and revetments built on these poor soils would likely fail, representing a loss of critical infrastructure. An earthquake event of this magnitude located off the coast could cause a significant local tsunami that would further damage structures and jeopardize lives. An earthquake may also cause minor landslides along unstable slopes, which put at risk major roads and highways that act as sole evacuation routes. This would be even more likely if the earthquake occurred during the winter or early spring.

9.8 ISSUES

Important issues associated with an earthquake include the following:

- A large percentage of the planning area is located on NEHRP D soils, which is prone to liquefaction. Structures on these soils may experience significant structural damage; however, this threat is unknown as liquefaction susceptibility maps have not been developed.
- It is estimated that 75 percent of planning area housing stock was built before modern seismic codes were in place. An estimated 33 percent of housing units were built before seismic provisions became uniformly applied through building code applications. Many structures may need seismic retrofits in order to withstand a moderate earthquake. Residential retrofit programs, such as Earthquake Brace+Bolt, may be able to assist in the costs of these efforts.
- The number and location of unreinforced masonry buildings in the planning area is unknown.
- Significant but infrequent earthquake events, such as an event on the Big Lagoon-Bald Mountain Fault or the Cascadia Subduction Zone, could cause significant property damage in the planning area and generate large amounts of debris that would need to be hauled away.
- Due to limitations in current modeling abilities, the risk to critical facilities and infrastructure in the planning area from the earthquake hazard is likely understated. A more thorough review of the age of critical facilities, codes they were built to, and location on liquefiable soils should be conducted.

- Damage to road systems in the planning area after an earthquake has the potential to significantly disrupt response and recovery efforts and lead to isolation of populations.
- Earthquakes can cause conflagration of wooden homes and collapse of essential buildings such as fire stations.
- Landslides and tsunamis are major natural secondary hazards that could have a widespread effect on the county.
- Citizens are expected to be self-sufficient up to two weeks after a major earthquake without government response agencies, utilities, private-sector services, and infrastructure components. Education programs are currently in place to facilitate development of individual, family, neighborhood, and business earthquake preparedness. It takes individuals, families, and communities working in concert with one another to truly be prepared for disaster.
- After a major seismic event, Del Norte County is likely to experience disruptions in the flow of goods and services resulting from the destruction of major transportation infrastructure across the broader region.

10. FLOODING

10.1 GENERAL BACKGROUND

10.1.1 Types of Floodplains in the Del Norte Planning Area

A floodplain is the area adjacent to a river, creek, lake or the ocean that becomes inundated during a flood. In general, there are two types of floodplains in Del Norte County: riverine and coastal.

Riverine Floodplains

Riverine floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

When floodwaters recede after a flood event, they leave behind layers of rock and mud. These gradually build up to create a new floor of the floodplain. Floodplains generally contain unconsolidated sediments (accumulations of sand, gravel, loam, silt, and/or clay), often extending below the bed of the stream. These sediments provide a natural filtering system, with water percolating back into the ground and replenishing groundwater. These are often important aquifers, the water drawn from them being filtered compared to the water in the stream. Fertile, flat reclaimed floodplain lands are commonly used for agriculture, commerce and residential development.

Connections between a river and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

Coastal Floodplains

Coastal floodplains are adjacent to the ocean and other tidally influenced areas. Like riverine floodplains, coastal floodplains may be broad or narrow, depending on local topography and natural flood defenses such as dune systems or tidal wetlands. Coastal floods are usually caused by coastal storms that, when combined with normal tides, push water toward the shore. This is commonly referred to as storm surge. The result can be waves that extend further inland, causing damage to development that would not normally be subject to wave action.

10.1.2 Measuring Floods and Floodplains

The frequency and severity of flooding are measured using a discharge probability for river systems and wave heights for coastal systems. The discharge probability is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Storm surge levels are determined by modeling water depth, wind speed, vegetative cover and other factors to determine the "wave runup," how far inland waves will reach, and "wave setup" the height, speed, and slope of waves and how they differ from the still-water elevation (see Figure 10-1). Flood studies use historical records to determine the probability of occurrence for different discharge levels and storm surge levels. These measurements reflect statistical averages only; it is possible for multiple floods with a low probability of occurrence (such as a 1-percent-annual-chance flood) to occur in a short time period. For riverine flooding, the same flood event can have flows at different points on a river that correspond to different probabilities of occurrence.

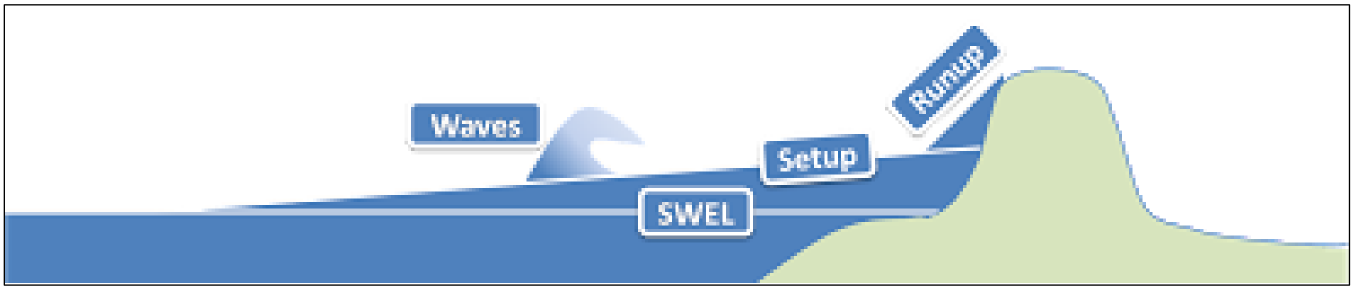


Figure 10-1. Storm Surge Stillwater Elevation and Added Effects of Wave Setup and Runup

The extent of flooding associated with a 1-percent annual probability of occurrence (also called the base flood) is used as the regulatory boundary by many agencies. Also referred to as the special flood hazard area, this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.

10.1.3 Floodplain Ecosystems

Floodplains can support ecosystems that are rich in plant and animal species. A floodplain can contain 100 or even 1,000 times as many species as a river. Wetting of the floodplain soil releases an immediate surge of nutrients: those left over from the last flood, and those that result from the rapid decomposition of organic matter that has accumulated since then. Microscopic organisms thrive and larger species enter a rapid breeding cycle. Opportunistic feeders (particularly birds) move in to take advantage. The production of nutrients peaks and falls away quickly, but the surge of new growth endures for some time. This makes floodplains valuable for agriculture. Species growing in floodplains are markedly different from those that grow outside floodplains. For instance, riparian trees (trees that grow in floodplains) tend to be very tolerant of root disturbance and very quick-growing compared to non-riparian trees.

10.1.4 Effects of Human Activities

Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate in floodplains for a number of reasons: water is readily available; riverine floodplain land is fertile and suitable for farming; transportation by water is easily accessible; land is flatter and easier to develop; and there is value placed in ocean views. But human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels or causing erosion of natural flood protection systems such as dunes. Flood potential can be increased in several ways: reducing a stream’s capacity to contain flows; increasing flow rates or velocities downstream; and allowing waves to extend further inland. Human activities can interface effectively with a floodplain as long as steps are taken to mitigate the activities’ adverse impacts on floodplain functions.

10.1.5 FEMA Regulatory Flood Zones

FEMA defines flood hazard areas as areas expected to be inundated by a flood of a given magnitude. These areas are determined via statistical analyses of records of river flow, storm tides, and rainfall; information obtained through consultation with the community; floodplain topographic surveys; and hydrologic and hydraulic analyses. Flood hazard areas are delineated on DFIRMs, which provide the following information:

- Locations of specific properties in relation to special flood hazard areas
- Base flood elevations (1-percent-annual-chance) at specific sites
- Magnitudes of flood in specific areas
- Undeveloped coastal barriers where flood insurance is not available
- Regulatory floodways and floodplain boundaries (1-percent and 0.2-percent-annual-chance floodplain boundaries).

Land area covered by floodwaters of the base flood is the special flood hazard area on a DFIRM—an area where NFIP floodplain management regulations must be enforced, and where mandatory purchase of flood insurance applies. This regulatory boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities, because many communities have maps showing the extent of the base flood and likely depths that will occur.

The base flood elevation (the water elevation of a flood that has a 1-percent chance of occurring in any given year) is one of the most important factors in estimating potential damage from flooding. A structure within a 1-percent-annual-chance floodplain has a 26-percent chance of undergoing flood damage during the term of a 30-year mortgage. The 1-percent-annual-chance flood is used by the NFIP as the basis for insurance requirements nationwide. DFIRMs also depict 0.2-percent-annual-chance flood designations.

10.2 HAZARD PROFILE

There are six types of flood events that can impact the planning area: coastal flooding, riverine flooding, nuisance flooding, tsunami flooding, and flooding from sea level rise or a dam failure. This hazard profile focuses on the coastal and riverine flood hazards. Floods resulting from a dam failure are discussed in Chapter 7. Nuisance flooding from rainfall events is discussed in Chapter 12. Tsunami flooding is discussed in Chapter 13. Floods from sea level rise are discussed in Chapter 15

10.2.1 Flooding Sources

There are two sources of floodplains in Del Norte County: coastal flooding is associated with tidal action and storm surge, and riverine flooding is associated with river systems.

Coastal Flooding

Del Norte County has a coast shoreline length of 45.5 miles. From the Oregon border to Point St. George, there are about 14 miles of rocky coast, and 11 miles of sandy beach backed by sand dunes. The remainder of the county coastline is rocky with pocket beaches and reaches of sand such as Crescent City and the mouth of the Klamath River. This latter reach includes the Redwood National Park and the Del Norte Coast Redwood State Park, and is noted for its rugged headlands and scenic shoreline (2010 Hazard Mitigation Plan).

Flooding along the Pacific coast near Crescent City is often associated with the simultaneous occurrence of very high tides, large waves, and storm swells during the winter. Storm centers from the southwest produce the type of storm pattern most commonly responsible for serious coastal flooding. The strong winds and high tides that create storm surges are also accompanied by heavy rains. In some instances, high tides back up river flow, which causes flooding at the river mouths (FEMA, 2017).

River Systems

The Klamath and Smith Rivers are within the Klamath Mountains province; the other river systems in the county are within the Coast Range province. Drainage in the Klamath Mountains province is dendritic (streams and their tributaries have a branch-like arrangement), differing from the trellis drainage patterns typical of the Coast Range province. Northwest-trending folds and faults control the drainage patterns in the Coast Range province, leading to a fairly uniform orientation of rivers (2010 Hazard Mitigation Plan).

Significant flood hazard areas in Del Norte County are limited to the Smith River, Klamath River and Elk Creek systems because these are the river systems where development has occurred in or near the floodplain.

Smith River

The Smith River drains a basin of 609 square miles. The river flows through the Klamath Mountains, except for the final 15 miles, where it slices through the Coastal range and crosses a broad coastal plan before emptying into the Pacific Ocean. The Smith River is classified as a “Wild and Scenic River” by the National Parks Service and is the only major river in California to flow freely for its entire length without a dam. Its floodplain includes Lake Earl, Lake Talawa, a portion of U.S. Highway 101, a portion of Lower Lake Road, agricultural land and scattered residential uses.

The Lake Earl-Lake Talawa-Lower Smith River complex covers an area of 12 miles along the Pacific Ocean between Crescent City and the Oregon border. Under normal conditions, the two lakes have a combined surface area of approximately 2,500 acres and an elevation about 4 feet above mean sea level. No natural surface drainage out of the lakes exists, but under sufficiently high stages the sandbar at the southwest end of Lake Talawa is overtopped or breached. The natural breaching action can be either from ocean waves crashing over the bar or high water in the lakes overtopping it. The breach provides drainage into the ocean until wave action by the ocean again closes it. Channeling or breaching operations through the sand bar are performed by local interests approximately three times per year in anticipation of flooding or to relieve high stages in the lakes.

The most notable flooding in the area results from intense storms occurring after extended periods of rain, which prime the lake basin and the adjacent Smith River basin for runoff. Smith River discharges of approximately 140,000 cubic feet per second—the 10-percent-annual chance flow—cause overbank flow in the Smith River floodplain, which spills over into the Lake Earl-Talawa Lake complex. The Smith River basin is fan-shaped with a common focal point of the four major tributaries, which gives the basin its very sharp reaction to rainfall and runoff. As a result, floods within the basin are normally of short duration, lasting about 2 to 4 days. Floods develop rapidly, with the peak being reached in 6 to 8 hours after the most intense portion of the storm (2010 Hazard Mitigation Plan).

Klamath River

The largest river basin in the region is the Klamath River, which originates in Oregon and drains 12,120 square miles, of which 234 square miles is in Del Norte County. The Klamath River is the second largest river in California, exceeded only by the Sacramento River. Its basin is south and east of the Smith River basin. The major tributaries to the Klamath River include the Salmon, Scott, Shasta and Trinity Rivers, none of which are in Del Norte County. The portion of the Klamath River that lies within Del Norte County is referred to by the U.S. Army Corps of Engineers as Reach I, extending from the mouth of the Klamath to the Humboldt County line. Within Reach I and the Coastal Zone lie the communities of Requa, Camp Klamath and Klamath. Due to this development, flooding along Reach I is a hazard to life and property.

Flood flows in the Klamath basin are of two types—rain and snowmelt. The rain flood flows are the more damaging. Practically all damaging flood events have occurred during the period of November through March. Usually these events have occurred from rainstorms of several days in duration. Based on USGS gage data near

Klamath, the maximum record discharge of 557,000 cubic feet per second occurred on December 3, 1964, with a gage height of 55.3 feet.

Snowmelt floods usually begin in March and have not typically caused the damage associated with rain floods. Due to the size of the Klamath River basin, a true “worst-case scenario” would be a rain-on-snow event. While these types of events are not typical for the region, they are possible in light of potential climate change (2010 Hazard Mitigation Plan).

Elk Creek

Elk Creek originates in Jedediah Smith Redwood State Park. Several small tributaries flow from the park and combine just west of Elk Valley Road to form the main channel. The creek then flows southwest, draining Elk Valley, and empties into Crescent City Harbor.

Elk Creek is much smaller than the Smith and Klamath Rivers. Its watershed is approximately 6 square miles, and its recognized floodplain covers less than 1 square mile. However, due to its proximity to Crescent City, it is of considerable importance in emergency management planning.

Flooding on Elk Creek is caused by a combination of excess runoff and tidal action. Excess runoff is caused by heavy rainfall and tidal action is caused by wind, waves and tsunamis. Flooding history on Elk Creek indicates that tidal action has been the principal cause of flooding. As a prime example, during the 1964 tsunami that hit Crescent City, the Elk Creek floodplain acted as a natural inlet for water generated by the tsunami, and flooding occurred on a considerable amount of the Elk Creek floodplain, including portions of downtown Crescent City (2010 Hazard Mitigation Plan).

10.2.2 Flood Control Structures in the Planning Area

There is one levee located in the southwestern portion of the planning area—the Klamath-Glen Levee, which was built by the U.S. Army Corps of Engineers in 1972 and is operated and maintained by Del Norte County. The levee is 1.68 miles in length and was last inspected in August 2010. Certification for the levee was being sought at the time of this plan update (USACE National Levee Database, 2018).

Several flood control measures are in place to protect the City of Crescent City. According to the Flood Insurance Study for the County, two breakwaters were constructed to reduce the effects of swells and waves in the harbor, and a landfill was developed as a recreational park along the harbor with a riprap wall along its perimeter that has effectively reduced flooding to the southeastern shore of the city (FEMA, 2017).

10.2.3 Past Events

Table 10-1 lists major declared and undeclared flood events in Del Norte County since 1955. Some of the major flood events are described in more detail in the sections that follow.

December 1955 Flood Event

The December 1955 flood occurred following weeks of above-normal precipitation in the county, with rainfall as high as 24 inches over three days in Klamath. Damage occurred countywide, with the majority along the Smith River. These storms produced a peak discharge of 165,000 cubic feet per second with a stage of 41.2 feet at the Smith River gauging station. It is estimated that 7,600 acres of pasture and other agricultural lands in the delta area were inundated to an average depth of about 3 feet by the Smith River and its tributaries. Floodwaters from the Smith River overflowed into Talawa Slough and raised the surface of Lake Earl. Due to the flat slope of the land adjacent to the lake, 3,200 acres of land bordering the lake were flooded. Agricultural damage consisted of silt, gravel and debris from timbering operations being deposited on pastureland.

Table 10-1. History of Flood Events

Date	Declaration #	Type of event	Assistance Type[c]	Estimated Damage
Dec. 14, 2016	N/A	Flooding and landslides	N/A	$8.31 million[b]
Oct. 16, 2016	N/A	Flash Flood from heavy rain	N/A	$0[b]
Dec. 28, 2008	N/A	Flood from heavy rain	N/A	$7,000
Feb. 3, 2006	DR-1628	Flooding, severe winter storms, and landslides	IA, PA	$20,266,666[a]
Feb. 9, 1998	DR-1203	Severe winter storms, flooding	PA	$1.27 million[a]
Jan. 4, 1997	DR-1155	Severe winter storms, flooding	IA, PA	$15.15 million[a]
Dec. 1, 1995	DR-N/A	Severe winter storms, flooding	IA, PA	$6.0 million[a]
Mar. 12, 1995	DR-1046	Severe Winter Storms, flooding	PA	$1.0 million[a]
Jan. 9, 1995	DR-1044	Winter storms, flooding, landslides, mud flows	IA, PA	$11.2 million[a]
Feb. 3, 1993	DR-979	Severe storm, winter storm, mud & landslides, flooding	PA	$583,530[a]
Feb. 25, 1992	DR-935	Snow storm, heavy rain, high winds, flooding, mudslide	IA	$10,000[a]
Feb. 21, 1986	DR-758	Flooding	N/A	N/A
Jan. 25, 1983	DR-677	Coastal storms, floods, slides, tornados	N/A	$500,000[a]
Jan. 1978	DR-547	—	NA	NA
Feb. 8, 1973	DR-364	Severe storms, High Tides, flooding	N/A	$100,493[a]
Jan. 8,1970	DR-283	Severe storms, flooding	N/A	$104,670[a]
Dec. 1964	N/A	Severe winter storms, flooding	N/A	$17.85 million[a]
Dec. 1955	N/A	Severe winter storms, flooding	N/A	$22 million

a. Data obtained from Spatial Hazard Events and Losses Database for the United States
b. Data obtained from the NOAA Storm Events Database
c. IA = Individual Assistance; PA = Public Assistance; N/A = Information is not available or applicable

December 1964 Flood Event

Heavy rains accompanied by runoff from an unusually large snowpack led to flooding of all river systems within the county in December 1964. The 1964 flood events are considered to be the floods of record for the Del Norte County planning area. Total damage reached $17.85 million. The flood swept away the entire town of Klamath along the Klamath River, with the nearby towns of Camp Klamath, Requa, and Klamath Glen also sustaining heavy damage and one fatality reported. Millions of board feet of lumber, thousands of acres of prime farmland, and 400 head of livestock were lost, causing a tremendous economic impact to the county.

January 1978 Flood event

A combination of high astronomical tides, strong onshore winds, high storm waves, and excessive rainfall produced an aggravated erosional condition in January 1978. A series of storms emanated from a more southern direction than normal, carrying larger amounts of precipitation and wind. These storms, in conjunction with seasonal high tides, generated large destructive storm surges that battered the northern California coastline, damaging many of the better-protected beaches. Jetties and breakwater barriers were overtopped and in some cases undermined.

Winter Storms of 1983

The winter of 1983 brought an extremely unusual series of high tides, storm surges and storm waves. Record high tides were recorded in Del Norte County, with the worst coastal flooding recorded since the 1964 Alaska tsunami.

January 1995 Flood Event

Significant and extended heavy rain and wind caused severe flooding along the California coastline. Flood damage was reported throughout much of the county, totaling an estimated $11.2 million. The county received both state and federal disaster declarations.

March 1995 Flood Event

Winter storms and flooding caused $1 million in damage throughout the county. The county received a second presidential disaster declaration.

January 1997 Flood Event

The U.S. Forest Service reported that the storms of December 1996 and January 1997 produced precipitation on the Klamath National Forest that was two to three times the monthly average. The four-day storm at the end of December produced rain above 7,000 feet. The flood of 1997 involved the movement of soil, rock, and organic debris from hill slopes to stream channels on the Klamath National Forest at a scale not experienced since about 1974. The majority of the reported damage associated with this event was from landslides and road failures. The estimated damage to road facilities exceeded $35 million within the Klamath National Forest.

January 2006 Flood Event

The year began with a New Years' weekend storm pummeling Del Norte County, damaging the Crescent City harbor, flooding Klamath and closing Highways 101 and 169. Damage exceeded $5 million. California Office of Emergency Services officials identified 64 sites as sustaining significant damage. On February 3, President Bush declared Del Norte County and nine other California counties disaster areas. A section of west Klamath Beach Road, wiped out during the storms, finally reopened on April 5 thanks to a temporary bridge that allowed one-way traffic.

December 2016 Flood Event

A strong atmospheric river brought widespread rainfall to Northwest California in mid-December. Flooding and landslides resulted in significant damage along the coast. Three counties declared a local state of emergency, with several million dollars in damage reported. Large surf impacted the coast in conjunction with a small storm surge. This resulted in damage to coastal bluffs along the Del Norte coast (NOAA Storm Events Database).

10.2.4 Location

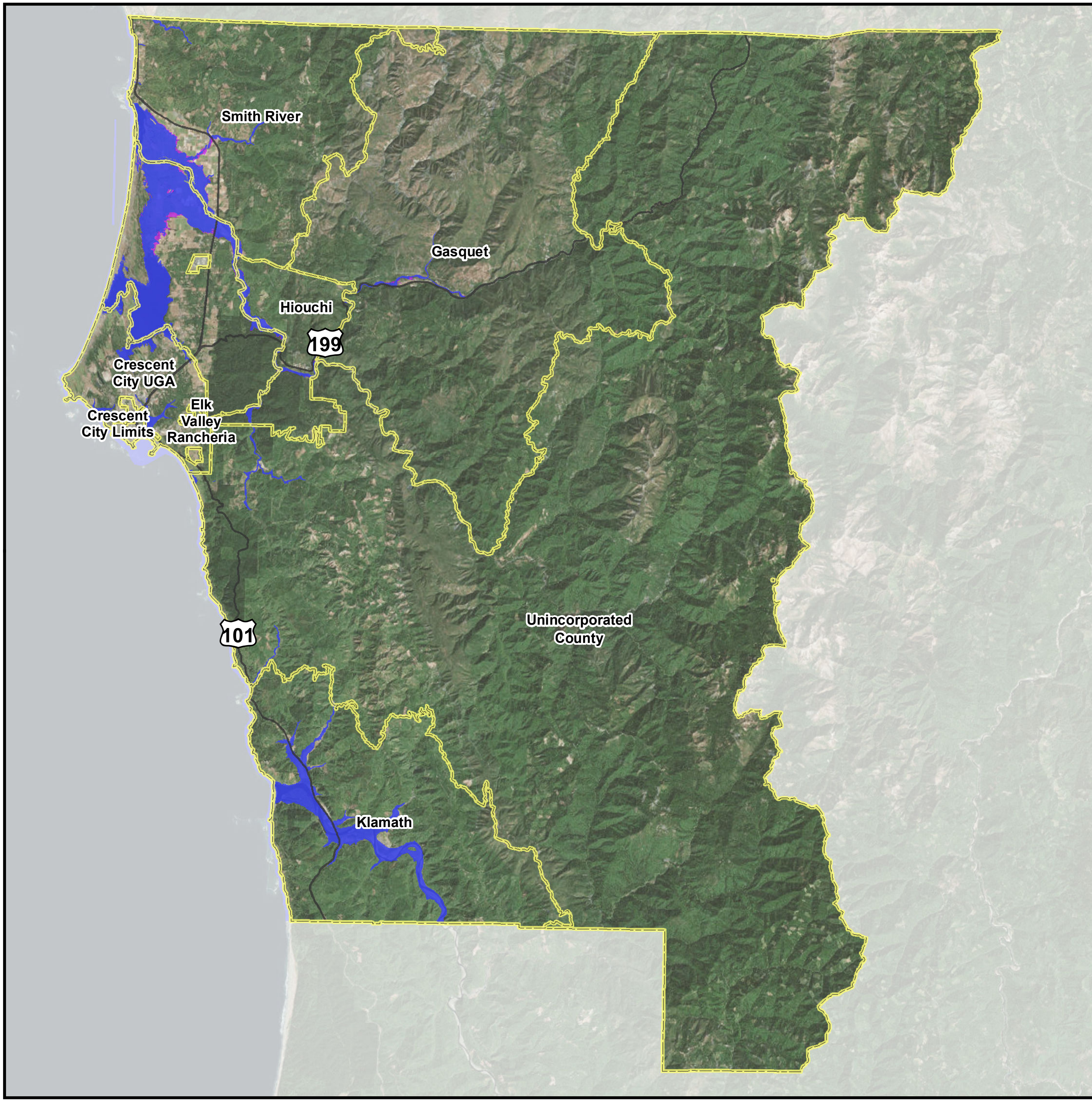
Flooding in Del Norte County has been extensively documented by gage records, high water marks, damage surveys and personal accounts. This documentation was the basis for the DFIRMs generated by FEMA for the planning area. These maps are not the total depiction of the flood risk in an area, but they are the most detailed and consistent data source available. The DFIRMs dated August 2, 2017 are the sole source of data used in this risk assessment to map the extent and location of the flood hazard (see Figure 10-2).

10.2.5 Frequency

Assigning recurrence intervals to the discharges of historical floods on different rivers can help indicate the intensity of a storm over a large area. For example, the 1964 flood event was determined to have flow on the Klamath River equivalent to a 0.4-percent-annual-chance flood, but flow on the Smith River equivalent to a 1-percent-annual-chance flood.

Del Norte County

**Figure 10-2.
FEMA DFIRM Flood
Boundaries**



Planning Unit Boundaries

1% Chance Annual Flood (100-year)

0.2% Chance Annual Flood (500-year)

0 3 6 12

Miles

N
W E
S

Map Data Sources:Del Norte County, CalTrans, Hazus 4.2, FEMA, USDA, CalOES, State of California

The planning area can expect an average of one episode of minor river flooding each winter. Winter floods inundate most of the county's 1-percent-annual-chance floodplain at intervals of 3 to 10 years. The frequency of flooding in smaller streams and basins can be expected to increase somewhat as a result of increased development in Del Norte County, increasing the amount of impervious surface.

10.2.6 Severity

The principal factors affecting flood damage are flood depth and velocity. The deeper and faster flood flows become, the more damage they can cause. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. Wave action has significant velocity, and waves as small as 1.5 feet can cause substantial damage to structures and other development.

Flood severity for riverine flooding is often evaluated by examining peak discharges; Table 10-2 lists peak flows used by FEMA to map the floodplains of the planning area. Peak discharge is generally described using the measurement cubic feet per second. A discharge rate of 20,000 cubic feet per second would fill an Olympic size swimming pool in about 4 seconds.

Table 10-2. Summary of Peak Discharges in the Planning Area

	Discharge (cubic feet/second)			
Source/Location	10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
Middle Fork Smith River; 10,000 feet upstream of confluence with Smith River-Gasquet reach	21,500	30,500	34,500	44,000
North Fork Smith River; Approximately 4,000 feet upstream of confluence of middle fork Smith river and north fork Smith River.	39,500	57,000	64,200	80,000
Smith River-Gasquet Reach; Just downstream of confluence of middle fork Smith River and North Fork Smith River	65,000	93,100	105,000	132,000
Smith River-Hiouchi Reach-1; Approximately 17,000 feet downstream of U.S. Highway 199 (Hiouchi Bridge)	144,000	198,000	222,000	278,000
Smith River-Hiouchi Reach-2; Just downstream of confluence of South Fork	134,000	184,000	206,000	258,000
Smith River-Pacific Ocean to U.S. Highway 101, above Peacock Creek	142,000	195,000	218,000	273,000
Rowdy Creek-Approximately 11,500 feet upstream of confluence with Smith River (Gasquet Reach)	8,800	12,400	13,800	16,500

Source: FEMA Flood Insurance Study Number 06015CV000C, Del Norte County, California and Incorporated Areas, August 2, 2017

Flood severity from coastal flooding is determined by wave runup and setup. Table 10-3 shows the storm surge water levels used for mapping the coastal floodplains in the planning area. Base flood elevations that include wave height range from 18 to 55 feet for a 1-percent-annual-chance event in the planning area.

10.2.7 Warning Time

Due to the sequential pattern of meteorological conditions needed to cause serious flooding, it is unusual for a flood to occur without warning. Warning times for floods can be between 24 and 48 hours. Flash flooding can be less predictable, but potential hazard areas can be warned in advanced of potential flash flooding danger. The National Weather Service issues flood watches and alerts for the planning area. The Del Norte County website includes links to the NOAA California Nevada River Forecast Center, which includes flood stage information for the river systems in the planning area.

Table 10-3. Regional Storm Surge Water Elevations

Tide Gauge	Regional Storm Surge Water Elevations (feet, North American Vertical Datum)
50-percent	8.79
20-percent	9.20
10-percent	9.48
4-percent	9.86
2-percent	10.16
1-percent	10.48
0.2 percent	11.30

Source: FEMA, 2017

10.3 SECONDARY HAZARDS

The most problematic secondary hazard for flooding in Del Norte County is bank erosion. In many cases the threat and effects of bank erosion are worse than actual flooding. This is especially true on the upper courses of the rivers in the county where there are steep gradients, where the floodwaters may pass quickly and without much damage, but scour the banks, edging properties closer to the floodplain or causing them to fall in. Flooding is also responsible for hazards such as landslides when high flows over-saturate soils on steep slopes, causing them to fail. Hazardous materials spills are also a secondary hazard of flooding if storage tanks rupture and spill into streams, rivers or drainage sewers.

10.4 EXPOSURE

A quantitative assessment of exposure to the dam failure hazard was conducted using the flood mapping shown in Figure 10-2 and the asset inventory developed for this plan (See Section 6.3). Detailed results are provided in Appendix C and summarized below.

10.4.1 Population

Population was estimated using the residential building count in the flood hazard areas and multiplying by the 2016 estimated average population per household. Using this approach, the estimated population residing in the 1-percent-annual-chance flood hazard area is 3 percent of the planning area population (684 people). The population residing in the 0.2-percent-annual-chance flood hazard area is also about 3 percent of the planning area population (793 people). The planning units with the largest percent of their population exposed are Gasquet and Klamath. Elk Valley Rancheria does not have any exposure to the flood hazard.

10.4.2 Property

An estimated 5 percent (more than $793 million) of the total replacement value of the planning area is located in the 1-percent-annual-chance flood hazard area and 6 percent (more than $921 million) is located in the 0.2-percent-annual-chance flood hazard area. Figure 10-3 and Figure 10-4 show the percentage and count, by land use type, of exposed planning area structures. Over half of the exposed structures are in the Unincorporated County and Klamath planning units.

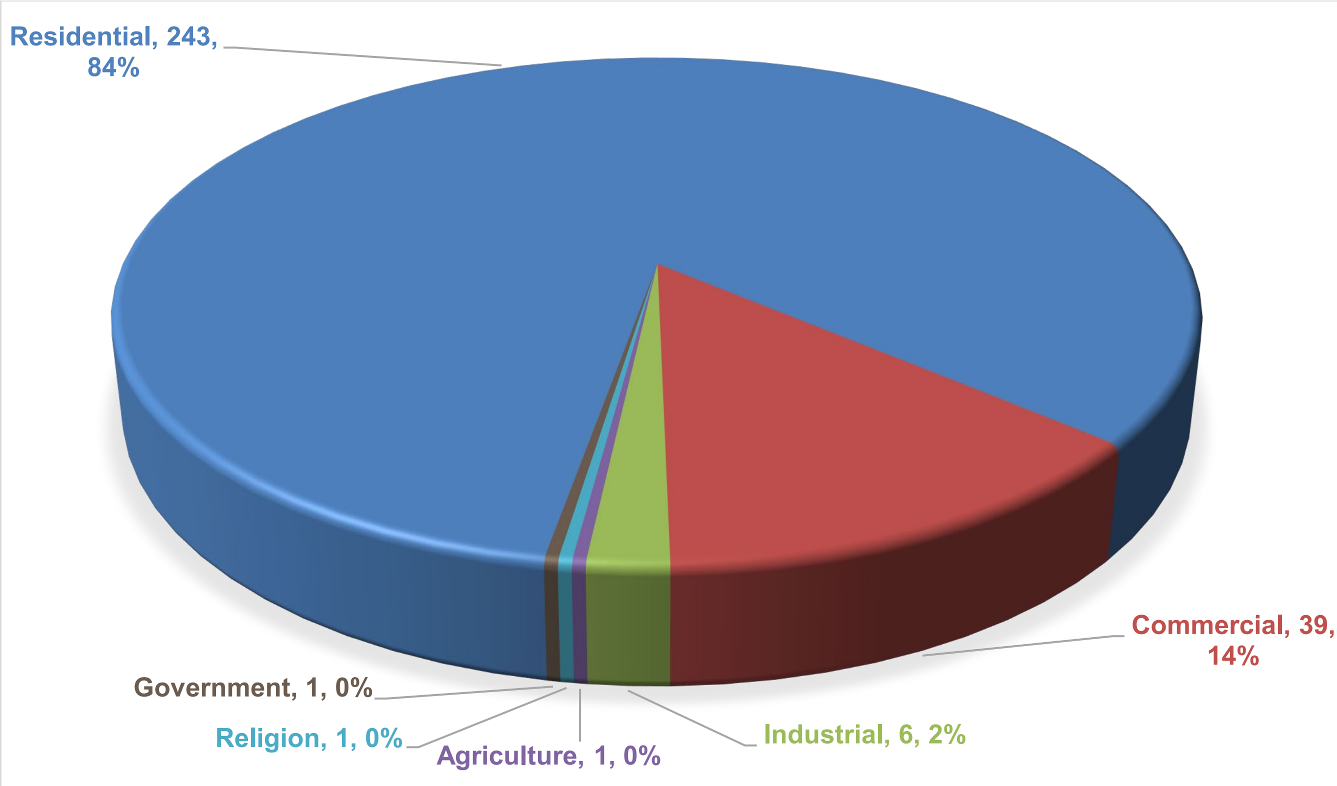


Figure 10-3. Structures in the 1-percent-annual-chance Flood Hazard Area, by Land Use Type

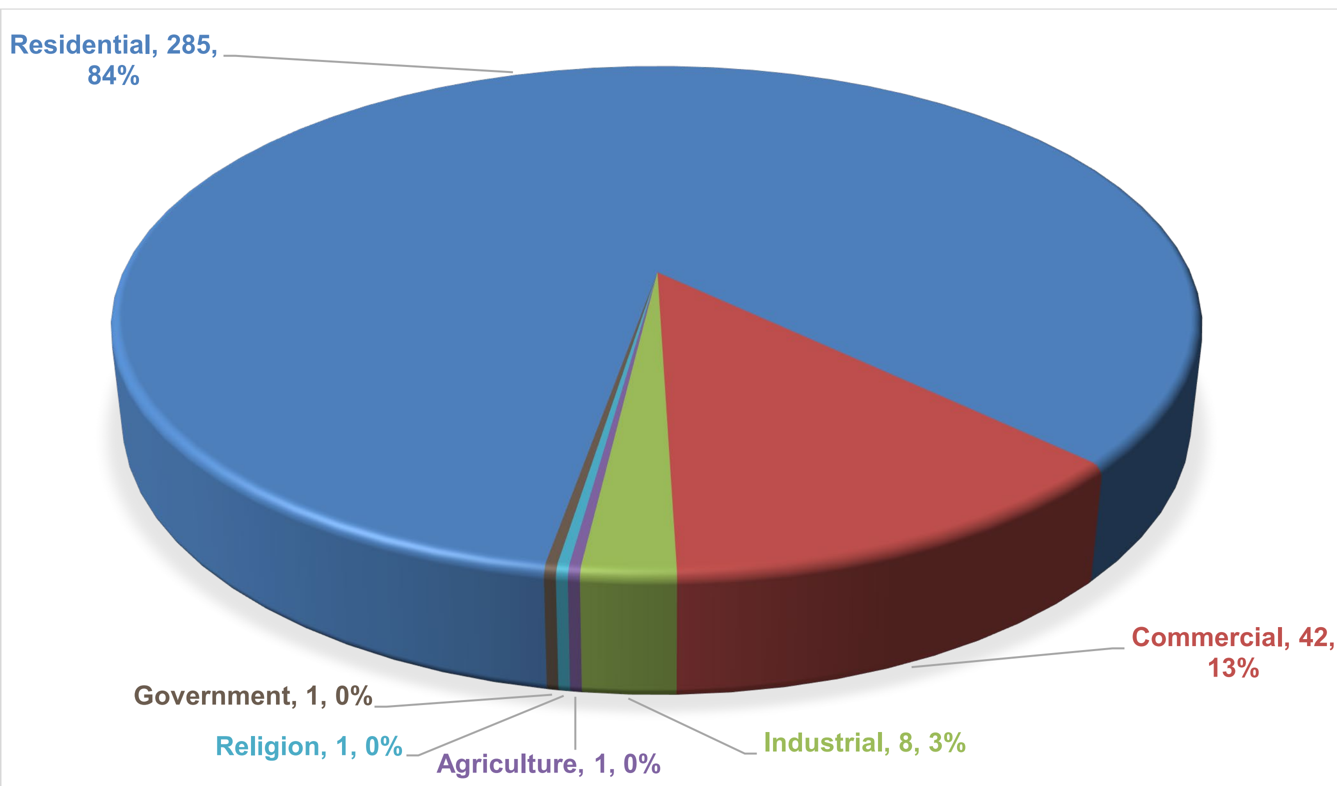


Figure 10-4. Structures in the 0.2-percent-annual-chance Flood Hazard Area, by Land Use Type

10.4.3 Critical Facilities and Infrastructure

Critical facilities and infrastructure exposed to the flood hazard represent 17 percent (44 facilities) of the total critical infrastructure and facilities in the planning area for the 1-percent-annual-chance flood hazard and 18 percent (46 facilities) for the 0.2-percent-annual-chance flood hazard. The breakdown of exposure by facility type is shown in Figure 10-5. Linear infrastructure is also exposed, including utility lines and roads. The following major roads in Del Norte County pass through the 1-percent-annual-chance flood hazard area and thus are exposed to flooding:

- State Highway 169
- State Highway 197
- U.S. Highway 101
- U.S. Highway 199

Some of these roads are built above the flood level and some function as levees to prevent flooding. Still, in certain events these roads may be blocked or damaged by flooding, preventing access to many areas.

10.4.4 Environment

Flooding is a natural event, and floodplains provide many natural and beneficial functions. Nonetheless, flooding can impact the environment in negative ways. Migrating fish can wash into roads or over dikes into flooded fields, with no possibility of escape. Pollution from roads, such as oil, and hazardous materials can wash into rivers and streams. During floods, these can settle onto normally dry soils, polluting them for agricultural uses. Human development such as bridge abutments and levees, and logjams from timber harvesting can increase stream bank erosion, causing rivers and streams to migrate into non-natural courses.

10.5 VULNERABILITY

The results of the vulnerability assessment indicate estimated damage for the 1-percent and 0.2-percent-annual-chance flood hazards. It is rare that floodplains throughout the entire planning area would experience a flood of these magnitudes simultaneously.

10.5.1 Population

Displaced Persons and Vulnerable Populations

The Hazus analysis of impacts on persons and households in the planning area estimated that 176 people and 213 people could be displaced by the 1- and 0.2-percent-annual-chance event, respectively. Those who have trouble evacuating, especially if waters rise suddenly without much warning, are most vulnerable. This includes those with access and functional needs, the elderly, and the very young. In addition, economically disadvantaged populations whose houses are impacted by flood events may not have the means to make repairs, especially if they do not have flood insurance. A geographic analysis of demographics using the Hazus model identified populations vulnerable to the flood hazard as follows:

- **Economically Disadvantaged Populations—**It is estimated that 18 percent of the households within the 1-percent-annual-chance flood hazard area are economically disadvantaged, defined as having household incomes of $50,000 or less.
- **Population over 65 Years Old—**It is estimated that 18 percent of the population in the 1-percent-annual-chance flood hazard area are over 65 years old.
- **Population under 16 Years Old—**It is estimated that 22 percent of the population in the 1-percent-annual-chance flood hazard area are under 16 years of age.

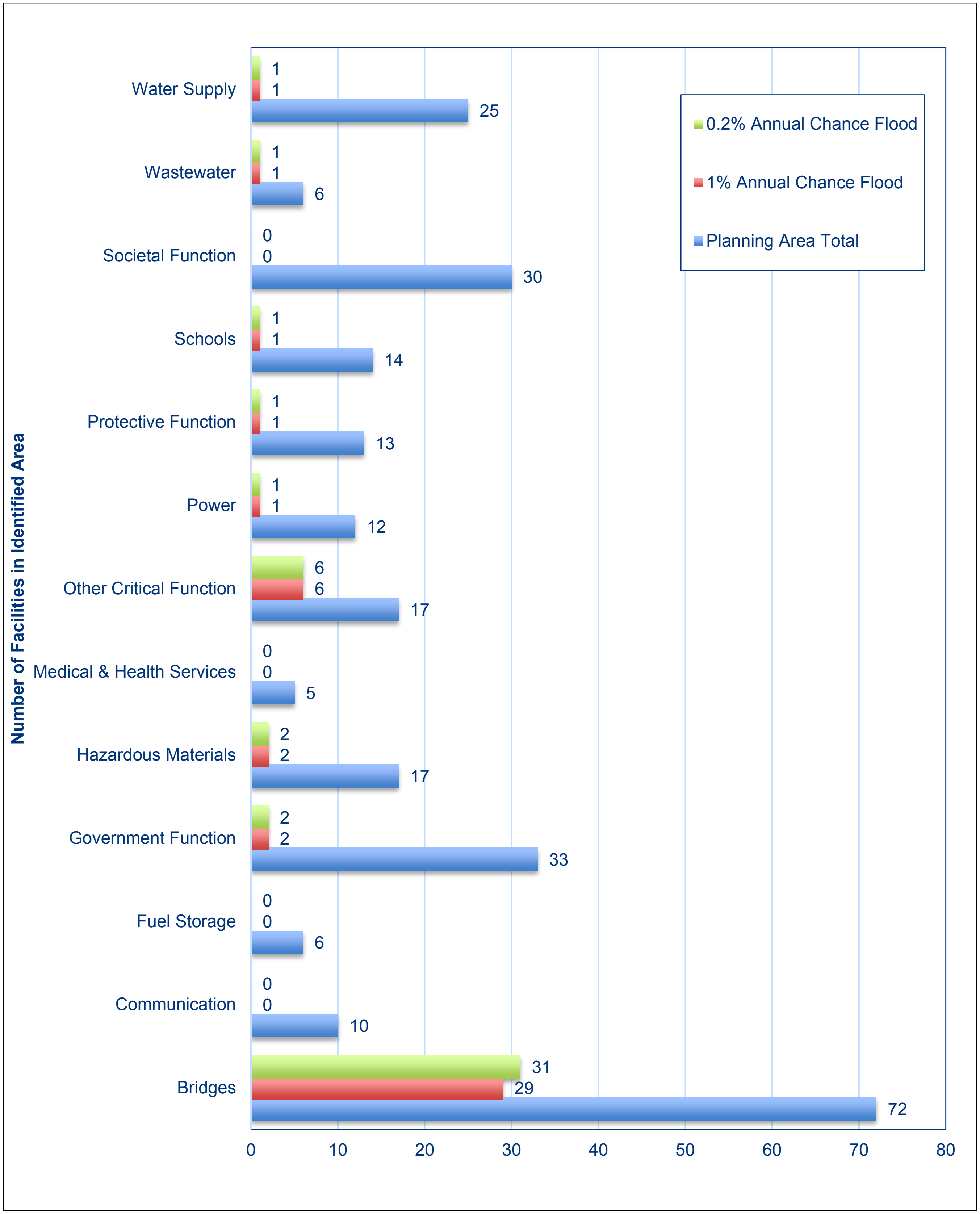


Figure 10-5. Critical Facilities and Infrastructure in Mapped Flood Hazard Areas and Countywide

10.5.2 Property

Property Impacted and Flood Insurance Statistics

The most vulnerable structures in the planning area are those that are not constructed to standards to withstand the impacts of a flood. Such structures may have been built before flood damage prevention regulations were in effect or may not be subject to flood-related building codes because they are outside mapped flood hazard areas. In Crescent City, an estimated 77 percent of the housing units were built before the City entered the National Flood Insurance Program (NFIP) in 1982 and began enforcing floodplain regulations. Del Norte County began participation in the NFIP in 1983, and it is estimated that 58 percent of the structures in the planning area, including those in Crescent City, were built before this time. It is unknown how many of these structures are located in flood hazard areas (U.S. Census Bureau, 2018). Elk Valley Rancheria does not participate in the NFIP and has no mapped floodplains.

Table 10-4 summarizes planning area participation in the NFIP. The number of flood insurance policies in force has increased in unincorporated portions of the planning area since the last hazard mitigations plan was developed in 2010; however, the number of policies in force in Crescent City has dropped by more than half (from 154 in 2009 to 47 at present). The average flood insurance claim paid out in the planning area since participation in NFIP began is $18,788, indicating that many of these claims were likely for slight to moderate damage. There are few flood insurance policies in effect in the planning area. It is unknown whether these policies are on structures within special flood hazards areas; however, if all of the current policies are for structures in the special flood hazard area, then 36 percent of exposed structures still lack flood insurance.

Table 10-4. Flood Insurance Statistics

Jurisdiction	Crescent City	Unincorporated County	Total
Date of Entry Initial Flood Insurance Rate Map Effective Date	11/23/1982	1/24/1983	
Current DFIRM Effective Date	8/2/2017	8/2/2017	
# of Flood Insurance Policies	21	165	**186**
Total Insurance Coverage in Force	$5,844,600	$41,246,100	**$47,090,700**
Claims Paid (Open/Closed without Payment)	2 (0/0)	24 (0/11)	**26 (0/11)**
Value of Claims paid	$116,627	$371,872	**$488,499**
Repetitive Loss Properties[a]			
Not Mitigated	0	0	0
Mitigated	1	0	1

a. A repetitive loss property is any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period, since 1978.

Source: FEMA, 2018 as of 1/31/2018

Even structures that are constructed to current regulatory standards may be vulnerable if floodwaters are higher than flood design standards. About 80 percent of structures in the 1-percent and 0.2-percent-annual-chance flood hazard areas would be damaged—234 and 271 structures, respectively.

Damage Estimates

Table 10-5 summarizes Hazus estimates of flood damage in the planning area. The debris estimate includes only structural debris and building finishes; it does not include additional debris that may result from a flood event, such as from trees, sediment, building contents, bridges or utility lines. The almost 80,000 tons of estimated debris from a 1-percent-annual-chance flood event is enough to fill nearly 3,200 25-ton trucks.

Table 10-5. Estimated Impact of a Flood Event in the Planning Area

Damage Type	1%-Annual-Chance Event	0.2%-Annual-Chance Event
Structure Debris (Tons)	79,262	88,062
Buildings Impacted	234	271
Total Value (Structure + Contents) Damaged	$156 million	$195 million
Damage as % of Total Value	1%	1%

10.5.3 Critical Facilities and Infrastructure

Table 10-6 and Table 10-7 summarize the Hazus estimates of damage to critical facilities and infrastructure in the planning area. About 93 percent of the critical facilities exposed to the 1-percent-annual-chance flood and 89 percent of those exposed to the 0.2-percent-annual-chance flood are predicted to experience some damage. Most facilities—75 percent for the 1-percent-annual-chance flood and 70 percent for the 0.2-percent-annual-chance flood—are predicted to experience only slight damage.

Hazardous Materials

There are two planning area facilities in special flood hazard areas known to manufacture, process, store, or otherwise use certain chemicals above minimum thresholds. If damaged by a flood, these facilities could release chemicals that cause cancer or other human health effects, significant adverse acute human health effects, or significant adverse environmental effects. During a flood event, containers holding these materials can rupture and leak into the surrounding area, disastrously affecting the environment and residents.

Table 10-6. Damage Level to Critical Facilities Exposed to the 1-Percent-Annual-Chance Flood

		Predicted Damage Level[a]			
Facility Type	Number of Facilities Exposed	None	Slight	Moderate	Substantial
Government Functions	2	0	0	2	0
Hazardous Materials Facilities	2	0	2	0	0
Medical & Health Services	0	—	—	—	—
Other Critical Functions	6	1	2	3	0
Protective Functions	1	0	0	1	0
School Facilities	1	1	0	0	0
Societal Functions	0	0	0	0	0
Bridges	29	1	28	0	0
Communication	0	—	—	—	—
Fuel Storage	0	—	—	—	—
Power	1	0	1	0	0
Wastewater	1	0	0	1	0
Water Supply	1	0	0	1	0
Total/Average	**44**	**3**	**33**	**8**	**0**

a. None = No damage to structure or contents; Slight = 0-10% damage to structure; Moderate = 11-49% damage to structure; Substantial = 50-100% damage to structure

Table 10-7. Damage Level to Critical Facilities Exposed to the 0.2-Percent-Annual-Chance Flood

Facility Type	Number of Facilities Exposed	Damage Level[a]			
		None	Slight	Moderate	Substantial
Government Functions	2	0	0	2	0
Hazardous Materials Facilities	2	0	2	0	0
Medical & Health Services	0	—	—	—	—
Other Critical Functions	6	1	2	2	1
Protective Functions	1	0	0	1	0
School Facilities	1	1	0	0	0
Societal Functions	0	—	—	—	—
Bridges	31	3	28	0	0
Communication	0	—	—	—	—
Fuel Storage	0	—	—	—	—
Power	1	0	0	1	0
Wastewater	1	0	0	1	0
Water Supply	1	0	0	1	0
Total/Average	**46**	**5**	**32**	**8**	**1**

a. None = No damage to structure or contents; Slight = 0-10% damage to structure; Moderate = 11-49% damage to structure; Substantial = 50-100% damage to structure

Utilities and Infrastructure

Roads that are blocked or damaged can isolate residents and can prevent access throughout the planning area, including for emergency service providers needing to get to vulnerable populations or to make repairs. Bridges washed out or blocked by floods or debris also can cause isolation. Underground utilities can be damaged. Levees can fail or be overtopped, inundating the land that they protect. Floodwaters can back up drainage systems, causing localized flooding. Culverts can be blocked by debris from flood events, also causing localized urban flooding. Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing wastewater to spill into homes, neighborhoods, rivers and streams.

10.5.4 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. Some well-known, water-related functions of floodplains (noted by FEMA) include:

- Natural flood and erosion control
- Provide flood storage and conveyance
- Reduce flood velocities
- Reduce flood peaks
- Reduce sedimentation
- Surface water quality maintenance
- Filter nutrients and impurities from runoff
- Process organic wastes
- Moderate temperatures of water
- Groundwater recharge
- Promote infiltration and aquifer recharge
- Reduce frequency and duration of low surface flows.

Areas in the floodplain that typically provide these natural functions are wetlands, riparian areas, sensitive areas, and habitats for rare and endangered species.

10.6 FUTURE TRENDS IN DEVELOPMENT

Expected development trends in Del Norte County are not such that there is major concern about development in identified flood risk areas. Both Crescent City and Del Norte County participate in the National Flood Insurance Program and are considered to be in good standing, based on program compliance. As a participant in the NFIP, both communities have agreed to regulate new development in the mapped floodplain according to standards that equal or exceed those specified under 44 CFR Section 60.3. This will ensure that any development allowed in the floodplain will be constructed such that the flood risk exposure is eliminated or significantly reduced.

There are estimated to be 646 undeveloped parcels that intersect the 1-percent-annual-chance flood hazard area, 75 percent designated for residential development (see Figure 10-6). The total land area of the parcels that fall within the mapped inundation areas is 3,842 acres (35 percent of total undeveloped acreage) meaning that in many instances development on these parcels may be able to be sited outside of the special flood hazard area.

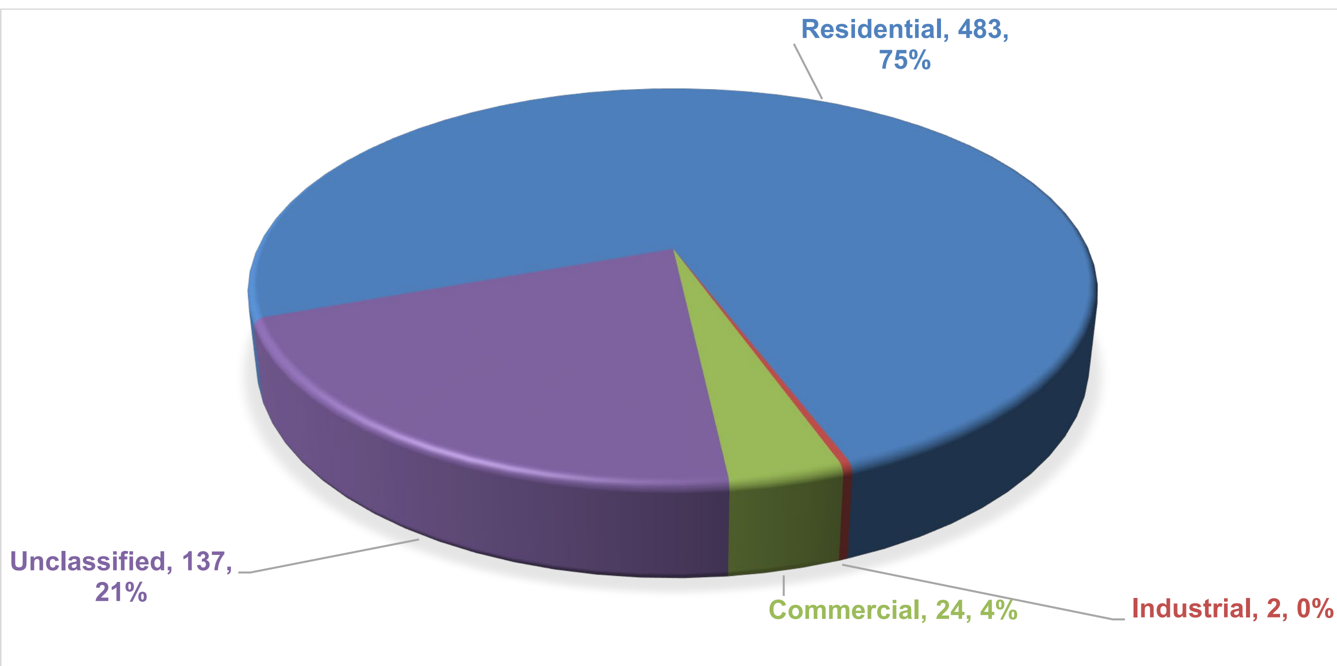


Figure 10-6. Undeveloped Parcels in the 1%-Annual-Chance Flood Zone, by Land Use Type

10.7 SCENARIO

The major river systems in Del Norte County flood at irregular intervals, but generally in response to a succession of intense winter rainstorms occurring between early November and late March. A series of weather events that meet these conditions can cause severe flooding. The worst-case scenario is a series of storms that flood numerous drainage basins in a short time. This would overwhelm city and County response and floodplain management departments. Major roads would be blocked, preventing critical access for many residents and critical functions. High river flows could cause rivers to scour, possibly washing out roads and creating more isolation problems. In the case of multi-basin flooding, the County may not be able to make repairs quickly enough to restore critical facilities and infrastructure.

10.8 ISSUES

The planning team has identified the following flood-related issues relevant to the planning area:

- It is estimated that a significant number of structures in the planning area were built before any regulations existed on floodplain development. These structures may be particularly vulnerable to the flood hazard.
- The number of flood insurance policies in force in Crescent City has dropped by more than half since the development of the previous hazard mitigation plan. It is estimated that at least 36 percent of structures in the special flood hazard area do not have flood insurance.
- The almost 80,000 tons of estimated debris from a 1-percent-annual-chance flood event is enough to fill nearly 3,200 25-ton trucks.
- No critical facilities in the planning area are expected to be substantially damaged by a 1-percent-annual-chance flood.

11. LANDSLIDE

11.1 GENERAL BACKGROUND

11.1.1 Landslide Types

Landslides are commonly categorized by the type of initial ground failure. Common types of slides are shown on Figure 11-1 through Figure 11-4. The most common is the shallow colluvial slide, occurring particularly in response to intense, short-duration storms. The largest and most destructive are deep-seated slides, which are less common than other types.

Source: Washington Department of Ecology, 2014

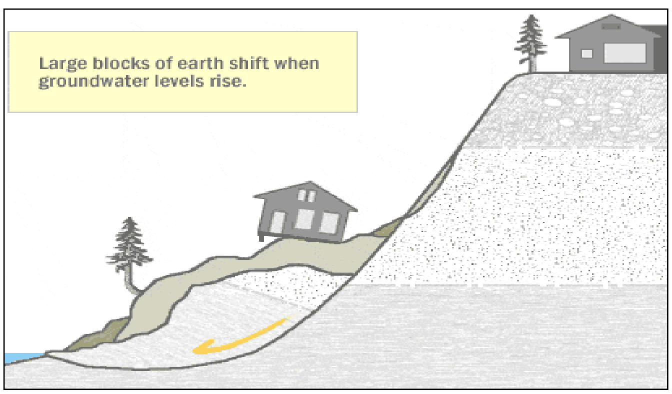


Figure 11-1. Deep Seated Slide

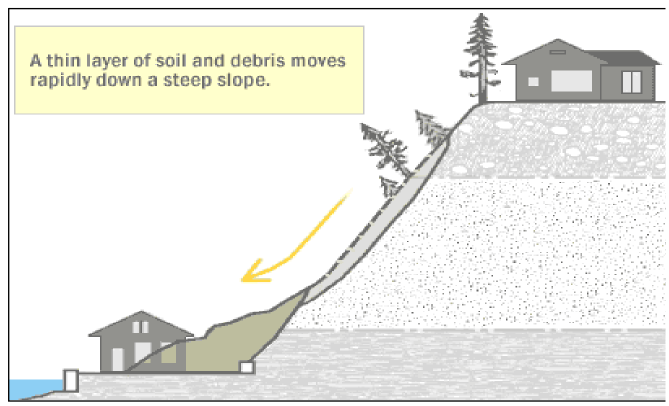


Figure 11-2. Shallow Colluvial Slide

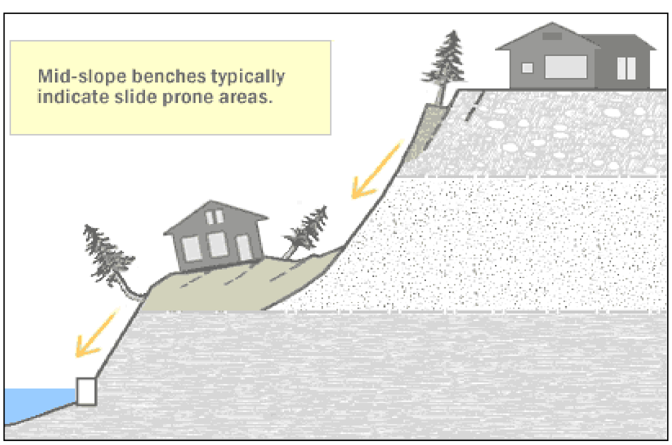


Figure 11-3. Bench Slide

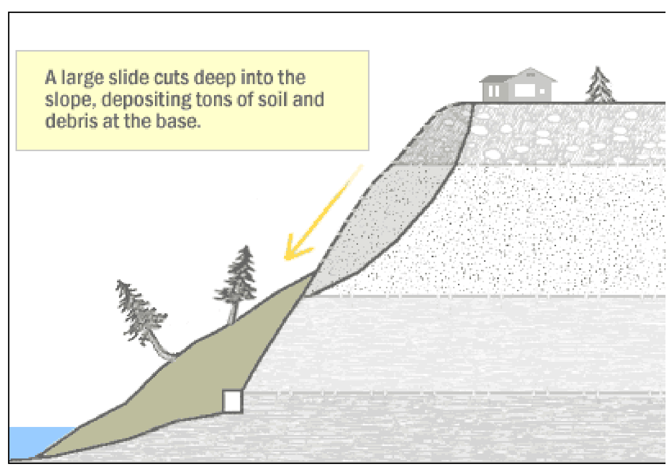


Figure 11-4. Large Slide

Other landslide types also include the following:

- **Block slides**—Blocks of rock that slide along a slip plane as a unit down a slope.
- **Creep**—A slow-moving landslide often only noticed through crooked trees and disturbed structures.
- **Debris avalanche**—A debris flow that travels faster than about 10 miles per hour (mph). Speeds in excess of 20 mph are not uncommon, and speeds in excess of 100 mph, although rare, can occur. The slurry can travel miles from its source, growing as it descends, picking up trees, boulders, cars, and anything else in its path (Figure 11-5).
- **Earth flows**—Fine-grained sediments that flow downhill and typically form a fan structure.
- **Mudslides or Debris Flows**—Rivers of rock, earth, organic matter and other soil materials saturated with water. They develop in the soil overlying bedrock on sloping surfaces when water rapidly accumulates in the ground, such as during heavy rainfall or rapid snowmelt.
- **Rock falls**—Blocks of rock that fall away from a bedrock unit without a rotational component.
- **Rock topples**—Blocks of rock that fall away from a bedrock unit with a rotational component.
- **Rotational slumps**—Blocks of fine-grained sediment that rotate and move down slope.
- **Transitional slides**—Sediments that move along a flat surface without a rotational component.

Source: California Department of Conservation, 2017c

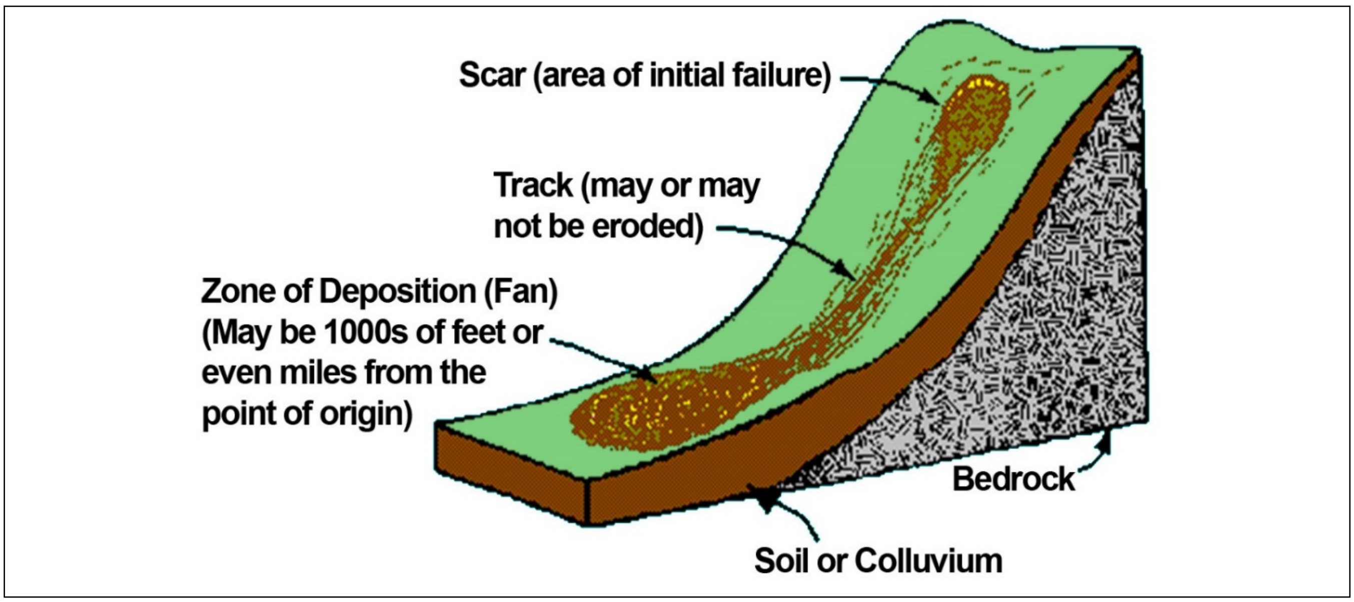


Figure 11-5. Typical Debris Avalanche Scar and Track

11.1.2 Landslide Causes

Landslides are caused by a combination of geological and climate conditions, as well as encroaching urbanization. Vulnerable areas are affected by residential, agricultural, commercial, and industrial development and the infrastructure that supports it. The following human activities have particular influence on the landslide hazard:

- **Construction Earthwork—**Excavation, grading and fill during construction of buildings or roads on sloping terrain can steepen the terrain and increase weight loads on slopes, potentially increasing the landslide hazard.
- **Drainage and Groundwater Alterations—**Activities that increase the amount of water flowing into landslide-prone slopes can increase the landslide hazard. This can include broken or leaking water or sewer lines, water retention facilities that direct water onto slopes, lawn irrigation, minor alterations to

small streams, and ineffective stormwater management measures. Development that increases impervious surface may redirect surface water to other areas. Road and driveway drains, gutters, downspouts, and other constructed drainage facilities can concentrate and accelerate flow.
- **Changes in Vegetation**—Removal of vegetation from very steep slopes, by wildland fire or land clearing, can increase landslide hazards. In addition, woody debris in stream channels (both natural and man-made) may cause the impacts from debris flows to be more severe.

Other factors that can contribute to landslide include the following:

- Change in slope of the terrain
- Increased load on the land, shocks and vibrations
- Change in water content
- Groundwater movement
- Frost action
- Weathering of rocks
- Removing or changing the type of vegetation covering slopes.

11.1.3 Del Norte County Conditions

The geological conditions of Del Norte County are dominated by an actively faulted and sheared older bedrock (Franciscan) overlain by younger, soft marine and fluvial sediments. Most of the region has rapid uplift rates. The region's steep topography reflects the rapid tectonic uplift and simultaneous erosional processes. Due to the cool, rainy Pacific Northwest climate, soil moisture levels remain high throughout much of the year and are often at or near saturation in winter (2010 Hazard Mitigation Plan). The combination of large rain events, easily eroded bedrock and overlying sediments, and fast uplift rates makes the county susceptible to landslides and mudslides, which can be triggered by rain or seismic events. Conditions are exacerbated by the steady encroachment of development and the infrastructure that supports it.

11.2 HAZARD PROFILE

11.2.1 Past Events

Landside activity is common in Del Norte County. Table 11-1 list the known damage-causing landslides that have occurred in the County.

Table 11-1. Landslide Events in Del Norte County

Dates of Event	Primary Event Type	FEMA Disaster #	Losses/Impacts
Ongoing	Landslide	N/A	Highway 101 Last Chance Grade landslides have been causing damage for decades; more than 200 slides have been mapped.
12/17/2005 – 1/3/2006	Severe Storm	DR-1628	Severe storms, flooding, mudslides, and landslides; $7.65 million in damage
12/28/1996 – 4/1/1997	Severe Storm	DR-1155	Severe storms, flooding, mud and landslides; $15.15 million in damage
1/3/1995 – 2/10/1995	Severe Storm	DR-1044	Severe winter storms, flooding, landslides, mud flows
December 1995	Earthquake	N/A	Major flash flood from landslide in the South Fork (Smith River) Canyon, 7 miles above Hiouchi
1/5/1993 – 3/20/1993	Flood	DR-979	Severe winter storm, mud & land slides, and flooding

Sources: FEMA 2018; 2010 Crescent City/Del Norte County Hazard Mitigation Plan, Damage estimates from Spatial Hazard Events and Losses Database for the United States

The most recent site-specific landslides were along the Last Chance Grade area of Highway 101, which saw $35 million in damage in the winter of 2017-2018 (California Department of Transportation, 2018). The most recent widespread landslide damage in the county was during winter storms of 2005-06. Record rain and wind that winter storms resulted in thousands of large and small-scale landslides along every major transportation corridor of the county (Highways 101, 199, 197, and 169). The result was millions of dollars in damage and much of the county cut off from the outside world. Drainage systems and catchment basins could not handle the volume of runoff, focusing the water's energy against vulnerable slopes and manmade structures. In some cases, saturated soils became overloaded with the weight of rainwater and collapsed. Private homeowners reported significant damage, particularly in areas where natural drainage ways have been paved, diverted or otherwise modified.

11.2.2 Location

Dormant Sites of Previous Landslides

One of the best predictors of where landslides might occur is the location of past landslides, which can be recognized by distinctive topographic shapes that can remain in place for thousands of years. Such sites range from a few acres to several square miles. Many show no evidence of recent movement and are not currently active. A few may become active in any given year. The recognition of ancient dormant landslide sites is important in the identification of areas susceptible to landslides because they can be reactivated by earthquakes or by exceptionally wet weather. These dormant sites are also vulnerable to construction-triggered sliding. The shoreline contains many large, deep-seated dormant landslides.

Landslide Susceptibility Mapping

In 2011, the California Geological Survey conducted a statewide analysis using a combination of regional rock strength and slope data to create classes of susceptibility to deep-seated landslides. The analysis assumed, in general, that susceptibility to deep-seated landslides is low on very low slopes in all rock materials and increases with slope and in weak rocks. The analysis also factored in locations of past landslides. Figure 11-6 shows deep-seated landslide susceptibility classes (none, low, moderate, high, and very high).

Last Chance Grade

Highway 101, the main transportation corridor in northern coastal California, traverses a particularly rugged and landslide-prone area between Crescent City and Wilson Creek. Reoccurring landslides frequently occur on the section of this highway, called Last Chance Grade. According to a project study report for the area, landslides that damage the highway have been occurring for decades (see Figure 11-7 and Figure 11-8; Caltrans, 2018). Caltrans has mapped more than 200 landslides in this area (2010 Hazard Mitigation Plan, see Figure 11-9; California Geologic Society, 2018).

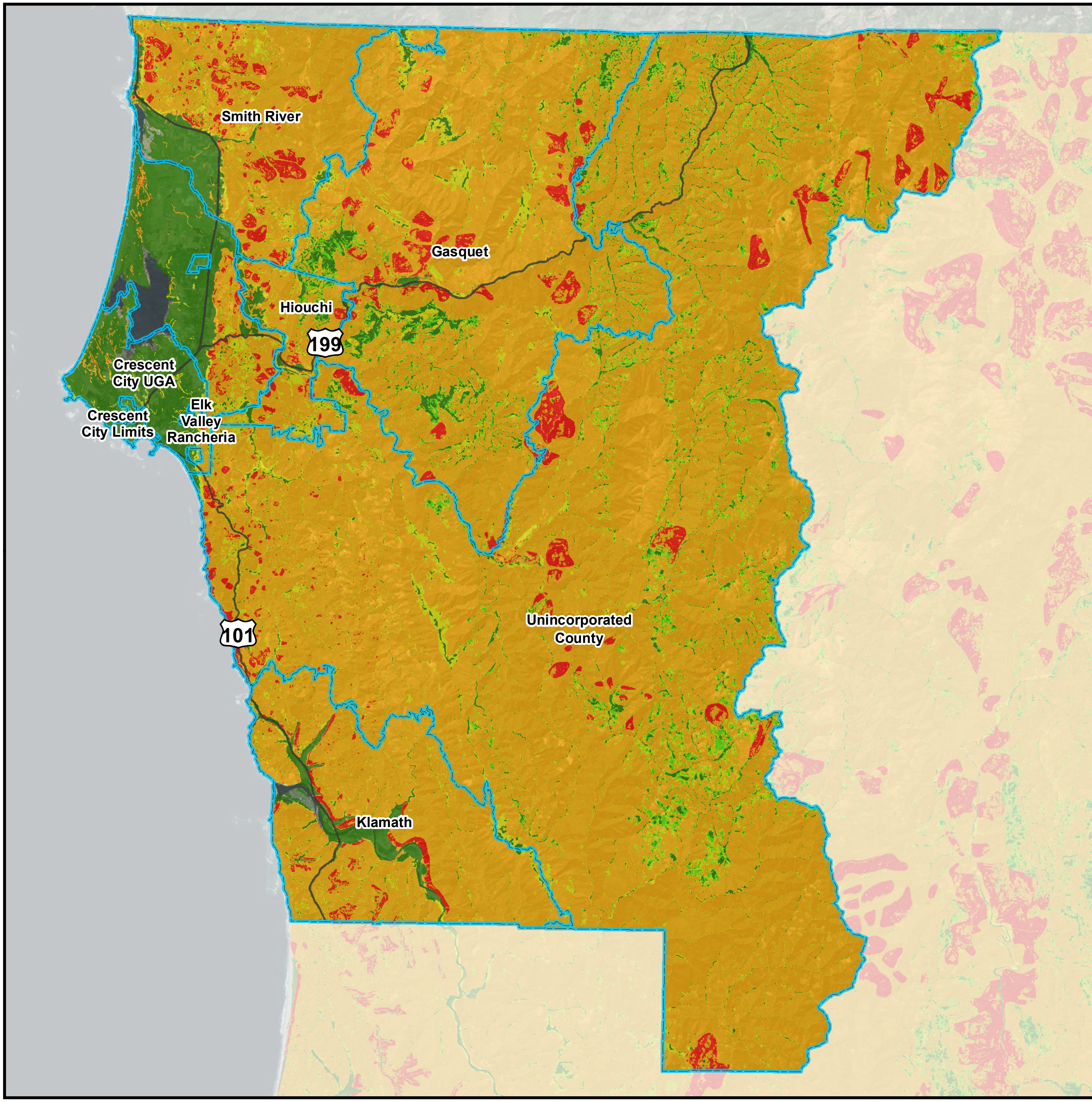
Since Highway 101 is the principal supply route to the planning area, landslides that impact this travel corridor can have severe economic impact on Del Norte County. The Highway 101 corridor from Wilson Creek to Crescent City has received a great deal of attention in the form of studies and mitigation efforts. Caltrans and other stakeholders are currently working to identify and implement a permanent solution for this area (Caltrans, 2016a).

11.2.3 Frequency

Landslides are often triggered by other natural hazards such as earthquakes, heavy rain, floods or wildland fires, so their frequency is often related to the frequency of these other hazards. In Del Norte County, landslides typically occur during and after severe storms, so the potential for landslides largely coincides with the potential for sequential severe storms that saturate steep, vulnerable soils. Most weather-induced landslides in the county occur in the winter after the water table has risen. Landslides that result from earthquakes can occur at any time.

Del Norte County

**Figure 11-6.
Susceptibility to Deep-Seated Landslides**



Planning Unit Boundaries

Landslide Category

- None
- Low
- Moderate
- High
- Very High / Existing

Map Data Sources:Del Norte County, CalTrans, Hazus 4.2, EPA, USDA, California Geological Survey, State of California

Figure 11-7. Highway 101, Last Chance Grade

Figure 11-8. Highway 101 Landslide Clean Up, Winter 2005-06

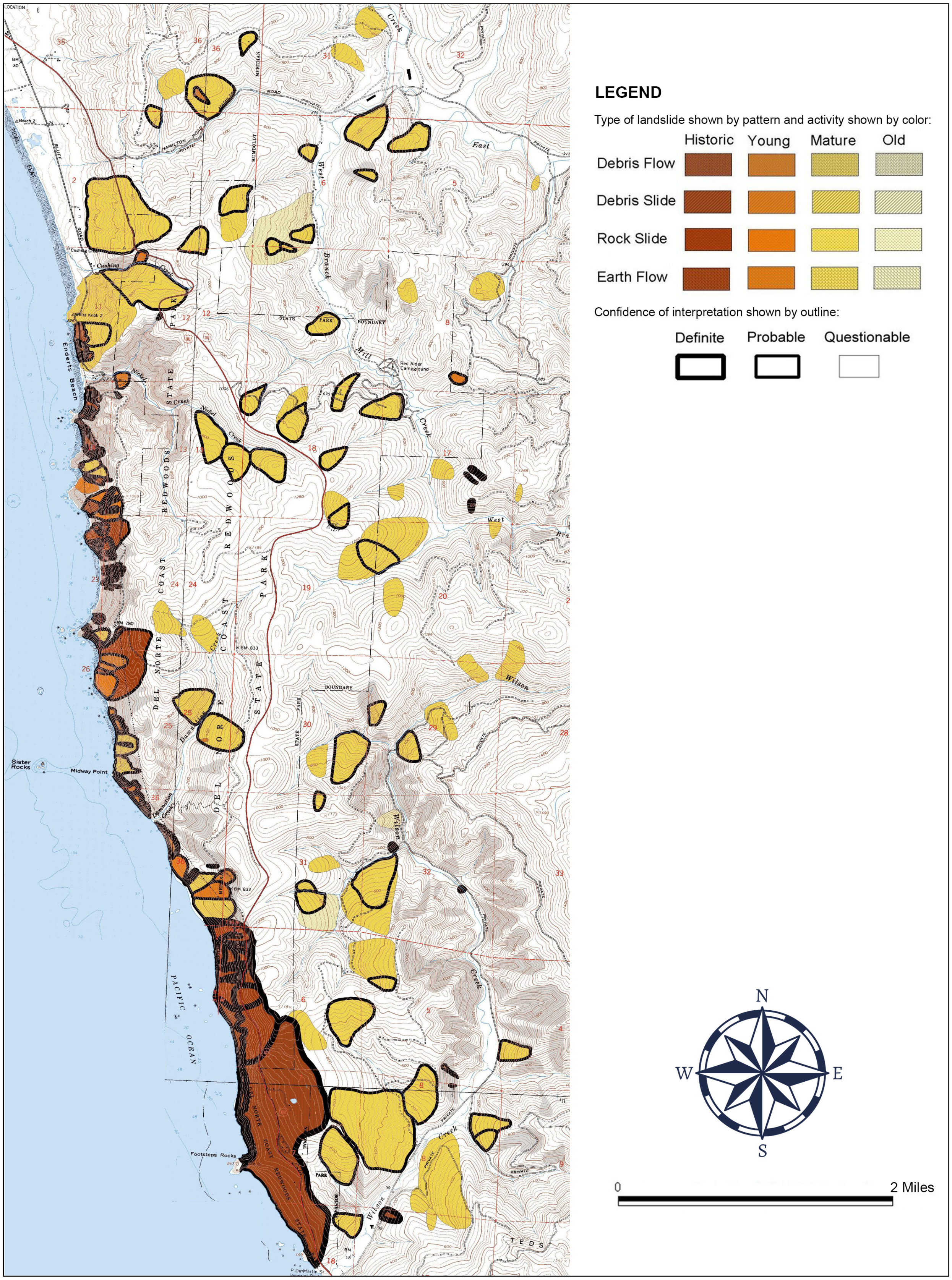


Figure 11-9. Last Chance Grade Historical Landslide Mapping

Since 1993, there have been four disaster declarations where landslide impacts were known to occur, an average of about one such event every six years. Many smaller-scale landslides occur in the planning area every year. The probability of a landslide event occurring in the County in any given year is high.

11.2.4 Severity

Landslides destroy property and infrastructure and can take the lives of people. They have the potential of destabilizing the foundation of structures, which may result in monetary loss for residents. Slope failures in the United States result in an average of 25 to 50 lives lost per year and an annual cost to society of about $1.5 billion (FEMA, n.d.). Landslides can pose a serious hazard to properties on or below hillsides. They can cause block access to roads, which can isolate residents and businesses and delay commercial, public and private transportation. This can result in economic losses for businesses. Vegetation or poles on slopes can be knocked over, resulting in possible losses to power and communication lines. Landslides also can damage rivers or streams, potentially harming water quality, fisheries and spawning habitat.

Shallow slides are the most common in Del Norte County, but large catastrophic slides occasionally occur in most parts of the county. Falls, slides, and mud and debris flows caused about half of all damage during the 2005-06 storms in Del Norte County, including tens of millions of dollars of damage to road infrastructure.

11.2.5 Warning Time

The velocity of landslides ranges from a slow creep of inches per year to many feet per second, depending on slope angle, material and water content. Some methods used to monitor landslides 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 precipitation for an area can help in these predictions. However, there is no practical warning system for individual landslides. The current standard operating procedure is to monitor situations on a case-by-case basis, and respond after the event has occurred. Generally accepted warning signs for landslide activity include the following:

- Springs, seeps, or saturated ground in areas that have not typically been wet before
- New cracks or unusual bulges in the ground, street pavements or sidewalks
- Soil moving away from foundations
- Ancillary structures such as decks and patios tilting and/or moving relative to the main house
- Tilting or cracking of concrete floors and foundations
- Broken water lines and other underground utilities
- Leaning telephone poles, trees, retaining walls or fences
- Offset fence lines
- Sunken or down-dropped road beds
- Rapid increase in creek water levels, possibly accompanied by increased turbidity (soil content)
- Sudden decrease in creek water levels though rain is still falling or just recently stopped
- Sticking doors and windows, and visible open spaces indicating jambs and frames out of plumb
- A faint rumbling sound that increases in volume as the landslide nears
- Unusual sounds, such as trees cracking or boulders knocking together.

11.3 SECONDARY HAZARDS

Landslides are not generally known to result in secondary hazards. However, they themselves are often secondary hazards of other event types, such as earthquakes, severe weather or wildland fires.

11.4 EXPOSURE

A quantitative assessment of exposure to the landslide hazard was conducted using the susceptibility class mapping shown in Figure 11-6 and the asset inventory developed for this plan (See Section 6.3). Detailed results are provided in Appendix C and summarized below.

11.4.1 Population

Population was estimated using the residential building count in each mapped hazard area and multiplying by the 2016 estimated average population per household. Using this approach, the estimated population living in mapped landslide hazard areas is 14 percent of the total planning area population (3,831 people). Population exposure estimates by susceptibility class are shown in Table 11-2. Planning units with the highest percentage of their population exposed to high and very high landslide susceptibility classes are Gasquet (46 percent), Hiouchi (35 percent), Klamath (28 percent) and Smith River (38 percent). In addition to these resident populations, motorists driving on landslide prone roadways and those engaged in recreation activities such as hiking or camping may be exposed to the landslide hazard.

Table 11-2. Del Norte County Population Exposure to Landslide Hazard

Susceptibility Class	Population Exposed	% of Total Population
Moderate	1,683	6%
High	1,944	7%
Very High	204	Less than 1%
Total	**3,831**	**14%**

11.4.2 Property

Figure 11-10 shows the percentage and count, by land use type, of planning area structures in the very high and high susceptibility classes. An estimated 95 percent of these (773 structures) are residential. Almost all of the structures in the very high susceptibility class are residential (71 structures), and the vast majority of them are in the Klamath (17 structures), Smith River (29 structures), and Unincorporated County (18 structures) Planning Units.

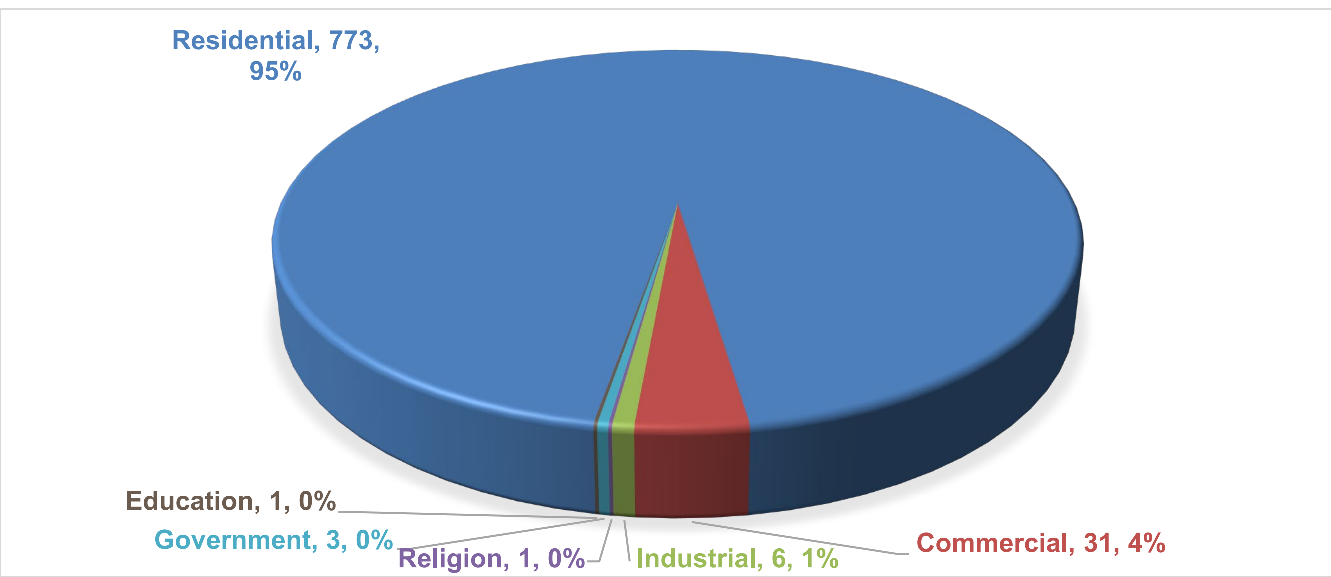


Figure 11-10. Structures in the High or Very High Landslide Susceptibility Classes, by Land Use Type

The total replacement value of property in the landslide hazard are is more than $1.8 billion—12 percent of the planning area total:

- Moderate susceptibility class: $868.8 million
- High susceptibility class: $852.7 million
- Very high susceptibility class: $97.6 million

11.4.3 Critical Facilities and Infrastructure

Critical facilities and infrastructure exposed to the landslide hazard represent 30 percent of the total critical infrastructure and facilities in the planning area. Only 3 percent (9 facilities) are located in very high susceptibility classes, all in the northern portion of the planning area. Linear infrastructure is also exposed to damage from landslides including roads, power and phone lines. The breakdown of exposure by susceptibility class and facility type is shown in Figure 11-11.

11.4.4 Environment

All natural resources and habitats in the mapped landslide susceptibility class areas are exposed to the landslide hazard.

11.5 VULNERABILITY

Vulnerability estimates for the landslide hazard are described qualitatively. No loss estimation of these facilities was performed because damage functions have not been established for the landslide hazard. Modeling based on identified landslide hazard areas would overestimate potential losses because it is unlikely that all areas susceptible to landslides would experience landslides at the same time.

11.5.1 Population

All people exposed the landslide hazard are potentially vulnerable to landslide impacts. Populations with access and functional needs as well as elderly populations and the very young are more vulnerable to the landslide hazards as they may not be able to evacuate quickly enough to avoid the impacts of a landslide.

11.5.2 Property

All property exposed to the landslide hazard is vulnerable. Property located in very high landslide susceptibility classes is most vulnerable, especially structures that were built before modern building codes were adopted. Estimates were developed to indicate the loss that would occur if landslide damage were equal to 10, 30 or 50 percent of the exposed property value, as summarized in Table 11-3. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure.

Table 11-3. Loss Potential in the Landslide Hazard Areas

		Damage = 10% of Exposed Value		Damage = 30% of Exposed Value		Damage = 50% of Exposed Value	
Susceptibility Class	Exposed Value	Loss	% of Total Replacement Value	Loss	% of Total Replacement Value	Loss	% of Total Replacement Value
Moderate	$868.8 million	$86.8 million	0.6%	$260.6 million	1.7%	$434.4 million	2.8%
High	$852.7 million	$85.3 million	0.6%	$255.8 million	1.7%	$426.4 million	2.8%
Very High	$97.6 million	$9.8 million	0.1%	$29.3 million	0.2%	$48.8 million	0.3%
Total	**$1.819 billion**	**$181.9 million**	**1.2%**	**$545.7 million**	**3.5%**	**$909.5 million**	**5.9%**

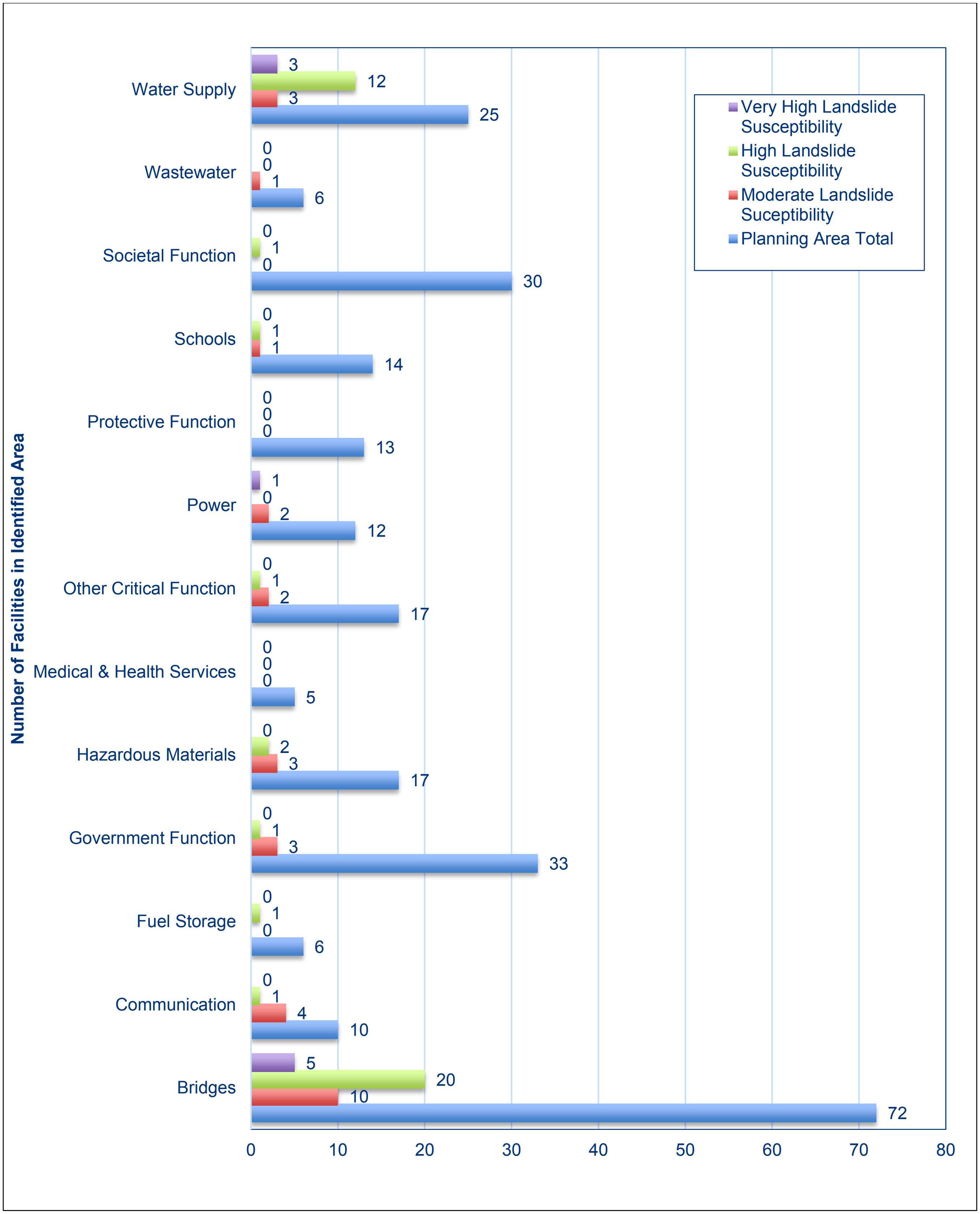


Figure 11-11. Critical Facilities and Infrastructure in Mapped Landslide Susceptibility Classes and Countywide

11.5.3 Critical Facilities and Infrastructure

All exposed critical facilities and infrastructure are vulnerable to the landslide hazard. Landslides can have a range of impacts on critical facilities and infrastructure:

- **Roads**—Access to major roads after a disaster is crucial to safety and to response operations. Landslides can block roads, isolating neighborhoods and causing problems for public and private transportation. This can result in economic losses for businesses. U.S. Highway 101 is prone to landslide hazards, causing significant disruption to transportation corridors in the planning area.
- **Bridges**—Landslides can significantly impact road bridges. They can knock out bridge abutments or significantly weaken the soil supporting them, making them hazardous for use. Two of the bridges in high susceptibility classes are owned by the County; the other three are owned by Caltrans.
- **Power Lines**—Power lines are generally elevated above steep slopes; but the towers supporting them can be subject to landslides. A landslide could trigger failure of the soil underneath a tower, causing it to collapse and ripping down the lines. Power and communication failures due to landslides can create problems for vulnerable populations and businesses and may generate significant communication issues. Analysis showed that Pacific Gas & Electric lines pass through many highly unstable slope areas.

11.5.4 Environment

Landslides can cause numerous problems for all exposed parts of the environment, as described in the sections below. However, that landslides also can serve beneficial functions to the natural environment. They supply sediment and large wood to stream channel networks and can contribute to complexity and dynamic channel behavior critical for aquatic and riparian ecological diversity.

Habitat

Landslides that fall into streams may significantly impact fish and wildlife habitat, as well as affecting water quality. Hillsides that provide wildlife habitat can be lost due to landslides. Endangered species and their critical habitat in the planning area may be located in landslide hazard areas.

Agricultural and Timber Resources

Agricultural resources include rangelands, timberlands, cultivated farmlands, and dairy lands. Agricultural lands are an important element of the Del Norte County identity and economy. Landslides can have major consequences for such resources, primarily timberland due to the large portion of it on steep slopes in remote locations. Roads accessing timberlands are often susceptible to slides and erosional events and frequently are contributing factors to landslides. Landslide activity on these roads can remove them from production.

Scenic Resources

Del Norte County possesses numerous natural and cultural scenic resources, including redwood forests, beaches, flora and fauna habitat, wild and scenic rivers, agricultural lands, historical buildings, and coastal amenities such as sea stacks, sea cliffs, and sand dunes. Many of these resources can be directly impacted by landslides:

- **Coastal Views**—Del Norte County's coastline allows for a wide range of scenic vistas from Highway 101 and from beaches, state parks and coastal access points. Landslides could visually impact these views or prevent access to views.
- **Forests**—Forestlands define much of the visual landscape of Del Norte County. Redwood National Park, Six Rivers National Forest, and Redwoods State Park are all significant, protected forests within the county. Forestland is abundant well beyond these protected areas. The scenic value of these natural

resources, viewed from within or from outside, is of great importance. Landslides are a natural part of forest lands and can have an impact.

- **Scenic Highways**—A scenic road is defined as a roadway that, in addition to its transportation function, provides opportunities for the enjoyment of natural and scenic resources. Scenic roads direct views to areas of exceptional beauty, natural resources or landmarks, or historic and cultural interest. Because these routes are frequently located in less developed areas, they are frequently susceptible to landslides. Currently, Del Norte County possesses only one federally designated scenic highway—the Smith River Scenic Byway. This byway predominantly follows U.S. Highway 199 from the U.S. Highway 101 intersection to the Oregon Border. A number of other state highways in the planning area are eligible for scenic highway designation (California Department of Transportation, 2011).

11.6 FUTURE TRENDS IN DEVELOPMENT

The California Building Standards Code has adopted the International Building Code (IBC) by reference. The IBC includes provisions for geotechnical analyses in steep slope areas that have soil types considered susceptible to landslide hazards. These provisions assure that new construction is built to standards that reduce the vulnerability to landslide risk. The Del Norte County General Plan (2003) and the City of Crescent City General Plan (2001) contain policies relating to managing risk to development in landslide hazard areas.

According to County Assessor records, there are 719 undeveloped parcels that intersect very high and high landslide susceptibility classes. About 70 percent of these are designated for residential development (see Figure 11-12). The total land area of the parcels that fall within the mapped inundation areas is 3,162 acres (29 percent of total undeveloped acreage). Development on these parcels will be regulated by applicable zoning and building codes.

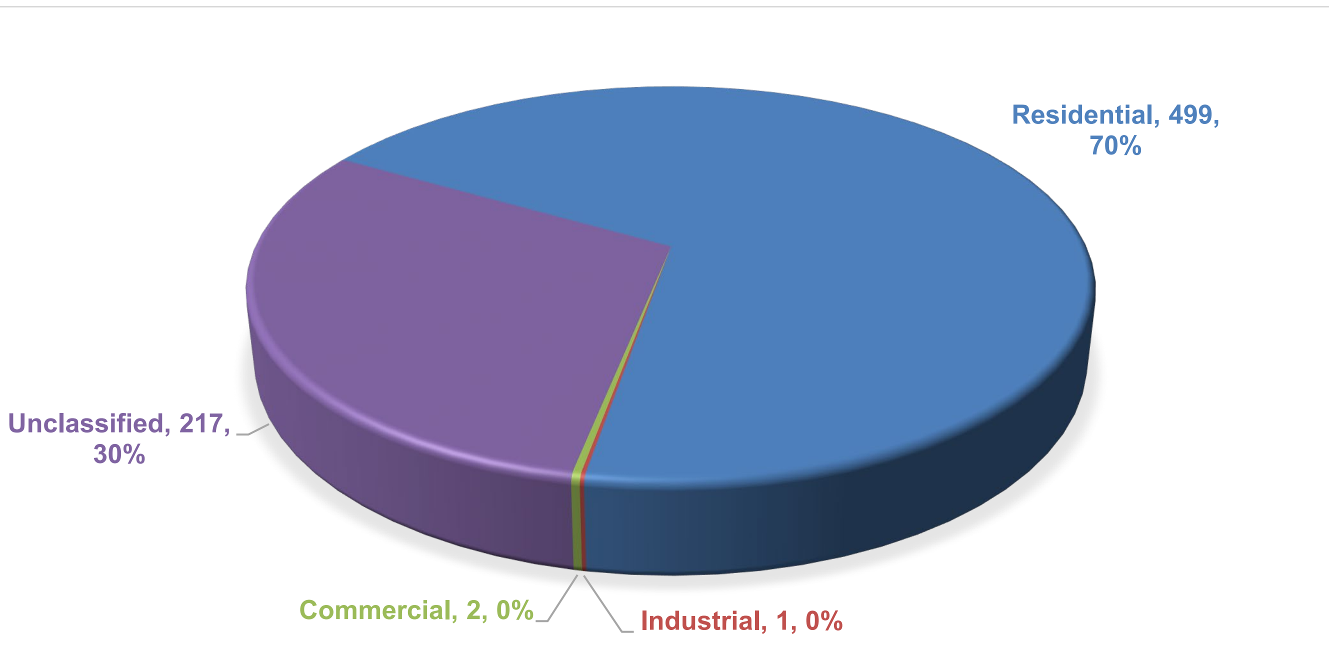


Figure 11-12. Undeveloped Parcels in the High and Very High Susceptibility Classes, by Land Use Type

11.7 SCENARIO

Major landslides in Del Norte County occur as a result of soil conditions that have been affected by severe storms, groundwater or human development. Landslides are most likely during late winter when the water table is high. After heavy rains, soils become saturated with water. As water seeps downward through upper soils that may consist of permeable sands and gravels and accumulates on impermeable silt, it will cause weakness and destabilization in the slope. The worst-case scenario for landslide hazards in the planning area would generally correspond to a severe storm with heavy rain and flooding, followed by a damaging earthquake. An earthquake that occurs when water tables are high and soils are saturated has the potential to trigger a significant number of landslides in the planning area.

11.8 ISSUES

Important issues associated with landslides in the planning area include the following:

- An accurate picture of where landslides occurred during previous storms is vital in making intelligent land use planning and mitigation decisions. In the past, many landslide losses may have gone unrecorded because insurance companies do not cover such damage. Transportation network damage has often been repaired under the general category of “maintenance.” Many of the landslides on Del Norte County’s steep coastal bluffs and river and stream front properties cannot be seen from aerial reconnaissance; they are only clearly visible from close quarters on the ground.
- Landslides may result in isolation of the entire county (worst case) or neighborhoods and communities, due to the fact that large portions of the transportation infrastructure are in areas of high and moderate slope instability. Isolation may result in food shortages, loss of power, and severely reduced economic productivity.
- There are critical facilities in areas of unstable slopes that could result in interruption to utility services, particularly water and power. This creates a need for mitigation and for continuity of operations planning to develop procedures for providing services without access to essential facilities.
- Landslides may result in loss of water quality to the environment and for drinking purposes, due to increased sediment delivery into surface waterways.
- There are existing homes in landslide hazard areas throughout the planning area. The degree of vulnerability of these structures depends on the codes and standards the structures were constructed to. Information to this level of detail is not currently available.
- The impact of climate change on landslides is uncertain. If climate change impacts the timing and intensity of rain event, then the frequency of landslide events may increase.
- The risk associated with the landslide hazard overlaps the risk associated with other hazards such as earthquake, flood and wildland fire. This provides an opportunity to seek mitigation alternatives with multiple objectives that can reduce risk for multiple hazards.
- California’s Disclosures in Real Property Transactions law requires disclosure if a property is in a landslide hazard area. Such disclosure is dependent upon knowledge by the seller or the seller’s real estate agent or the posting of a landslide hazard map at the offices of the county recorder, county assessor, and county planning agency and a notice identifying the location of the map and any changes to it. Del Norte County currently does not have immediately available postings of hazard locations because the County is in the process of updating its address and parcel information systems.

12. SEVERE WEATHER

12.1 GENERAL BACKGROUND

Severe weather refers to any dangerous meteorological phenomena with the potential to cause damage, serious social disruption, or loss of human life. The most common severe weather events to impact the planning area are winter weather, thunderstorms, and damaging winds. For this risk assessment, any use of the term "severe weather" refers in these three event types in aggregate. They are assessed as a single hazard for the following reasons:

- Records indicate that each of these weather event types has impacted the planning area to some degree, and all have similar frequencies of occurrence.
- None of these weather event types have a clearly defined extent or location. Therefore, no quantitative, geospatial analysis is available to support exposure or vulnerability analysis; the analyses for this hazard are qualitative.

12.1.1 Winter Weather

Extreme Cold

Extreme cold occurs when temperatures are in dangerous ranges that may cause frostbite or hypothermia to people who are exposed. Extreme cold can occur as a result of low temperatures or a combination of low temperatures with wind chill. Figure 12-1 shows how wind can make temperatures feel colder than they really are. Extreme cold events often occur during severe winter storms.

Severe Winter Storms

Severe winter storms occur when there is significant precipitation and the temperature is low enough that the precipitation completely or partially freezes. Figure 12-2 shows the general circumstances that result in different winter precipitation events. The type of precipitation experienced during a winter storm can depend on location. Winter precipitation may fall as snow at higher altitudes but rain at lower elevations, with freezing rain or sleet at elevations in between.

12.1.2 Thunderstorms

NOAA classifies a thunderstorm as a storm with lightning and thunder produced by cumulonimbus clouds, usually producing gusty winds, heavy rain, and sometimes hail. Thunderstorms are usually short in duration (seldom more than two hours).

Lightning is an electrical discharge that results from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt." This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning instantaneously reaches temperatures approaching 50,000ºF. The rapid heating and cooling of air near the lightning causes thunder.

Temperature (°F)

Wind (mph) \ Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Figure 12-1. Wind Chill Chart

Source: NOAA, NWS, 2018b

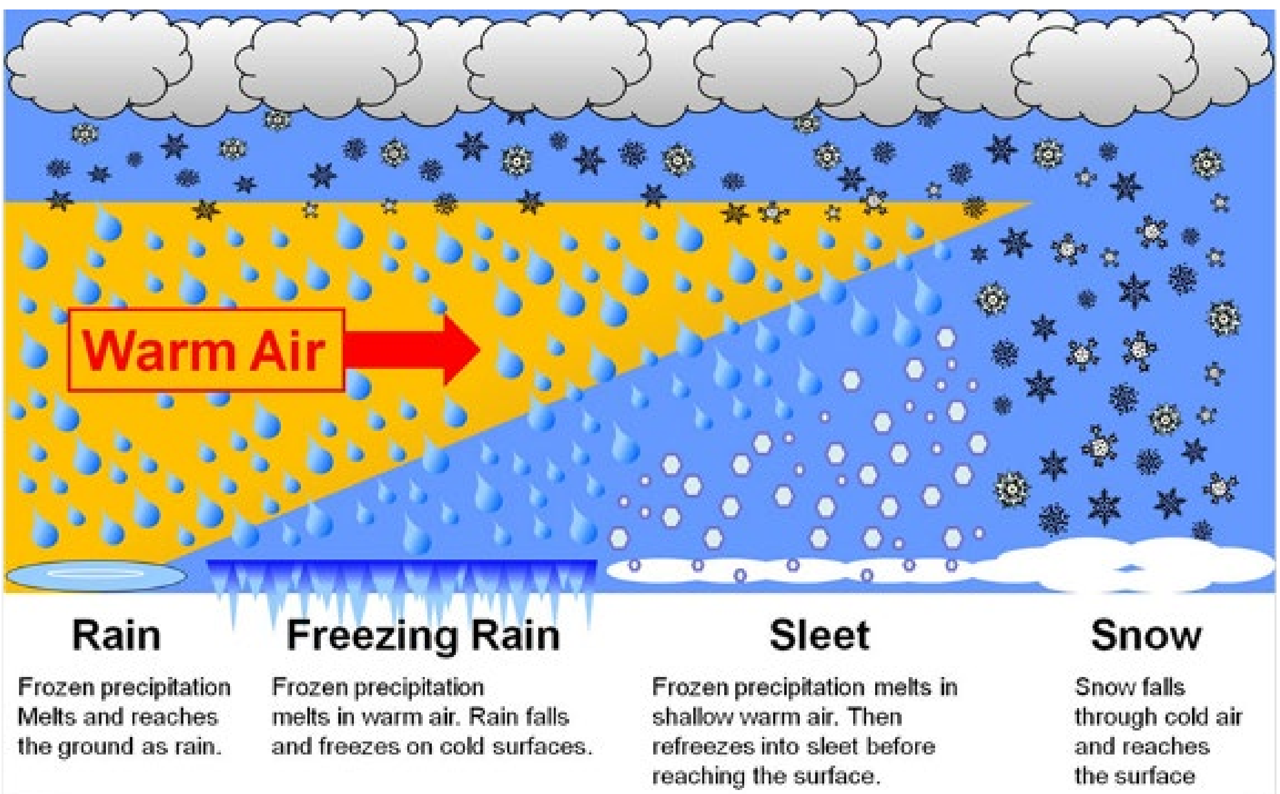


Figure 12-2. Effects of Air Temperature on Winter Precipitation Events

12.1.3 Damaging Winds

Straight-Line Winds

Straight-line wind is a general term used to describe damaging winds that are not tornadoes. They are many different types of straight-line winds. Most damaging straight-line winds are generated by thunderstorm systems, although some result from other types of weather phenomena (National Severe Storms Laboratory, 2018).

Tornado

A tornado is a violently rotating column of air with circulation reaching the ground. It almost always starts as a funnel cloud and may be accompanied by a loud roaring noise. Tornadoes are extremely destructive on a local scale (NOAA, NWS, 2018).

12.2 HAZARD PROFILE

12.2.1 Past Events

Table 12-1 summarizes past severe weather events in the planning area.

Table 12-1. Past Severe Weather Events in the Planning Area

Date	Location	Type	Magnitude	Property Damage
4/7/2017	Coastal & Interior Del Norte	High Wind	71 mph	Unknown
Description: An unusually strong April storm brought high winds to California. Significant damage occurred in Del Norte County where a third of the county lost power. Wind gusts up to 71 mph occurred in coastal Del Norte County. Numerous trees were damaged and fell onto roads. This included the temporary closure of Highway 101. Over 9,000 customers lost power.				
2/20/2017	Coastal Del Norte	High Wind	60 mph	Unknown
Description: An active winter system brought heavy rain and strong winds to Northwest California. Small stream flooding and wind damage occurred with this storm, February 19 – 21. Crescent City airport reported wind gusts between 50 and 60 mph.				
2/5/2017	Coastal Del Norte	High Wind	62 mph	Unknown
Description: A series of storm systems brought heavy rain to Northwest California February 6 – 11. With the ground already saturated from a very wet December and January, rivers rose sharply and reached stages not seen since 2005 in a few locations. Area roads were impacted with several slip outs and landslides. Each storm system brought bouts of strong winds that resulted in power outages and tree damage. Wind gusts up to 62 mph occurred at the Crescent City airport.				
1/22/2017	Coastal Del Norte	High Wind	74 mph	Unknown
Description: A series of strong storms brought flooding rains and strong coastal and ridge tops winds to the region. Rock and land slides occurred on primary and secondary highways, and trees fell during periods of strong winds, closing roads and causing power outages.				
10/15/2016	Coastal & Interior Del Norte/Smith River	High Wind/Severe Winter Storm	67 mph	Unknown
Description: A cold front brought strong winds to Northwest California only a couple of days after an earlier event. Winds exceeded 60 mph in Crescent City. Strong wind gusts were recorded in the mountains. Nearly a foot of rain fell over a 72-hour period from two storms, with minor flooding in Del Norte County. Camp Six remote automated weather station reported a gust of 58 mph. Additional gusts over 70 mph were reported on Ship Mountain but the observations were questionable due to a sensor malfunction. At least one tree fell across Highway 199 blocking the road just east of Jedediah Smith Redwoods State Park. A public report including photos through social media indicated flooding on Fred Haight Drive in Smith River after 10-12 inches of rain over the previous three days.				
10/13/2016	Del Norte Interior	High Wind	66 mph	Unknown
Description: A cold front brought heavy rain and strong southerly winds to portions of Northwest California including Humboldt and Del Norte counties. Winds were strongest on coastal headlands and near coast ridge tops.				
12/28/2008	Klamath	Severe Winter Storm	N/A	$7,000
Description: Heavy rain caused small stream and creek flooding throughout the coastal region of Del Norte County. Impacts were primarily limited to the flooding of roads, but one community sustained damage. Heavy rain caused debris-laden flow to block the culvert of a small stream near Klamath. The resultant flooding closed several roads and inundated one commercial building.				

Date	Location	Type	Magnitude	Property Damage
4/1/2008	North Coast Interior	Heavy Snow	N/A	Unknown
Description: An approaching cold front generated gusty south and southeast winds throughout Humboldt and Del Norte counties. The wind caused damage and power outages throughout the region. Snow at higher elevations affected transportation.				
12/28/2005	North Coast	Severe Winter Storm	N/A	$120 million (Del Norte, Humboldt, Trinity, and Mendocino Counties)
Description: A series of strong Pacific storm systems began on December 18, 2005 and continued through the end of the month. Total precipitation ranged from 12 to 20 inches. Flooding began on December 28. On the Klamath River, two boat ramps were damaged, 15 structures were flooded, and the Klamath River Bridge over Highway 101 sustained $15 million worth of damage. Humboldt and Del Norte Counties reported $21.5 million worth of landslide damage to county-owned roads. A storm surge coastal flooding event occurred. A wind gust of 64 mph was recorded at the Eureka Weather Forecast Office, and a gust of 97 mph was reported from a research vessel at dock. Combined damage from these two events was $4.9 million. Damage from the wind included downed power lines and trees falling on structures. Damage from coastal flooding occurred to shore-side facilities in Del Norte, Mendocino, and Humboldt Counties.				
12/31/2002	Crescent City	Funnel Cloud	N/A	Unknown
Description: Spotters reported numerous cold air funnels over the Pacific Ocean near Crescent City.				
12/21/1998	Del Norte County	Severe Winter Storm	N/A	Unknown
Description: Widespread small stream flooding in Del Norte, Humboldt and Mendocino Counties, with numerous road closures.				
12/2/1998	Central Portion	Severe Winter Storm	N/A	Unknown
Description: Heavy rain caused flooding along many small streams in Northern/Central Humboldt County and Central Del Norte County. Highway 101 near Sand Mine Road and Highway 197 northeast of Crescent City were closed due to flooding.				
11/23/1998	North Coast Interior	High Wind	69 mph	Unknown
Description: A strong Pacific storm system brought a peak measured gust of 60 mph at the Crescent City airport. Spotters estimated gusts up to 70 mph in Kneeland, Big Bar and Honeydew.				
11/20/1998	Countywide	Severe Winter Storm	N/A	Unknown
Description: Widespread urban and small stream flooding due to very heavy rain. Flooding was reported in the following locations: Fieldbrook, McKinleyville, Bayside (Jacoby Creek), Highway 197 near Crescent City, Arcata, Humboldt State University campus, Blue Lake, Elk River Road and Redwood National Park. Prairie Creek north of Orick flooded US Highway 101. Precipitation totals include: 9.47" in Ettersburg, 8.80" in Gasquet, 8.43" in McKinleyville, 7.14" in Fieldbrook, 6.00" in Crescent City, 5.92" in Orick and 4.91" in Blue Lake.				
2/1/1998	North Coast Interior	High Wind	55 mph	Unknown
Description: Gusty winds caused minor damage. Peak gusts were 55 mph at Maple Creek and 48 mph at Crescent City.				
12/30/1992	Coastal Del Norte	Tornado	F1	$25,000
Description: A tornado damaged the roof of the county sheriff's office with additional damage to cars, fences and power lines. The sheriff's department reported the tornado near the intersection of Cooper and Butte Streets. A utility shed was destroyed. Other damage was reported over a two-block path to roofs, cars, fences, and power lines.				
12/11/1992	Del Norte Interior	Tornado	F1	$2,500
Description: None available				
2/9/1983	Del Norte County	Thunderstorm Wind	Unknown	Unknown
Description: None available				
12/12/1973	Del Norte County	Thunderstorm Wind	58 mph	Unknown
Description: None available				
5/13/1960	Del Norte County	Tornado	Unknown	Unknown
Description: Pacific Airlines pilot reported tornado uprooted trees north of Klamath, California.				
1/10/1958	Del Norte County	Tornado	F0	Unknown
Description: None available				

Source: NOAA Storm Events Database, 2018

12.2.2 Location

Severe weather events have the potential to happen anywhere in the planning area. Communities in low-lying areas next to streams or lakes are more susceptible to flooding from heavy rain associated with severe winter storms or thunderstorms. Mountainous regions experience heavier snowfall and a greater risk of road closures. Wind events are most damaging to areas that are heavily wooded. Under most conditions, the planning area's highest winds come from the southwest.

12.2.3 Frequency

There have been 21 recorded severe weather events in the planning area since 1958. This amounts to a damaging severe weather event every 2 to 3 years on average. Severe winter storm events have occurred seven times, with an average recurrence rate of 8 to 9 nine years. Damaging winds events have occurred 15 times, with an average recurrence rate of every 3 to 4 years. In the planning area, there are an average of five thunderstorm days per year (NOAA, NWS 2018a). The probability of a severe weather event impacting the planning area is high.

12.2.4 Severity

Winter Weather

Winter storms are generally categorized by the amount of precipitation, degree of cold or wind chill, and strength of winds. A blizzard occurs when a winter storm has sustained or frequent wind gusts of 30 mph or greater and considerable falling and/or blowing snow that reduces visibility to less than a quarter mile. Generally, blizzards last for a period of three hours or longer (NOAA, NWS, 2009). Snowfall is generally considered heavy when 4 or more inches accumulates in 12 hours or less, or 6 or more inches accumulates in 24 hours or less. In the planning area, severe winter storms generally consist of rain and wind events, not snow and ice.

Thunderstorms

The National Weather Service classifies as thunderstorm as "severe" if it produces a tornado, has winds of at least 58 mph, or has hail at least 1 inch in diameter (NOAA, NWS, 2018c).

Damaging Winds

Damaging winds are those that exceed 50 to 60 mph. The Beaufort Wind Chart (Table 12-2) provides terminology and a description of potential impacts at different levels (National Severe Storms Laboratory, 2018). Tornado severity classified on the Fujita Tornado Damage Scale is shown in Table 12-3.

12.2.5 Warning Time

Meteorologists can often predict the likelihood of a severe weather event. This can give several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of a storm. Some storms may come on quickly, with only a few hours of warning time.

12.3 SECONDARY HAZARDS

Major flooding can occur if heavy rain falls on snow, resulting in rapid snow melt, or if rain is heavy enough that local streams and rivers reach flood stage (see Chapter 10 for more information on flooding). Localized flooding can occur when heavy rain overwhelms local drainage systems or pools in low-lying areas. Rain falling on saturated soils on slopes or on areas recently burned by wildland fire may lead to landslides (see Chapter 11 for more information on landslides). Lightning during thunderstorms presents a risk of starting a wildland fire (see Chapter 14 for more information on wildland fires).

Table 12-2. Beaufort Wind Chart

Beaufort Number	Range (mph)	Terminology	Description
0	0	Calm	Calm. Smoke rises vertically.
1	1-3	Light air	Wind motion visible in smoke.
2	4-7	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	Gentle breeze	Leaves and smaller twigs in constant motion.
4	13-18	Moderate breeze	Dust and loose paper is raised. Small branches begin to move.
5	19-24	Fresh breeze	Smaller trees sway
6	25-31	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use is difficult.
7	32-38	Near gale	Whole trees in motion. Some difficulty when walking into the wind.
8	39-46	Gale	Twigs broken from trees. Cars veer on road.
9	47-54	Sever gale	Light structure damage.
10	55-63	Storm	Trees uprooted. Considerable structural damage.
11	64-73	Violent storm	Widespread structural damage.
12	74-95	Hurricane	Considerable and widespread damage to structures.

Source: Lewis, 2018

Table 12-3. Operational Enhanced Fujita Scale

Enhanced Fujita Number	3-Second Gust (mph)
0	65-85
1	86-110
2	111-135
3	136-165
4	166-200
5	Over 200

Source: NOAA, 2018a

12.4 EXPOSURE

All people and property and the entire environment of the planning area is exposed to some degree to the severe weather hazard.

12.5 VULNERABILITY

12.5.1 Population

The most common problems associated with severe weather events are immobility and loss of utilities. Although all populations in the planning area are exposed to severe weather events, some populations are more vulnerable. Populations living at higher elevations with large stands of trees or power lines may be more susceptible to wind damage and black out, while populations in low-lying areas are at risk for possible flooding. In general, populations who lack adequate shelter during severe weather events, those who are reliant on sustained sources of power in order to survive, and those who live in isolated areas with limited ingress and egress options are the most vulnerable. The most common impacts of specific weather event types on people are as follows:

- **Winter Weather**—Deaths and injuries from severe winter storms are generally the result of traffic accidents, heart attacks from shoveling snow, and frostbite or hypothermia from prolonged exposure to the cold. Death and injury may also result from flooding from severe winter storms. About 70 percent of snow and ice-related injuries occur in automobiles, and 25 percent result from exposure. Of those killed or injured, 50 percent are people over the age of 60; more than 75 percent are male (National Severe Storms Laboratory, 2018).

- **Thunderstorms**—Since the 1940s, lightning has caused more deaths in the United States than tornadoes, floods, or hurricanes (NOAA, NWS, 2018d). California and the planning area are not particularly prone to thunderstorm events and there are no recorded fatalities from lightning within the planning area. Thunderstorm related deaths and injuries in the planning area are most likely to result from accompanying wind and flood events.
- **Damaging Winds**—Damaging winds can cause injuries and fatalities in a number of ways. Downed trees may fall on homes or cars, killing or injuring those inside. Objects that are not secured can be picked up in wind events and become projectiles. Structures that collapse or blow over during damaging wind events, especially tornadoes, may kill or injure those seeking shelter inside.

12.5.2 Property

All property is vulnerable during severe weather events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. The most common impacts of specific weather event types on property are as follows:

- **Winter Weather**—Damage from severe winter storms in the planning area is most likely to be related to secondary hazards, such as major or localized flooding or landslides. If extreme cold events accompany a severe winter storm, pipes may freeze, resulting in property damage.
- **Thunderstorms**—Damage from thunderstorms in the planning area is most likely to be related to secondary hazards accompanying the event, such as flooding, landslides or damaging winds. If lightning directly strikes a building, it may cause substantial damage and may even set the structure on fire.
- **Damaging Winds**—Mobile homes can be seriously damaged by wind gusts over 80 mph, even if they are anchored (National Severe Storms Laboratory, 2018). According to the American Community Survey, there are about 2,000 mobile homes in the planning area. Properties at higher elevations or on ridges may be more prone to wind damage. Falling trees can result in significant damage to structures. A major tornado could cause widespread damage to property in the planning area, but such an event is unlikely.

No modeling is available for quantitative loss estimations for the severe weather hazard. Instead, loss estimates were developed representing 1 percent, 3 percent and 5 percent of the replacement value of exposed structures:

- Loss of 1 percent of planning area replacement value—$154 million
- Loss of 3 percent of planning area replacement value—$462 million
- Loss of 5 percent of planning area replacement value—$770 million.

12.5.3 Critical Facilities

All critical facilities are vulnerable during severe weather events, especially those that lack backup power generation capabilities. If facilities supplying power to planning area land line telephone systems were disrupted, significant issues would arise with communication in the planning area. In addition, some facilities are particularly vulnerable to specific types of severe weather events:

- **Winter Weather and Thunderstorms**—Facilities located in areas prone to localized or major flooding are vulnerable. Transportation systems are vulnerable to disruption from flooding, snow and ice, or secondary hazard such as landslides.

- **Damaging Winds**—Critical facilities in the direct path of a tornado would be particularly vulnerable. Facilities located near trees or power lines that are likely to fall are also vulnerable. Roads and other transportation infrastructure could be blocked by downed trees or other debris.

Electric power losses due to severe weather can be estimated using standard values for loss of service for utilities published in FEMA's *2009 Benefit Cost Analysis Reference Guide*. The values associated with the loss of power are based on the affected population. Table 12-4 presents estimates for power failure associated with severe weather in the event of 10, 30 or 50 percent of the total planning area population losing power simultaneously. These results do not account for physical damage to utility equipment and infrastructure.

Table 12-4. Loss of Use Estimates for Power Failure for the Planning Area

Affected Planning Area Population	Number of People Affected	Estimated Electric Loss of Use[a]
10%	2,776	$349,816
30%	8,329	$1,049,447
50%	13,882	$1,749,078

a. $126 per person per day; based on FEMA's 2009 Benefit Cost Analysis Reference Guide

12.5.4 Environment

The vulnerability of the environment to severe weather is the same as the exposure. The environment is highly exposed to severe weather events. Natural habitats such as streams and trees are exposed to the elements during a severe storm and risk major damage and destruction. Prolonged rains can saturate soils and lead to slope failure. Flood events caused by severe weather or snowmelt can produce river channel migration or damage riparian habitat. Storm surges can erode beachfront bluffs and redistribute sediment loads.

12.6 FUTURE TRENDS

All future development will be affected by severe weather events. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. The planning partners have 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 (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.

12.7 SCENARIO

A worst-case severe-weather event would involve prolonged high winds during a winter storm with large amounts of precipitation after soils are already saturated. Such an event would have both short-term and long-term effects. Initially, schools and roads would be closed due to power outages caused by high winds and downed tree obstructions. Some areas of the county could experience limited ingress and egress. Prolonged rain could produce flooding, overtopped culverts with ponded water on roads, mud over roadways, and landslides on steep slopes. Floods and landslides could further obstruct roads and bridges, further isolating residents. If major landslides impact the two major highways in the planning area, significant transportation disruption could result.

12.8 ISSUES

Important issues associated with severe weather in the planning area include the following:

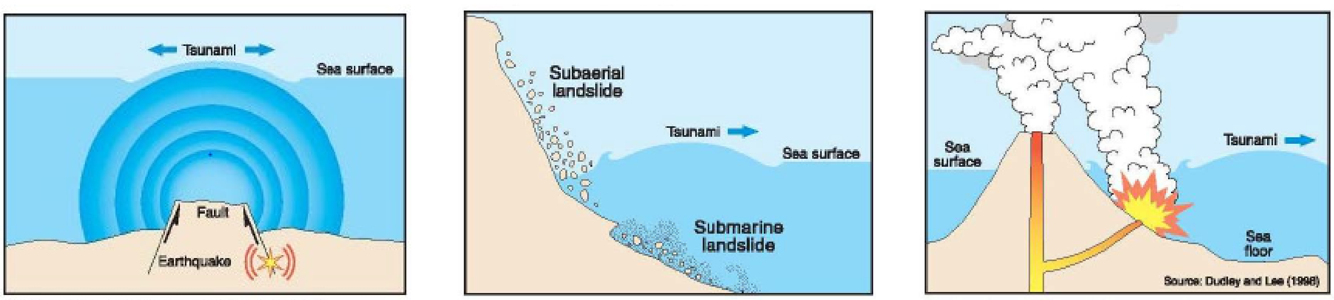
- Older building stock in the planning area is built to low code standards or none at all. These structures could be highly vulnerable to severe weather events such as damaging winds. Mobile homes are also vulnerable to damaging winds, and there are estimated to be more than 2,000 within the planning area.
- Redundancy of power supply must be evaluated, especially for critical facilities.
- Major transportation routes in the planning area are limited. If severe weather results in road closures, there could be cascading impacts on the county-wide transportation system, resulting in delays in response and recovery.
- Dead or dying trees as a result of drought are more susceptible to falling during severe storm events.
- Power outages that disrupt land line service could cause significant communication disruption.

13. TSUNAMI

13.1 GENERAL BACKGROUND

A tsunami is a series of high-energy waves that radiate outward like pond ripples from an area where a generating event occurs arriving at shorelines over an extended period. Tsunamis can be induced by earthquakes, landslides and submarine volcanic explosions (see Figure 13-1). Tsunamis are typically classified as local or distant, depending on the location of their source in comparison to where waves occur:

- The waves nearest to the generating source represent a local tsunami. Such events have minimal warning time, leaving few options except to run to high ground. The damage from the tsunami itself may be accompanied by additional damage from the triggering earthquake due to ground shaking, surface faulting, liquefaction or landslides.
- The waves far from the generating source represent a distant tsunami. Distant tsunamis may travel for hours before striking a coastline, giving a community a chance to implement evacuation plans.



Faulting of the ocean floor may produce a tsunami.
Subaerial or submarine landslides may produce a tsunami.
A submarine volcanic explosion may produce a tsunami.

Figure 13-1. Common Sources of Tsunamis

In the open ocean, a tsunami may be only a few inches or feet high, but it can travel with speeds approaching 600 miles per hour. As a tsunami enters the shoaling waters near a coastline, its speed diminishes, its wavelength decreases, and its height increases greatly. At the shoreline, tsunamis may take the form of a fast-rising tide, a cresting wave, or a bore (a large, turbulent wall-like wave). The bore phenomenon resembles a step-like change in the water level that advances rapidly (from 10 to 60 miles per hour). The first wave is usually followed by several larger and more destructive waves.

The configuration of the coastline, the shape of the ocean floor, and the characteristics of advancing waves play important roles in the destructiveness of the waves. Bays, sounds, inlets, rivers, streams, offshore canyons, islands, and flood control channels may cause various effects that alter the level of damage. Offshore canyons can focus tsunami wave energy, and islands can filter the energy. It has been estimated that a tsunami wave entering a flood control channel could reach a mile or more inland, especially if it enters at high tide. The orientation of the coastline determines whether the waves strike head-on or are refracted from other parts of the coastline. A wave may be small at one point on a coast and much larger at other points. The inundation area for a tsunami event is often described as runup as illustrated in Figure 13-2.

Source: UNESCO, Retrieved from Different Directions: Tsunami, n.d.

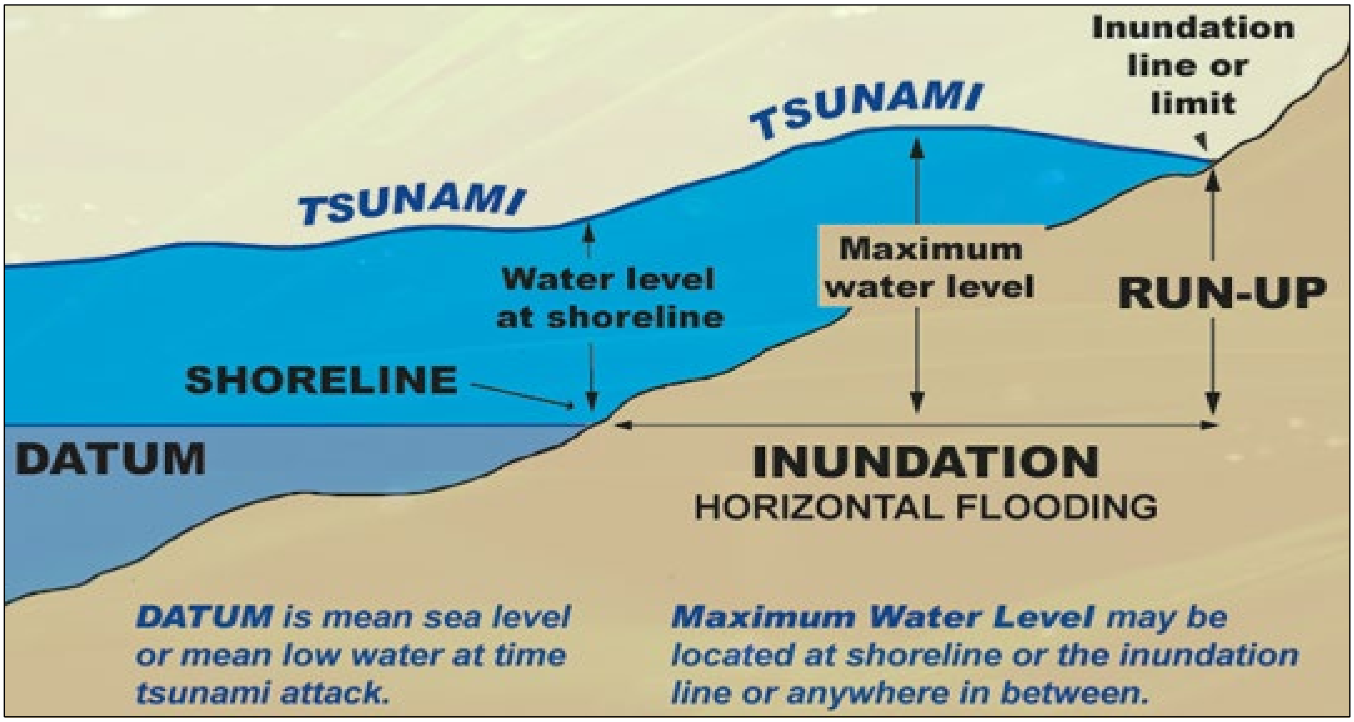


Figure 13-2. Runup Distance and Height in Relation to the Datum and Shoreline

13.2 HAZARD PROFILE

13.2.1 Past Events

The Global Historical Tsunami Database lists 39 tsunami events recorded in the planning area between 1938 and 2018 (see Table 13-1). Most of these were small and detected only by tide gages. Impacts were reported for four events that included a combined 12 deaths, 38 injuries and more than $37 million in damage. Almost half of all known fatalities from tsunami events on the U.S. west coast (48 percent) have occurred in the planning area (Dunbar and Weaver, 2015).

Table 13-1. Tsunamis That Have Affected North Coast California

Date	Source	Runup				Impact
		Measurement Location	Distance from Source (km)	Travel Time from Source (hr:min)	Maximum Water Height (meters)	
11/10/1938	M 8.2 Earthquake, Shumagin Islands, AK	Crescent City	2898	4:13	0.18	
4/6/1943	M 8.2 Earthquake, Central Chile	Crescent City	9674		0.1	
4/1/1946[a]	M 8.6 Earthquake, Unimak Island, AK	Crescent City	3129	4:38	0.9	
12/20/1946	M 8.1 Earthquake, Honshu: S Coast (Japan)	Crescent City	8389	13:	0.23	
3/4/1952	M 8.1 Earthquake, SE Hokkaido Island (Japan)	Crescent City	7193		0.18	
11/4/1952	M 9 Earthquake, Kamchatka (Russia)	Crescent City	5575	7:54	0.93	

Date	Source	Runup				Impact
		Measurement Location	Distance from Source (km)	Travel Time from Source (hr:min)	Maximum Water Height (meters)	
3/9/1957	M 8.6 Earthquake, Andreanof Islands, AK	Crescent City	3989	5:11	0.65	
5/22/1960	M 9.5 Earthquake, Southern Chile	Crescent City	10266	15:29	1.68	3 injuries, $30,000 damage
10/13/1963	M 8.5 Earthquake, S. Kuril Islands (Russia)	Crescent City	6631		0.33	
3/28/1964[a]	M 9.2 Earthquake, Prince William Sound, AK	Chinook RV Park, Requa	2686			
		Crescent City	2661	4:3	1.98	
		Crescent City	2661	4:3	4.8	10 deaths, 35 injuries, $16 million in damage, 54 houses destroyed, 37 houses damaged
		Klamath River	2685		3.7	1 death, $5,000 damage
		Panther Creek Lodge, Requa	2685		0.9	
		Smith River	2642		2.03	$6,000 damage
2/4/1965	M 8.7 Earthquake, Rat Islands, Aleutian Islands, AK	Crescent City	4391		0.31	
10/17/1966	M 8.1 Earthquake, Central Peru	Crescent City	7463	12:6	0.07	
5/16/1968	M 8.2 Earthquake, Off East Coast of Honshu Island (Japan)	Crescent City	7323		0.61	
7/26/1971	M 7.9 Earthquake, Solomon Sea (Papua New Guinea)	Crescent City	9764		0.06	
10/3/1974	M 8.1 Earthquake, Central Peru	Crescent City	7654		0.08	
5/7/1986	M 8 Earthquake, Andreanof Islands, AK	Crescent City	3928		0.06	
4/25/1992	M 7.2 Earthquake, Cape Mendocino, N. California	Crescent City	154	0:47	0.55	
9/1/1994	M 7 Earthquake, N. California	Crescent City	195		0.07	
10/4/1994	M 8.3 Earthquake, S. Kuril Islands (Russia)	Crescent City	6858		0.5	
7/30/1995	M 8 Earthquake, Northern Chile	Crescent City	9116		0.11	
12/3/1995	M 7.9 Earthquake, S. Kuril Islands (Russia)	Crescent City	6672		0.14	
2/17/1996	M 8.2 Earthquake, Irian Jaya (Indonesia)	Crescent City	10811		0.18	
6/10/1996	M 7.9 Earthquake, Andreanof Islands, AK	Crescent City	4125		0.14	
6/23/2001	M 8.4 Earthquake, S. Peru	Crescent City	8277		0.2	
9/25/2003	M 8.3 Earthquake, Hokkaido Island (Japan)	Crescent City	7210	9:40	0.18	
12/26/2004	M 9.1 Earthquake, Off W. Coast of Sumatra (Indonesia)	Crescent City	13583		0.31	
6/15/2005	M 7.2 Earthquake, N. California	Crescent City	157	0:45	0.1	

Date	Source	Runup				Impact
		Measurement Location	Distance from Source (km)	Travel Time from Source (hr:min)	Maximum Water Height (meters)	
5/3/2006	M 8 Earthquake, Tonga	Crescent City	8591	11:23	0.27	
11/15/2006	M 8.3 Earthquake, S. Kuril Islands (Russia)	Crescent City	6298	8:31	0.88	$1 million damage
1/13/2007	M 8.1 Earthquake, S. Kuril Islands (Russia)	Crescent City	6230	8:55	0.23	
8/15/2007	M 8 Earthquake, S. Peru	Crescent City	7830	12:11	0.16	
9/29/2009	M 8.1 Earthquake, Samoa Islands	Crescent City	8041	10:56	0.33	
2/27/2010	M 8.8 Earthquake, Central Chile	Crescent City	10110	15:6	0.64	
3/11/2011	M 9.1 Earthquake, Honshu Island (Japan)	Crescent City	7544	9:47	2.47	$20 million damage
		Klamath River	7563		2.5	1 death
		Smith River	7531		2	
10/28/2012	M 7.7 Earthquake, British Columbia (Canada)	Crescent City	1364	2:40	0.44	
2/6/2013	M 7.9 Earthquake, Santa Cruz Islands (Solomon Islands)	Crescent City	9258		0.2	
4/1/2014	M 8.2 Earthquake, Northern Chile	Crescent City	8757	12:50	0.16	
9/16/2015	M 8.3 Earthquake, Central Chile	Crescent City	9766	14:44	0.32	
1/23/2018	M 7.9 Earthquake, Kodiak Island, AK	Crescent City	2393		0.25	

a. Source includes combination of earthquake and landslide.
Source: Global Historical Tsunami Database, National Center for Environmental Information, 2018

The following are the major tsunami events (1 meter or greater of run-up) that have impacted the planning area:

- **1960 Chile Earthquake Tsunami**—A 13-foot wave flooded the southeastern part of Crescent City following a number of 8.5-foot surges. Many streets were flooded, along with parts of Highway 101. The water brought in and left thousands of tons of logs and debris, literally covering Front Street. The most severe damage was in the vicinity of Citizens Dock. Three commercial fishing boats were sunk and other boats suffered considerable damage. A steel pile retaining wall at the dock partially failed. Damage was also done to the dock facilities, the dock cafe and Sea Scouts building. In some parts of the harbor, 12 feet of sediment was deposited.
- **1964 Alaska Earthquake Tsunami**—The 1964 tsunami event generated by the magnitude-9.2 Alaska earthquake (see Figure 13-3) resulted in the most fatalities. Tsunami waves reached Crescent City at heights of more than 20 feet and inundated 29 city blocks. Four waves were associated with this event.
- **2011 Japan Earthquake Tsunami**—An 8-foot swell of water destroyed docks and boats in the harbor and one observer was swept out to sea near the mouth of the Klamath River (McKinley, 2011).

In addition to these recorded events, a major tsunami impacted the area on January 26, 1700 after a major earthquake on the Cascadia Subduction zone (see Figure 13-4). The tsunami that left markers in the geologic record from Humboldt County to Vancouver Island in Canada and is noted in written records in Japan. Evidence suggests local tsunami wave heights on the order of 60 feet and water heights in Japan over 15 feet.

Source: National Centers for Environmental Information, 2018b

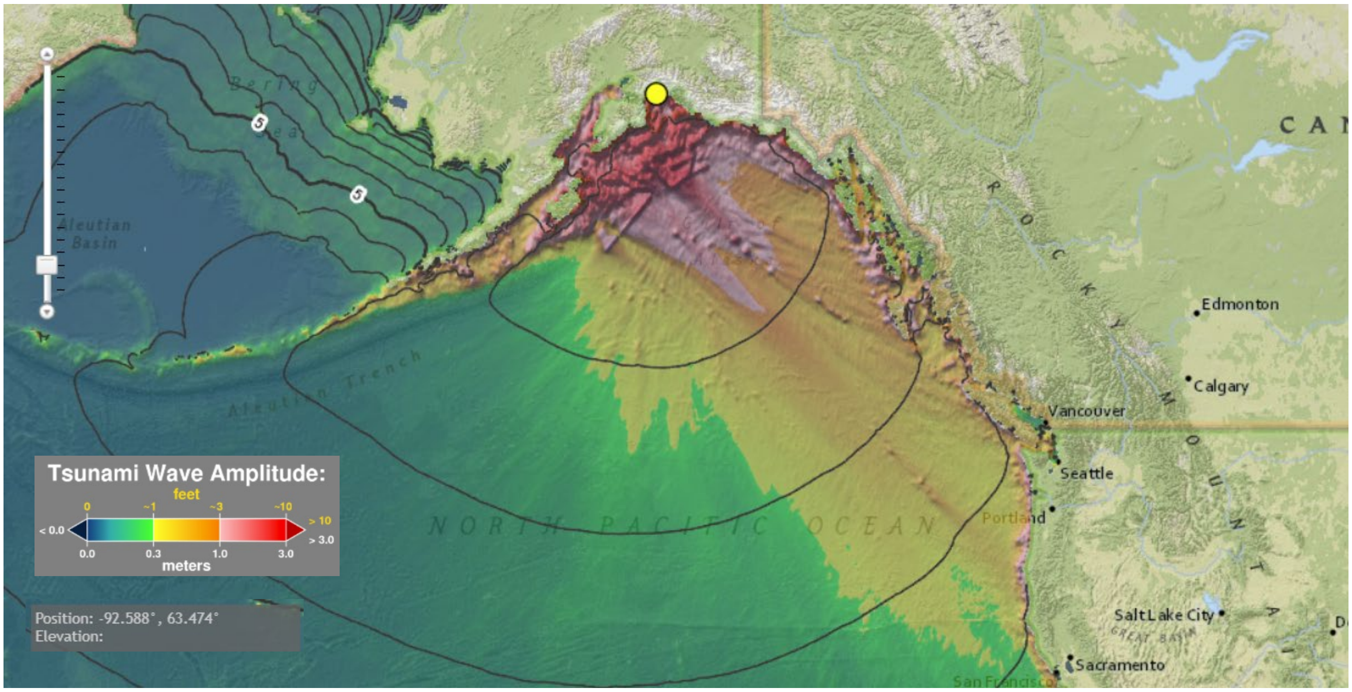


Figure 13-3. 1964 Alaska Earthquake Tsunami Event

Source: National Centers for Environmental Information, 2018b

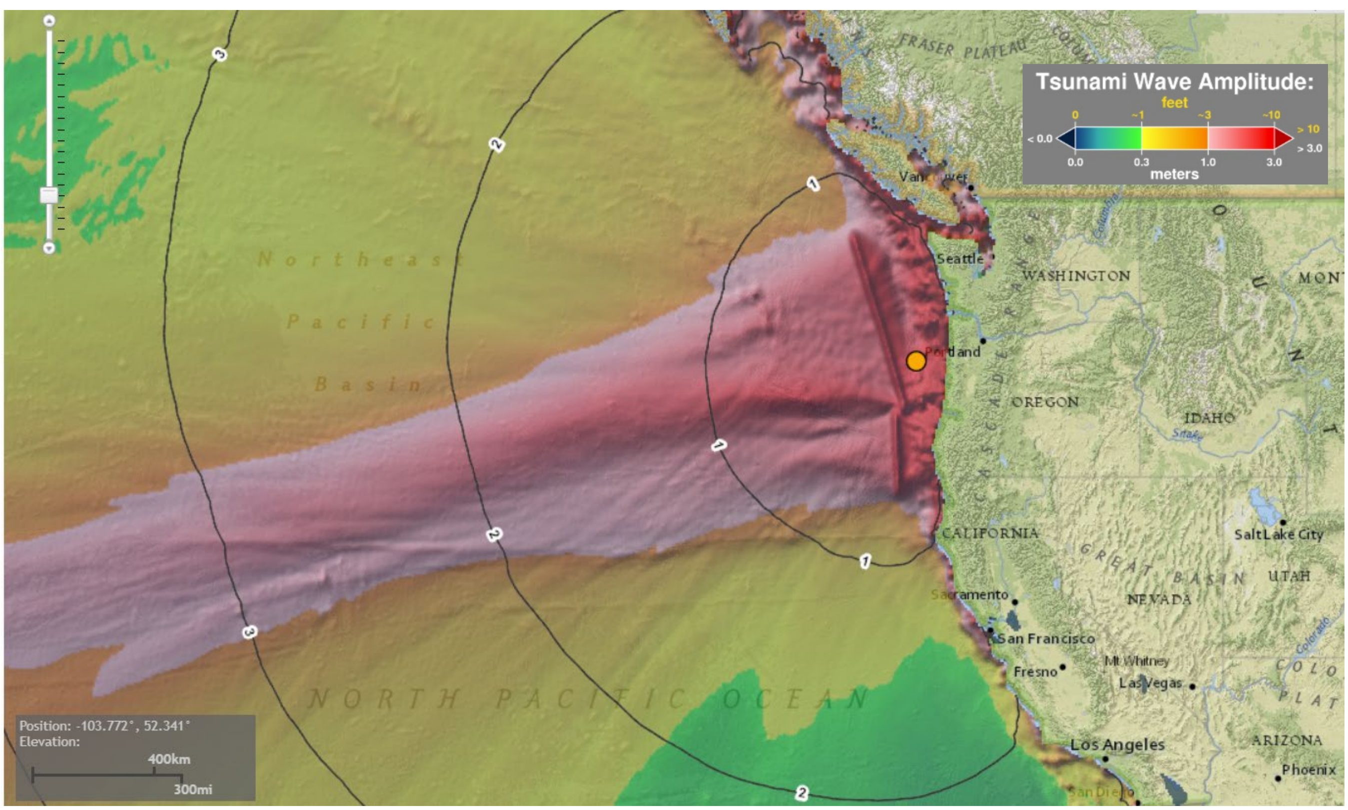


Figure 13-4. 1700 Cascadia Subduction Zone Earthquake Tsunami Event

13.2.2 Location

Figure 13-5 shows the extent and the location of the tsunami inundation areas for the Del Norte planning area. This map does not represent risk from a single event, but shows a composite area of risk that combines the inundation areas from a number of local and distant potential sources, including the Cascadia Subduction Zone, the Central Aleutians Island Subduction Zone, historical earthquake events, and other sources (California Department of Conservation, 2017). The inundation areas represent the maximum considered tsunami runup from a number of extreme, yet realistic, tsunami sources. Additional tsunami mapping information is available from the California Department of Conservation (California Department of Conservation, 2017a and 2017b).

13.2.3 Frequency

The frequency of tsunamis is related to the frequency of the events that cause them, so it is similar to the frequency of seismic or volcanic activities or landslides. There have been 39 tsunami events that have known to impact the planning area in 80 years. This amounts to a tsunami event in the planning area every 2 years on average. The majority of these events are minor tsunami events. Only three recorded major events (defined for these purposes as 1 meter or more of runup) have impacted the planning area, amounting to a major event occurring every 27 years on average. The National Tsunami Hazard Mitigation Program rates the risk to the U.S. west coast from the tsunami hazard as high to very high (Dunbar and Weaver, 2015).

13.2.4 Severity

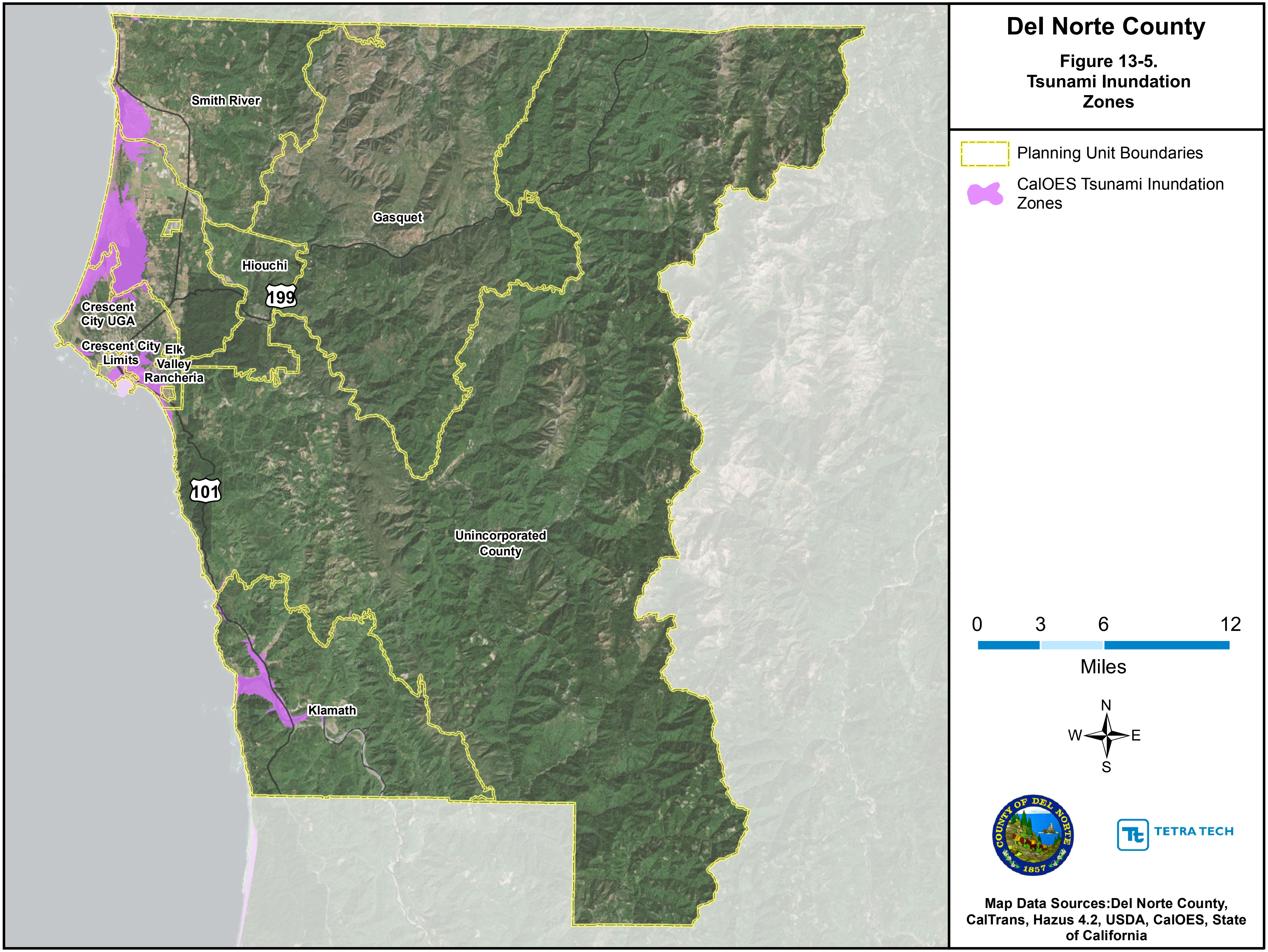
According to the National Tsunami Hazard Mitigation Program, tsunami events with runups of more than 1 meter are the most likely to be dangerous to people and property. The tsunami's size and speed, as well as the coastal area's form and depth, affect the impact of a tsunami. At some locations, the advancing turbulent wave front will be the most destructive part of the tsunami wave. In other situations, the greatest damage will be caused by the outflow of water back to the sea between crests, sweeping away items on the surface and undermining roads, buildings, bulkheads, and other structures. This outflow action can carry enormous amounts of highly damaging debris, resulting in further destruction. Ships and boats, unless moved away from shore, may be dashed against breakwaters, wharves, and other craft, or be washed ashore and left grounded after the withdrawal of the seawater (National Tsunami Hazard Mitigation Program, 2001). A local tsunami resulting from an earthquake event on the Cascadia Subduction zone presents the most severe risk to the planning area.

13.2.5 Warning Time

Visible Indications

Tsunamis are difficult to detect in the open ocean; with waves generally less than 3 feet high. The first visible indication of an approaching tsunami may be either a rise or drop in water surface levels (National Tsunami Hazard Mitigation Program, 2001):

- A drop in water level (draw down) can be caused by the trough preceding the advancing, large inbound wave crest. Rapid draw down can create strong currents in harbor inlets and channels that can severely damage coastal structures due to erosive scour around piers and pilings. As the water's surface drops, piers can be damaged by boats or ships straining at or breaking their mooring lines. The vessels can overturn or sink due to strong currents, collisions with other objects, or impact with the harbor bottom.
- The advancing tsunami may initially arrive as a strong surge increasing the sea level. This can be similar to the rising tide, but the tsunami surge rises faster and does not stop at the shoreline. Even if the wave height appears to be small, 3 to 6 feet for example, the strength of the accompanying surge can be deadly. Waist-high surges can cause strong currents that float cars, small structures, and other debris. Boats and debris are often carried inland by the surge and left stranded when the water recedes.


Del Norte County
Figure 13-5.
Tsunami Inundation Zones
Planning Unit Boundaries
CalOES Tsunami Inundation Zones
Smith River
Gasquet
Hiouchi
199
Crescent City UGA
Crescent City Limits
Elk Valley Rancheria
101
Unincorporated County
Klamath
0
3
6
12
Miles
N
W
E
S
TETRA TECH
Map Data Sources:Del Norte County, CalTrans, Hazus 4.2, USDA, CalOES, State of California

Warning System

Pacific Tsunami Warning System

The Pacific tsunami warning system evolved from a program initiated in 1946. It is a cooperative effort involving 26 countries along with numerous seismic stations, water level stations and information distribution centers. The National Weather Service operates two regional information distribution centers: one in Ewa Beach, Hawaii; and one in Palmer, Alaska. The warning system only begins to function when a Pacific basin earthquake of magnitude 6.5 or greater triggers an earthquake alarm. When this occurs, the following sequence of actions occurs:

- Data is interpolated to determine epicenter and magnitude of the event.
- If the event is magnitude 7.5 or greater and located at sea, a TSUNAMI WATCH is issued.
- Participating tide stations in the earthquake area are requested to monitor their gages. If unusual tide levels are noted, the tsunami watch is upgraded to a TSUNAMI WARNING.
- Tsunami travel times are calculated, and the warning is transmitted to disseminating agencies who relay it to the public.
- The system will cancel the watch or warning if reports from the stations indicate that no tsunami was generated or that the tsunami was inconsequential.

This system is not considered to be effective for communities close to the tsunami source, because the first wave would arrive before the data can be processed and analyzed. In this case, strong ground shaking would provide the first warning of a potential tsunami.

Local Warning Systems

The National Oceanic and Atmospheric Administration (NOAA), California Governor's Office of Emergency Services (Cal OES), and local emergency managers coordinate tsunami warning communications for the planning area. This emergency notification system is routinely tested and includes broadcasts on NOAA Weather Radio All Hazards, local television and radio stations, sirens, aircraft public address system. The Wireless Emergency Alert System may also be activated during a real event. In Del Norte County, the sirens and aircraft public address system are being phased out due to high maintenance costs and no funding support from the state. The civil air patrol does flyovers once a year, and the county is transitioning from tsunami sirens to a more direct approach, such as using Everbridge and other cell-phone-related notifications

Estimated Travel Times

The NOAA National Center for Environmental Information website provides maps that show estimated travel times to coastal locations for various tsunami-generating events. Figure 13-6 shows one example of the travel time for a tsunami generated in Aburatsu, Japan to reach the planning area—approximately 11 hours.

13.3 SECONDARY HAZARDS

Aside from the tremendous hydraulic force of the tsunami waves themselves, floating debris carried by a tsunami can endanger human lives and batter inland structures. Flooding can cause contamination of drinking water and can result in the spread of disease.

13.4 EXPOSURE

The exposure estimates for the tsunami hazard are based on a composite area of risk. Not all areas exposed would be impacted by any single event. The Gasquet and Hiouchi planning units do not have any exposure to the tsunami hazard.

Source: National Centers for Environmental Information, 2018c

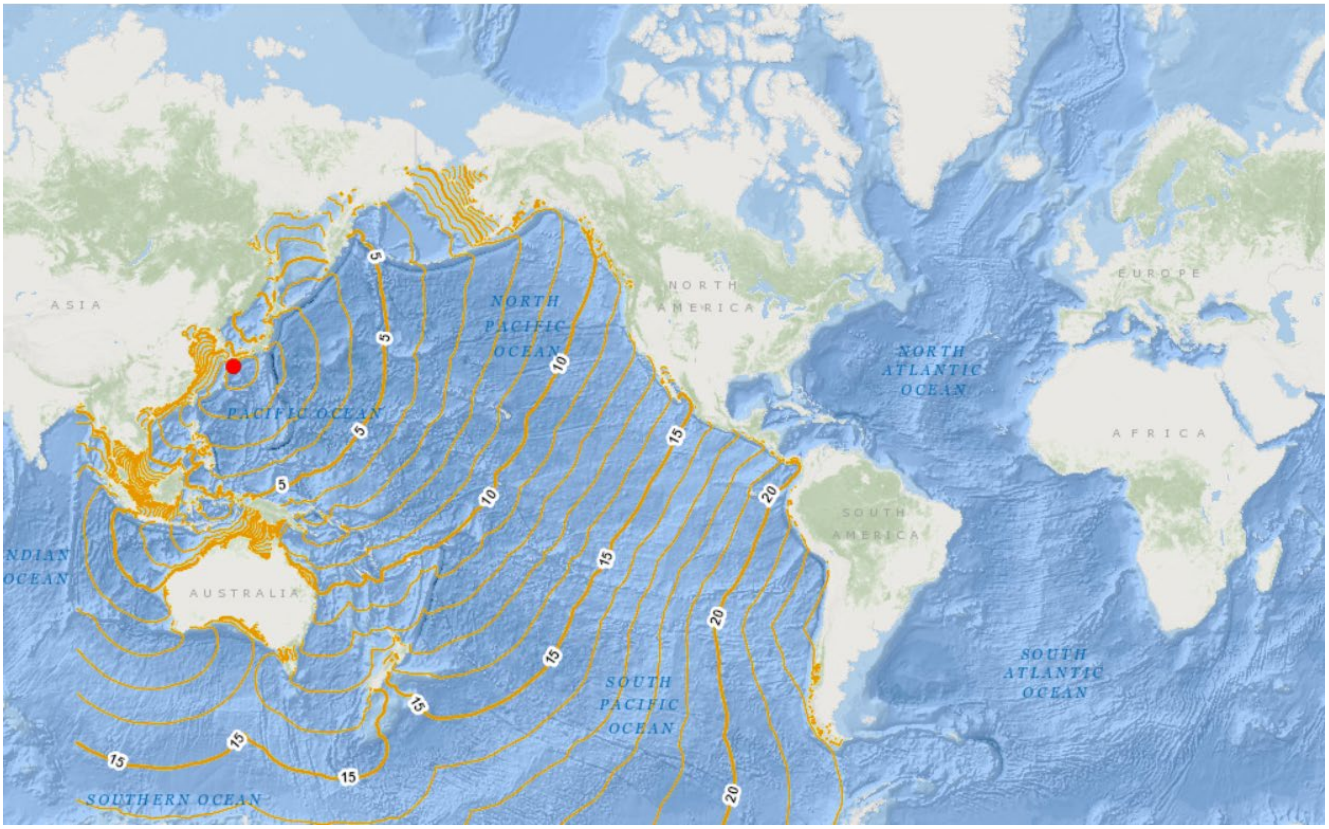


Figure 13-6. Potential Tsunami Travel Times in the Pacific Ocean, in Hours

13.4.1 Population

Population was estimated using the residential building count in the tsunami inundation area and multiplying by the 2016 estimated average population per household. Using this approach, the estimated population living in mapped tsunami inundation areas is 9 percent of planning area population (2,591 people). Most of these (1,727 people) reside in Crescent City, accounting for 23 percent of the city's population.

13.4.2 Property

An estimated 33 percent (more than $5 billion) of the total replacement value of the planning area is located in tsunami inundation areas. Figure 13-7 shows the percentage and count, by land use type, of exposed planning area structures. Most these (53 percent) are in Crescent City. Residential structures make up 67 percent of the exposed total (522 structures).

13.4.3 Critical Facilities and Infrastructure

Critical facilities and infrastructure exposed to the tsunami hazard represent 17 percent (45 facilities) of the total critical infrastructure and facilities in the planning area. Linear infrastructure is also exposed, including utility lines and roads. State Highway 69 and U.S. Highway 101 pass through tsunami inundation areas. The breakdown of exposure by facility type is shown in Figure 13-8.

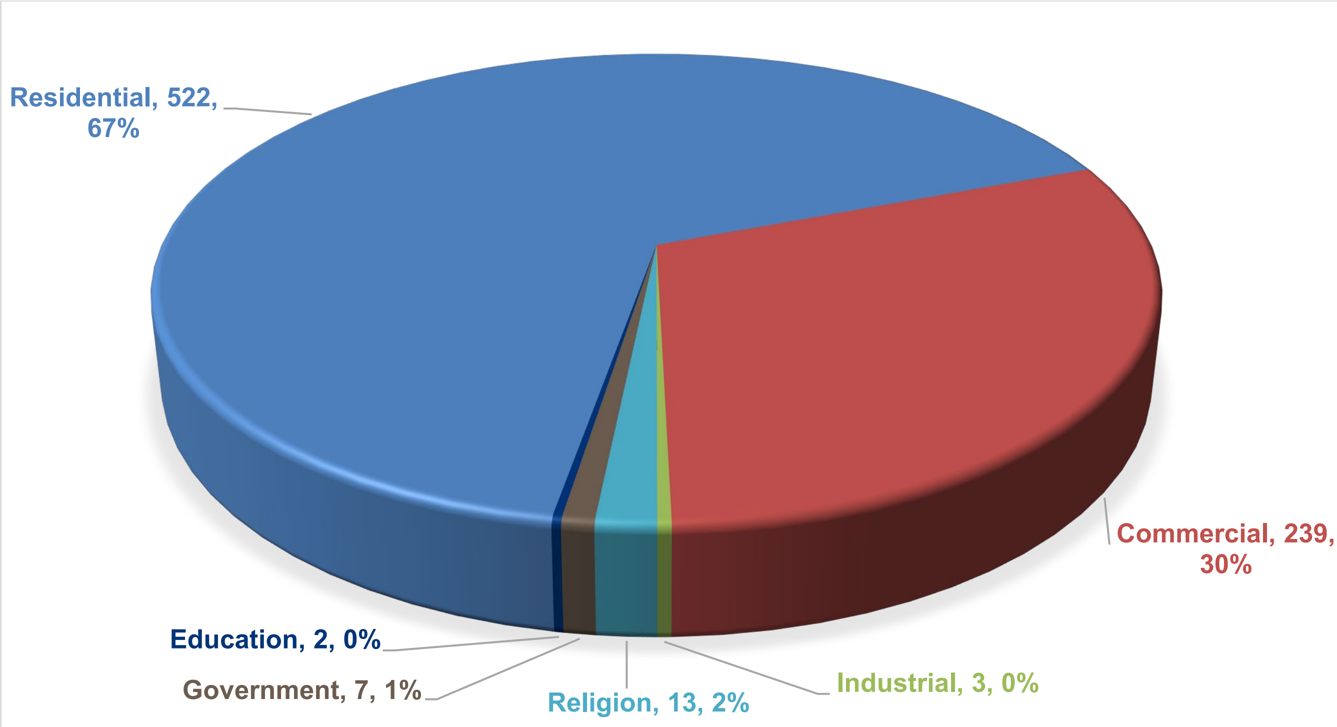


Figure 13-7. Structures in the Tsunami Inundation Zone, by Land Use Type

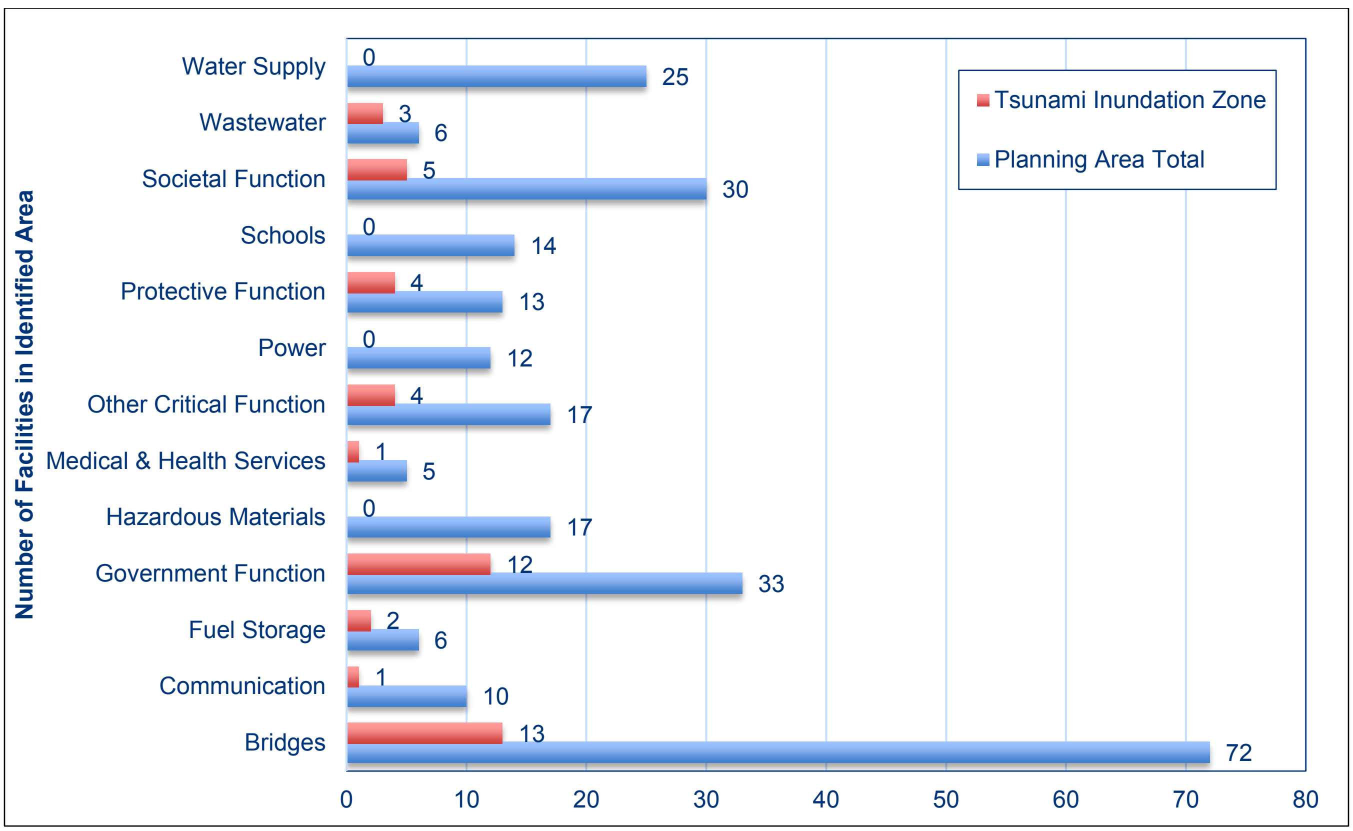


Figure 13-8. Critical Facilities and Infrastructure in Mapped Tsunami Inundation Zone and Countywide

13.4.4 Environment

All waterways and beaches would be exposed to the effects of a tsunami; inundation of water and introduction of foreign debris could be hazardous to the environment. All wildlife inhabiting the area also is exposed.

13.5 VULNERABILITY

The vulnerability estimates for the tsunami hazard are based on a composite area of risk. Not all areas exposed would be impacted by any single event; therefore, vulnerability estimates are overstated.

13.5.1 Population

The populations most vulnerable to the tsunami hazard are the elderly, disabled and very young who reside near beaches, low-lying coastal areas, tidal flats and river deltas that empty into ocean going waters. In the event of a local tsunami generated in or near the planning area, there would be little warning time, so more of the population would be vulnerable. Hazus analysis of the tsunami inundation area indicates that a tsunami event could displace 1,222 people in the planning area.

13.5.2 Property

Property Impacted

The impact of tsunami waves and the scouring associated with debris that may be carried in the water could be damaging to all structures along beaches, low-lying coastal areas, tidal flats and river deltas. The most vulnerable are those in the front line of tsunami impact and those that are structurally unsound. The Hazus analysis indicated that 51 percent of the exposed structures (403 structures) would be impacted by the modeled scenario event.

Damage Estimates

Table 13-2 summarizes Hazus estimates of tsunami damage in the planning area. The estimated damage value is associated with the tsunami wave only; it does not include additional damage that may occur as a result of debris battering structures as the tsunami wave rushes in and out of the inundation area. The debris estimate includes only structural debris and building finishes; it does not include additional debris that may result from a tsunami event, such as from boats, trees, sediment, building contents, bridges or utility lines. The more than 186,000 tons of estimated debris is enough to fill more than 7,400 25-ton trucks.

Table 13-2. Estimated Impact of a Tsunami Event in the Planning Area

Structure Debris (Tons)	186,059
Buildings Impacted	403
Total Value (Structure + Contents) Damaged	$1.42 billion
Damage as % of Total Value	9.2%

Structures that were built to current floodplain regulations in the tsunami inundation area may have some level of protection, particularly if they were built to withstand wave action. In Crescent City, an estimated 77 percent of the housing units were built before the City entered the National Flood Insurance Program in 1982 and began enforcing floodplain regulations (U.S. Census, 2018). It is unknown how many of these structures are located in tsunami inundation areas. In addition to structure damage, ships moored at piers and in harbors often are swamped and sunk or are left battered and stranded high on the shore.

13.5.3 Critical Facilities and Infrastructure

Table 13-3 summarizes the Hazus estimates of damage to critical facilities and infrastructure in the planning area. An estimated 44 percent of the exposed facilities show damage to some extent in the tsunami scenario analyzed; however, only three of the damaged facilities are likely to be substantially damaged—all in the government function category. All damaged facilities are in the Crescent City or Crescent City UGA planning units.

Table 13-3. Damage Estimates to Critical Facilities in the Tsunami Hazard Area

Facility Type	Number of Facilities Exposed	Damage Level[a]			
		None	Slight	Moderate	Substantial
Bridges	13	12	1	0	0
Communication	1	0	1	0	0
Fuel Storage	2	0	0	2	0
Government Functions	12	3	0	6	3
Hazardous Materials Facilities	0	0	0	0	0
Medical & Health Services	1	0	1	0	0
Other Critical Functions	4	3	0	1	0
Power	0	0	0	0	0
Protective Functions	4	0	1	3	0
School Facilities	0	0	0	0	0
Societal Functions	5	5	0	0	0
Wastewater	3	3	0	0	0
Water Supply	0	0	0	0	0
Total/Average	**45**	**25**	**4**	**12**	**3**

a. None = No damage to structure or contents; Slight = 0-10% damage to structure; Moderate = 11-49% damage to structure; Substantial = 50-100% damage to structure

The following infrastructure is also vulnerable to damage:

- **Water Proximate Infrastructure**—Breakwaters and piers collapse, sometimes because of scouring actions that sweep away their foundation material and sometimes because of the sheer impact of the tsunami waves.
- **Flood Control Systems**—Floodwaters can back up drainage systems, causing localized flooding. Culverts can be blocked by debris from tsunami events, also causing localized urban flooding.
- **Utility Systems—**Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing waste to spill into homes, neighborhoods, rivers and streams. Tsunami waves can knock down power lines and radio/cellular communication towers. Power generation facilities can be severely impacted by wave action and by inundation from floodwater.

13.5.4 Environment

Environmental impacts would be most significant in areas closest to the point of impact. Local waterways and wildlife would be most vulnerable at these points. Areas near gas stations, industrial areas and facilities storing hazardous materials would be vulnerable. The vulnerability of aquatic habit and associated ecosystems in low-lying areas close to the coastline would be high. Tsunami waves can carry destructive debris and pollutants that can have devastating impacts on all facets of the environment, as evidenced in the Indian Ocean tsunami of December 2004. Millions of dollars spent on habitat restoration and conservation in the planning area could be wiped out by one significant tsunami.

13.6 FUTURE TRENDS IN DEVELOPMENT

It is assumed that development and redevelopment trends in Del Norte County are not such that there is major concern about development in identified tsunami risk areas. Future development in the County and the City of Crescent City will be regulated by their respective general plans. Both general plans include policies regarding construction in tsunami hazard areas:

- **Crescent City**—The City requires that construction in low-lying coastal areas—those in the zone of possible runup—be designed in accordance with recommendations stated in the report, *Protection of Crescent City, California From Tsunami Waves (*City of Crescent City, 2001).
- **Del Norte County**—The County requires construction in low-lying coastal areas or in the zone of possible tsunami runup to be designed in accordance with the requirements of the County Flood Hazard Ordinance (Del Norte County, 2003).

According to County Assessor records, there are 1,205 undeveloped parcels that intersect the tsunami hazard area, of which 81 percent are designated for residential development (see Figure 13-9). The total land area of the parcels that fall within the mapped inundation areas is 3,603 acres (33 percent of total undeveloped acreage), meaning that many of these parcels likely have locations where development could be placed outside of tsunami inundation zones.

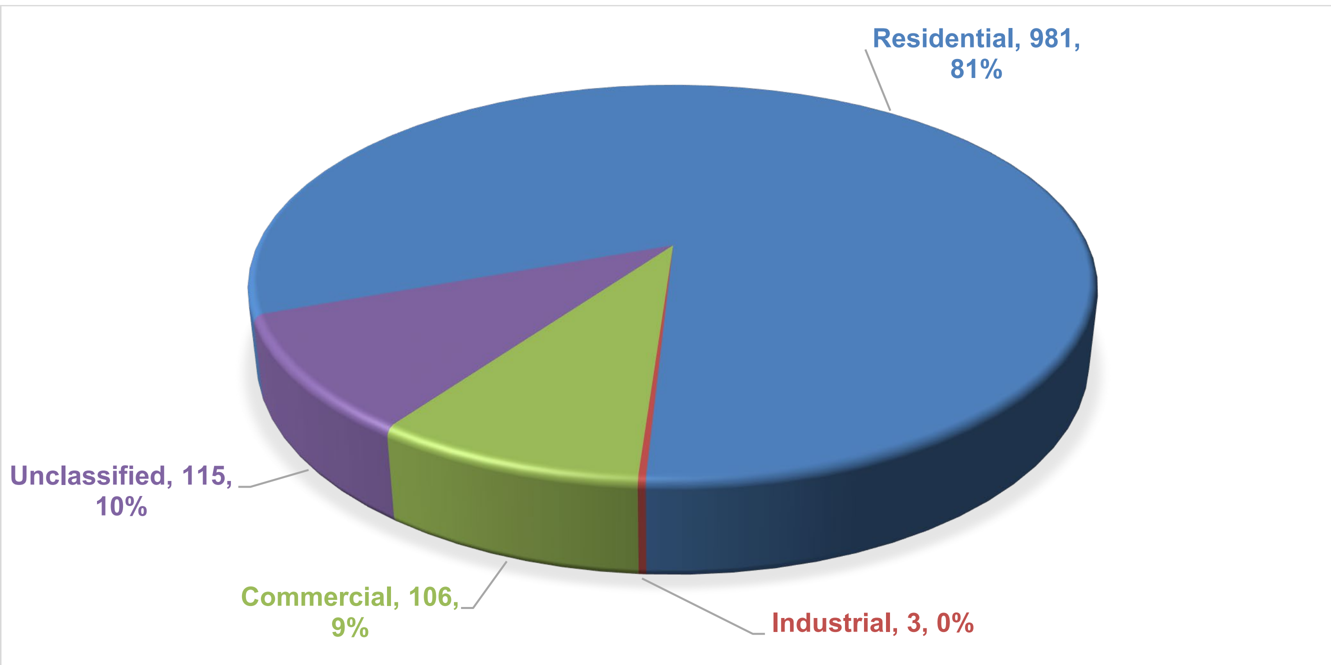


Figure 13-9. Undeveloped Parcels in the Tsunami Inundation Zone, by Land Use Type

13.7 SCENARIO

The worst-case scenario for the planning area is a local tsunami event triggered by a seismic event along the Cascadia subduction zone. Historical records suggest that tsunami wave heights on the order of 15 to 60 feet could be generated by a Cascadia subduction event. The Del Norte County planning area possesses some geographical features that may help absorb some of the impacts of tsunami events. However, a major tsunami event in the region would have devastating impacts on the people, property and economy of Del Norte County.

13.8 ISSUES

Important issues associated with a tsunami in the planning area include the following:

- A local tsunami presents the highest risk to the planning area, as evacuation times may be extremely limited.
- There are estimated to be 522 residential structures in the planning area located in tsunami inundation areas. Some of these structures have flood protection measures in place that may offer a degree of protection from tsunami risk; however, a large number of structures in the planning area were built before the City and County entered the NFIP.
- Risk from tsunami inundation is not subject to the State of California real estate disclosure law.
- It is estimated that more than 1,000 people would be displaced as a result of the modeled tsunami event.
- Significant debris would be produced as a result of a major tsunami impacting the planning area.
- More than 9 percent of the total replacement value of the planning area could be lost as a result of a tsunami event. This would have significant implications for the local economy and local taxes.
- There are 45 critical facilities in the planning area that are located in tsunami risk areas.
- The loss of harbor and dock facilities after an earthquake would have significant impacts on the local economy.
- To truly measure and evaluate the probable impacts of tsunamis on planning, new hazard mapping based on probabilistic scenarios likely to occur for Del Norte County needs to be created. The science and technology in this field are emerging. For tsunami hazard mitigation programs to be effective, probabilistic tsunami mapping will need to be a key component.
- Present building codes and guidelines do not adequately address the impacts of tsunamis on structures, and current tsunami hazard mapping is not appropriate for code enforcement.
- Organizations in the planning area such as the Redwood Coast Tsunami Work Group and Humboldt State University have done excellent work in implementing and supporting public information and awareness programs. These programs need to be continued, supported and enhanced to promote the concepts of mitigation and preparedness for the impacts of tsunamis and all hazards addressed by this plan.
- As tsunami warning technologies evolve, the tsunami warning capability within the planning area will need to be enhanced to provide the highest degree of warning to planning partners with tsunami risk exposure.
- With the possibility of climate change, the issue of sea level rise may become an important consideration as probable tsunami inundation areas are identified through future studies.
- Special attention will need to be focused on the vulnerable communities and tourists in the tsunami zone and on hazard mitigation through public education and outreach.

14. WILDLAND FIRE

14.1 GENERAL BACKGROUND

14.1.1 Causes of Wildland Fire

A wildland fire is any uncontrolled fire on undeveloped land that requires fire suppression. Wildland fires can occur naturally and are important to many ecosystem processes, but most are started by people. CAL FIRE's Fire and Resource Assessment Program (FRAP) includes a record of all historical wildland fires in Del Norte County. According to program statistics, 233 wildland fires burned in Del Norte County between 1909 and 2016. The cause of 204 of these fires is known and recorded, as shown in Figure 14-1; 63 percent of them (128 fires) were caused by human activities. Lightning accounts for another 33 percent (76 fires).

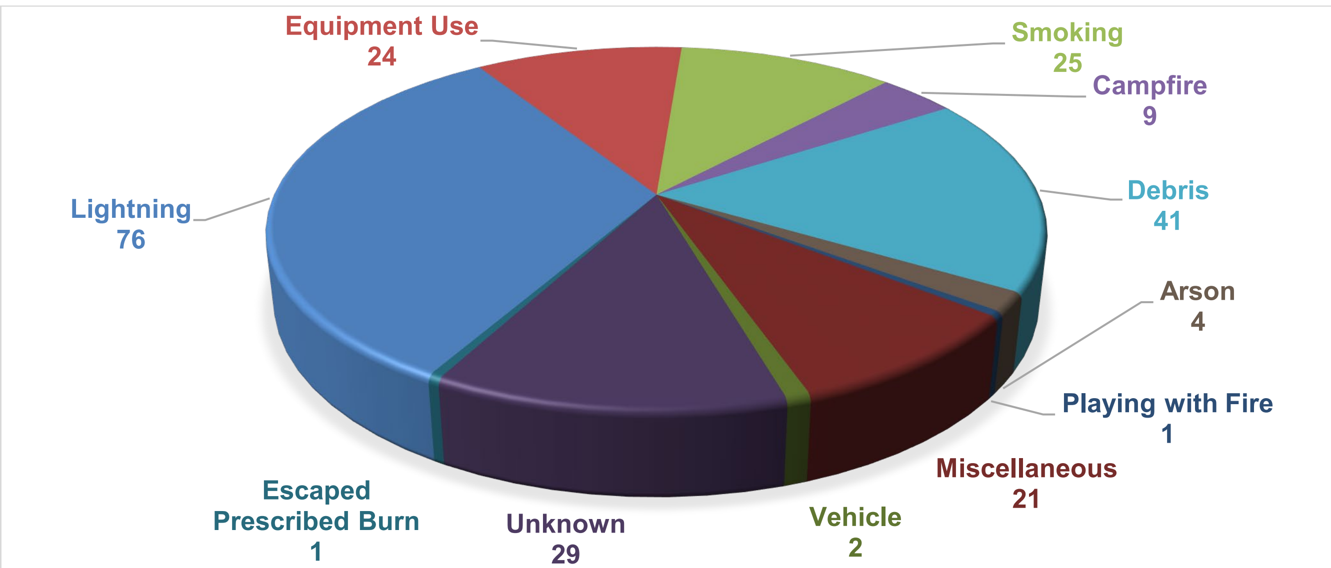


Figure 14-1. Causes of Wildland Fires in Del Norte County (of 220 Fires, 1909 – 2016)

14.1.2 Wildland Urban Interface

Natural resource lands, primarily forestlands, surround many unincorporated communities in Del Norte County. The areas where communities abut natural resource lands are known as the wildland-urban interface. At the interface, a mix of fuel, weather and topographical conditions create conditions that put a community at risk of wildland fire. A wildland-urban interface is an area of increased human influence and land use conversion. Population and demographic trends, economic and tax issues, and land use planning and policy issues all play a part in influencing the interface. Public values and perceptions shape the way that natural resources are managed and conserved at the interface.

An interface can also be defined as a zone where human-made infrastructure is located in or adjacent to areas prone to wildland fires. Such areas contribute to a neighborhood's or community's vulnerability to a wildland fire. The *Humboldt – Del Norte Unit Fire Management Plan* (California Department of Forestry and Protection, 2005) discusses communities at risk based on wildland urban interface areas, but mapping techniques have evolved since that plan was developed. This hazard profile uses fire hazard severity zones rather than wildland urban interface designations to describe risk.

14.2 HAZARD PROFILE

14.2.1 Past Events

Fire has been a significant factor in Del Norte County's history. Evidence of this can be seen in the fire scars on ancient redwoods, some dating back more than a thousand years. Before 1875, Native Americans often burned much of what is now Del Norte County. Fire would clear the understory of the forested areas, driving out insects and rodents. Fire also enhanced the grasses and forbs used to weave baskets. Early European settlers used fire for enlarging and replenishing pasture/agricultural lands. These fires often escaped their control (2010 Hazard Mitigation Plan).

Major land activities after initial European settlement were livestock grazing, farming, debarking of tanoak for tannin production, and logging of Douglas fir and coastal redwood. Logging was a dominant activity during this period. Logged areas were burned to assist with the removal of the logs and reduce the logging debris left behind. These fires were left to burn with no effective control efforts. Area ranchers also commonly set fire to lands in order to maintain grazing. Many resulting large fires are documented in area newspapers from 1880 to 1952 (2010 Hazard Mitigation Plan).

All recorded Del Norte County fires larger than 100 acres are listed in Table 14-1, along with the responding agency, the alarm date, and the cause of the fire. Due to steep terrain, inaccessibility, late notification or a combination of these, 17 fires reached significant size (over 3,000 acres).

Table 14-1. Del Norte County Fires >100 Acres (1909 to 2016)

Fire Name	Agency	Alarm Date	Cause	Area Burned (acres)
Feeder (Gasquet Complex)	USF	8/2/2015	Lightning	898
Summit (Gasquet Complex)	USF	8/2/2015	Lightning	640
Coon (Gasquet Complex)	USF	8/1/2015	Lightning	5,683
Peak (Gasquet Complex)	USF	8/1/2015	Lightning	11,525
Nickowitz	USF	8/1/2015	Lightning	7,576
Bear (Gasquet Complex)	USF	7/31/2015	Lightning	11,617
Blue Creek #3	USF	11/24/2009	Debris	6,705
Blue 2	USF	6/21/2008	Lightning	17,552
Mill	USF	6/20/2008	Lightning	65,882
Buck	USF	7/24/2006	Lightning	422
Shelly	USF	7/28/2002	Miscellaneous	843
Biscuit	USF	7/13/2002	Lightning	501,082
Kellogg	CAL FIRE	4/28/2002	Vehicle	174
Bottom	USF	9/15/2001	Lightning	101
Unnamed	USF	10/10/1998	Unknown Unidentified	441
Unnamed	USF	10/1/1998	Unknown Unidentified	6,284
Unnamed	USF	10/1/1998	Unknown Unidentified	318
Unnamed	USF	10/1/1998	Unknown Unidentified	496
Unnamed	USF	10/1/1998	Unknown Unidentified	3,617
Unnamed	USF	10/1/1998	Unknown Unidentified	956
Buck	USF	9/13/1998	Miscellaneous	841

Fire Name	Agency	Alarm Date	Cause	Area Burned (acres)
Panther	USF	9/26/1996	Arson	943
Kevin	USF	7/21/1994	Lightning	206
Klamath	CAL FIRE	9/11/1988	Miscellaneous	6,158
Patricks	USF	10/5/1980	Debris	104
Panther	USF	7/1/1972	Miscellaneous	209
Sugar	USF	9/12/1967	Equipment Use	477
Gasquet Mtn.	USF	9/19/1957	Miscellaneous	562
Flint Valley	USF	9/17/1951	Lightning	325
Notice Creek	USF	9/17/1951	Lightning	318
Lems Summit	CAL FIRE	9/16/1951	Unknown Unidentified	3,368
Pappas	CAL FIRE	7/29/1950	Unknown Unidentified	1,034
Rock Creek	USF	7/3/1950	Smoking	153
Unnamed	USF	9/29/1939	Lightning	199
Unnamed	USF	9/8/1932	Debris	288
Blue Creek #4	USF	11/25/1929	Debris	3,769
Blue Creek #2	USF	9/15/1929	Debris	6,112
French Hill	USF	9/1/1929	Debris	228
Bluff Creek	USF	7/29/1927	Lightning	5,656
Nickowitz	USF	7/24/1927	Lightning	1,004
Bluff Creek #2	USF	9/12/1924	Debris	1,227
Bluff Creek #1	USF	9/5/1924	Lightning	261
Summit Valley	USF	9/1/1924	Lightning	149
C&O Lbr. Co.	USF	8/15/1924	Equipment Use	119
Doctor Rock	USF	9/8/1922	Debris	558
Hardscrabble	USF	8/18/1920	Debris	199
Myrtle Creek	USF	6/26/1918	Debris	1,050
Stone Creek	USF	6/18/1918	Debris	119
Camp Creek	USF	6/12/1918	Lightning	3,565
Unnamed	USF	1/1/1918	Unknown Unidentified	5,469
Unnamed	USF	9/29/1917	Debris	2,970
Serpentine Camp	USF	9/3/1917	Debris	996
Unnamed	USF	8/24/1917	Debris	199
Unnamed	USF	9/7/1915	Debris	1,643
Unnamed	USF	8/22/1911	Unknown Unidentified	258
Bluff Creek	USF	7/24/1910	Campfire	298

Source: CAL FIRE FRAP, 2009

The largest recorded fire was the Biscuit Fire in 2002, which burned in southern Oregon and northern California. It began on July 13, 2002, due to lightning strikes and eventually burned over 500,000 acres. This fire caused the evacuation of Gasquet and surrounding communities. Its heavy smoke contributed to health problems for residents within a 100-mile radius. The Biscuit Fire's boundaries stretched from 10 miles east of the coastal community of Brookings, Oregon; south to the communities of Hiouchi and Gasquet; east to the Illinois Valley in southern Oregon; and north to within a few miles of the Rogue River in Oregon. The fire was one of the most difficult fires to contain in recent history.

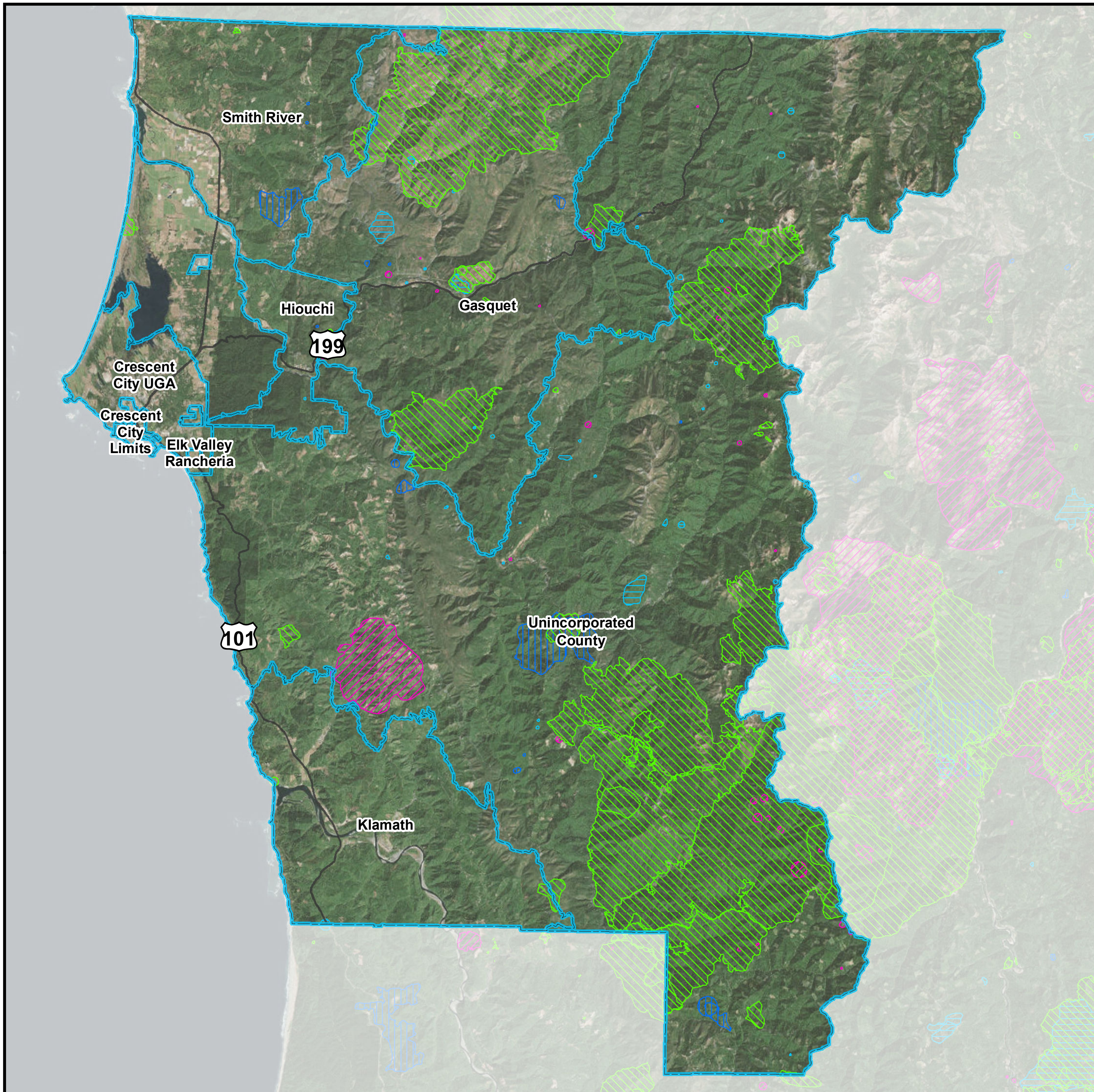
Figure 14-2 shows the location and size of historical fires in the county between 1909 and 2016, which burned more than 697,000 acres. The majority of wildland fires have been located in the north-central and southeastern portions of the county, with a few smaller fires in the central portion of the county. Of the 233 fires between 1909 and 2016, the average area burned was 2,994 acres per fire, including the Biscuit Fire. Without the Biscuit Fire being considered, the average fire size was about 840 acres per fire.

14.2.2 Location

CAL FIRE has modeled and mapped wildland fire hazard zones using a science-based and field-tested computer model that designates moderate, high or very high fire hazard severity zones (FHSZ). FHSZ ratings are derived from a combination of fire frequency (how often an area burns) and expected fire behavior under severe weather conditions. CAL FIRE's model derives fire frequency from 50 years of fire history data. Fire behavior is based on factors such as the following (CAL FIRE, 2017a):

- **Fuel**—Fuel may include living and dead vegetation on the ground, along the surface as brush and small trees, and above the ground in tree canopies. Lighter fuels such as grasses, leaves and needles quickly expel moisture and burn rapidly, while heavier fuels such as tree branches, logs and trunks take longer to warm and ignite. Trees killed or defoliated by forest insects and diseases are more susceptible to wildland fire. Forests in Del Norte Unit are predominantly mixed conifer forest consisting of coast redwood, Douglas fir and spruce, with intermingled hardwoods including madrone and tanoak. (National Fire Danger Rating System Fuel Model G or Fire Behavior Fuel Model 10). The large amount of precipitation the county receives on an annual basis creates a lot of vegetation, which is potential fuel. A key component of this fuel type is the large amount of down and dead woody fuel. This vegetation type consists of the following zones:
    - The coastal strip consists of coast redwood, Douglas fir and spruce. This is a closed-canopy forest with a thick understory of brush. The biomass here is equal to or greater than that of a rain forest.
    - The second zone occurs inland where Douglas fir dominates and resides with the hardwoods. This results in a more open canopy with a sparser understory.
- **Weather**—Relevant weather conditions include temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount and duration, and the stability of the atmosphere. When the temperature is high, relative humidity is low, wind speed is increasing and coming from the east (offshore flow), and there has been little or no precipitation so vegetation is dry, conditions are very favorable for extensive and severe wildland fires. These conditions occur more frequently inland where temperatures are higher and fog is less prevalent. During the dry summer months, the county's abundant vegetation dries out and becomes hazardous fuel. That fuel combined with a Chinook wind—hot and dry from the Great Basin—can produce extreme fire danger. The coastal area has a fire-weather scenario when prevailing winds from the Gulf of Alaska blow off the ocean.
- **Terrain**—Topography includes slope and elevation. The topography of a region influences the amount and moisture of fuel; the impact of weather conditions such as temperature and wind; potential barriers to fire spread, such as highways and lakes; and elevation and slope of land forms (fire spreads more easily uphill than downhill).

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 wildland fire 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. Detailed discussions of the zones and how they are developed are available on the CAL FIRE website (CAL FIRE, 2012 and 2012a).



Del Norte County

Figure 14-2.
Historical Fire Perimeters, 1909 - 2015

Planning Unit Boundaries

Historical Fire Perimeters

- 1909 - 1955
- 1956 - 1975
- 1976 - 1995
- 1996 - 2015

0 3 6 12
Miles

N W E S

Map Data Sources:Del Norte County, CalTrans, Hazus 4.2, EPA, USDA, CalFIRE, State of California

Figure 14-3 shows the FHSZ mapping for the planning area. The majority of the planning area is in a very high severity zone. The only areas not in mapped fire risk areas are small areas of the Smith River and Unincorporated planning units and the City of Crescent City. Table 14-2 shows the total area in each fire severity zone as well as the acres burned in each area.

14.2.3 Frequency

The overall probability of some wildland fire event impacting the planning area is high. Figure 14-4 charts the 233 major fires in the county each year from 1909 to 2016. The average is 2 fires per year and the range is 0 to 17 fires per year. The wildland fire probability varies with time of year and size of fire, as described in the following sections.

Frequency by Month

Del Norte County is a mountainous region characterized by steep, inaccessible topography with extensive forest resources (primarily redwood and Douglas fir). The wildland fire season in Del Norte County usually begins in June, peaks in August and September, and ends by mid-October. Over 80 percent of wildland fires in the county's history ignited between July and October, although wildland fires have ignited in every month of the year except December (see Figure 14-5).

Precipitation in Northern California is usually at its lowest from July to September. Thunderstorm activity, which typically begins in June with wet storms, turns dry with little or no precipitation reaching the ground as the season progresses into July and August. Thunderstorms with dry lightning are more prevalent in the eastern portion of the county. July and August are when local winds predominate, with the Pacific jet stream weak and well to the north. By mid or late September, north to northeast winds return to the north half of the planning area, bringing in moist ocean air. Drought, light snow pack, and local weather conditions can expand the length of the fire season.

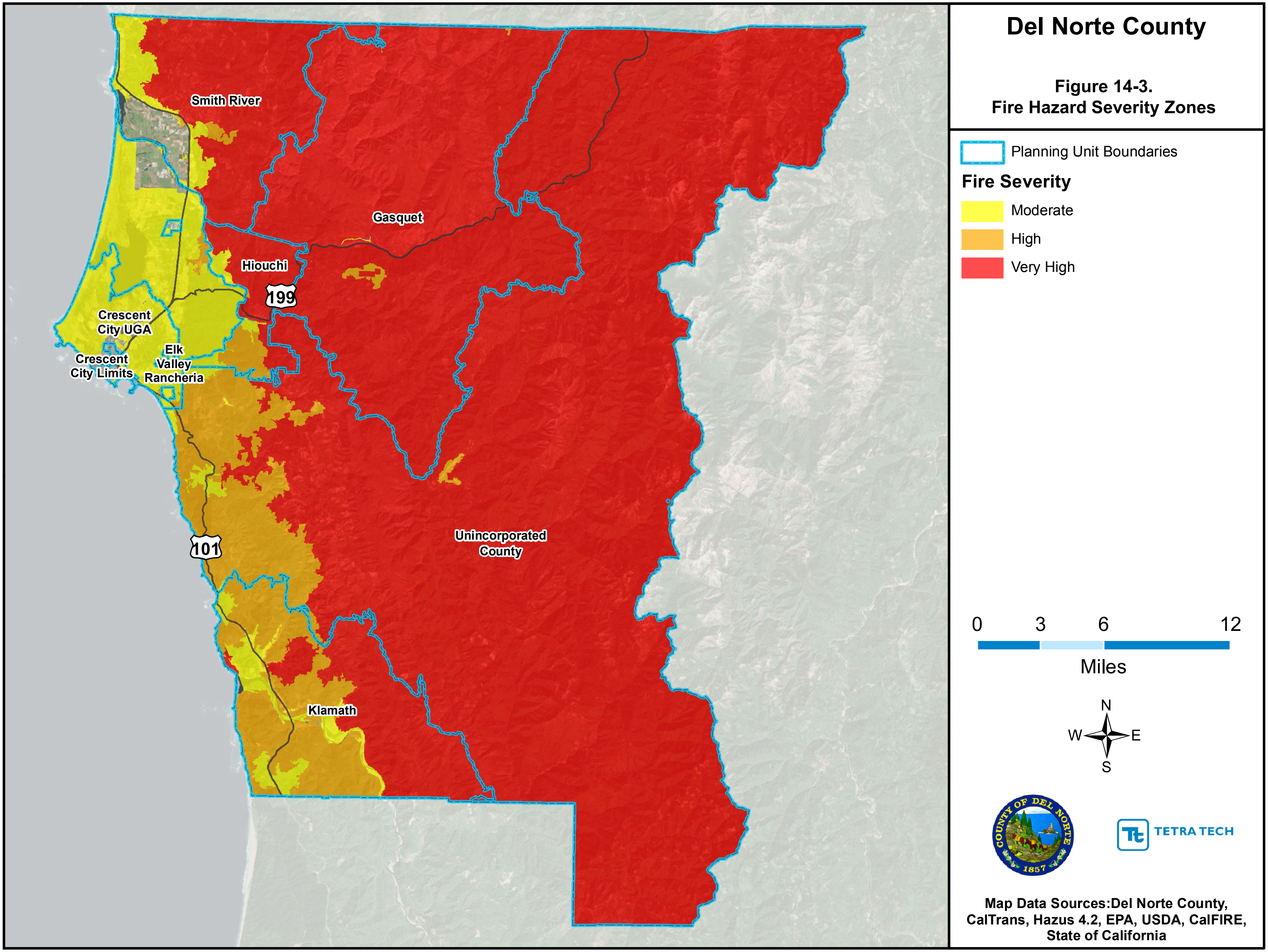
Frequency by Size of Fire

The potential for large wildland fires in Del Norte County is lower than in many other parts of California. Improved fire spotting techniques, better equipment, and trained personnel are major factors, as are the county's wet climate and normally low fire fuel conditions. The wet climate and the infrequent occurrence of strong, dry winds prevent potential fuel from reaching a combustible state. Unlike Southern California's trees, known for their production of an oily, combustible sap and their susceptibility to dry conditions, Del Norte County's forests retain moisture and are resistant to abnormal dry spells. Studies of the fire frequency of the coast redwood have suggested a 10-year return cycle east of Prairie Creek State Park, an 11- to 26-year cycle in Del Norte County Redwoods State Park, and up to 50-year cycle at humid coastal sites (Engber et al., 2016).

Although the potential for a disastrous wildland fire is much lower than in other parts of the state, the suppression of wildland fires in recent decades has resulted in a buildup of fuel and has increased the potential for large fires. There have been 17 significant fires (defined as greater than 3,000 acres) in the planning area in 108 years. This amounts to a significant fire occurring in the planning area every six years on average.

14.2.4 Severity

According to CAL FIRE, wildland fires in Del Norte County between 1909 and 2016 ranged from less than 1 acre to more than 500,000 acres. Figure 14-6 displays the severity (defined by total area burned) of Del Norte County's historical wildland fires. More than half of the historic fires in the planning area have been contained after burning less than 50 acres.



Del Norte County

Figure 14-3. Fire Hazard Severity Zones

Table 14-2. Record of Fire Affecting Planning Area

Fire Hazard Severity Zone (FHSZ)	Total Area in Zone (acres)	Area Burned, 1909 – 2015	
		Acres	Percent of Total
Moderate FHSZ	52,357	239	0.5
High FHSZ	57,823	2,364	4.1
Very High FHSZ	530,313	162,168	30.6
Total	640,493	164,771	25.7

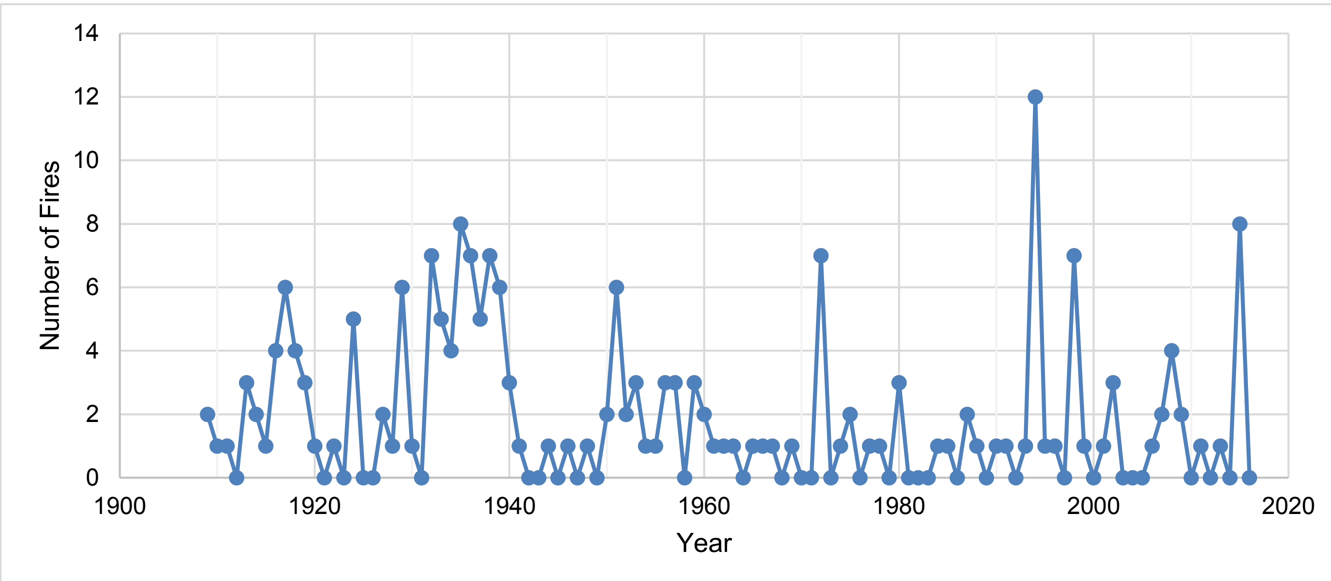


Figure 14-4. Annual Frequency of Fires in Del Norte County, 1909 – 2016

Source: FRAP, 2018

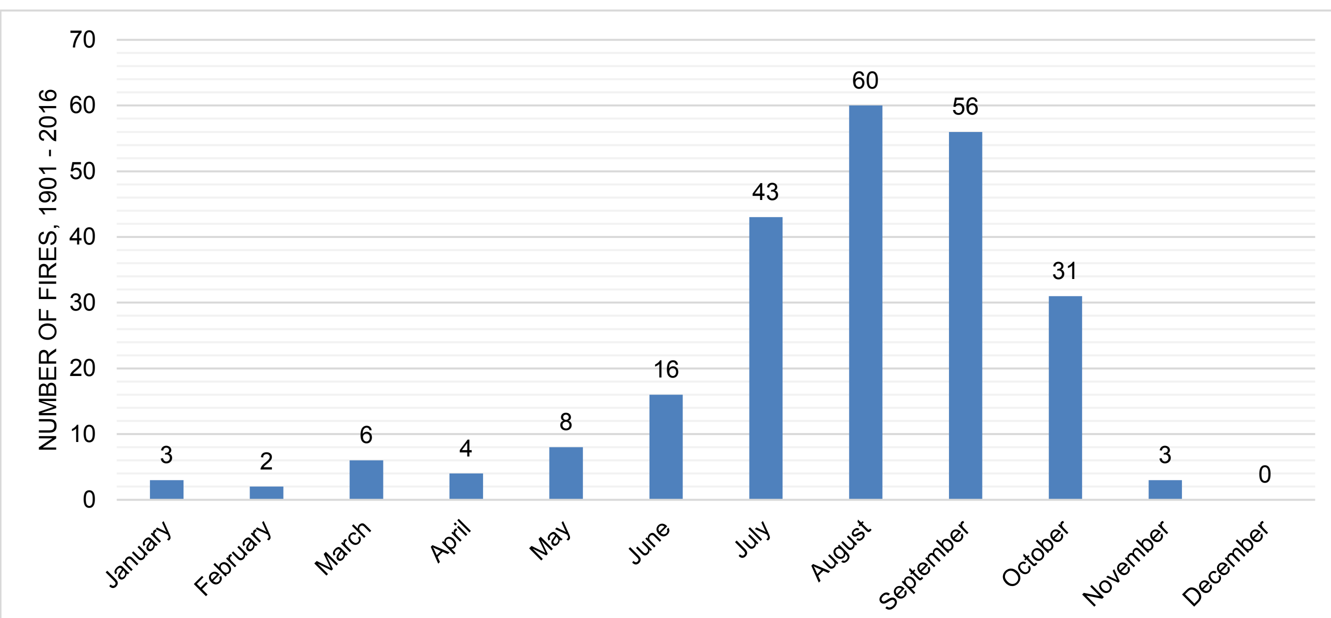


Figure 14-5. Months in which Del Norte County Wildland Fires Have Ignited, 1909 – 2016

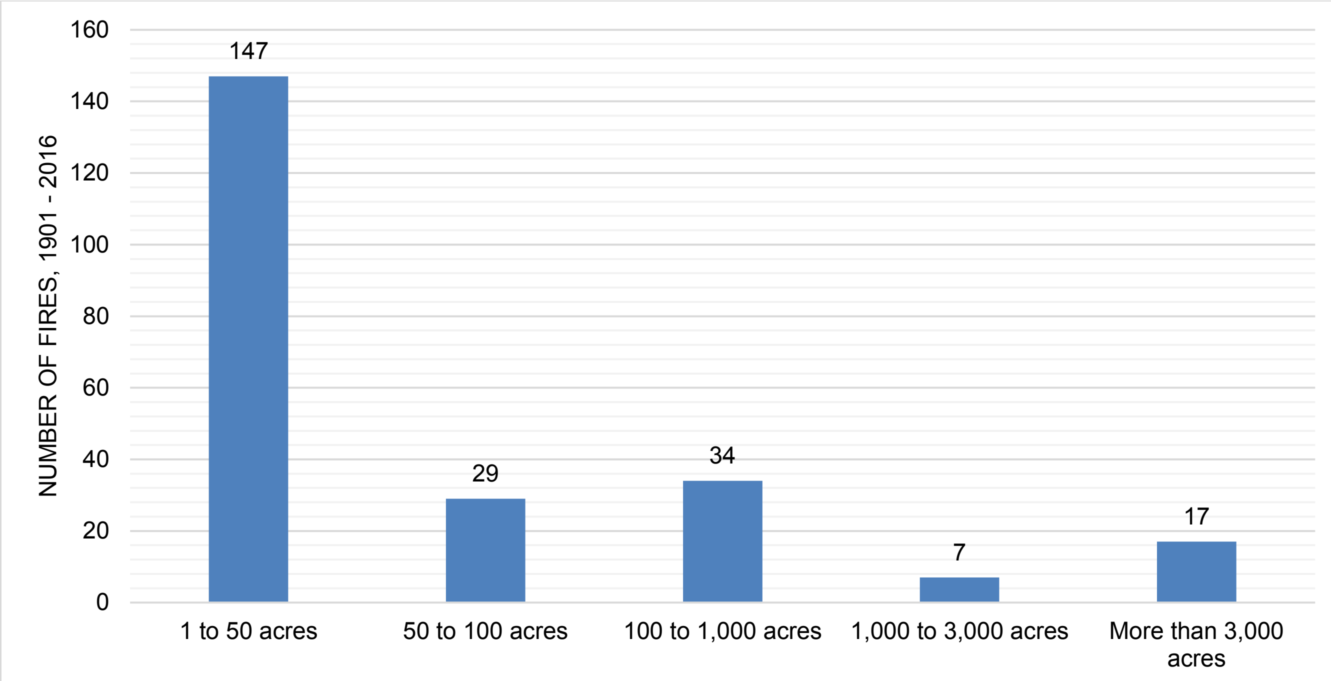


Figure 14-6. Area Burned by Del Norte County Wildland Fires, 1909 – 2016

14.2.5 Warning Time

Wildland fires are often caused by humans, intentionally or accidentally. There is no way to predict when one might break out. Since fireworks often cause brush fires, extra diligence is warranted around the Fourth of July when the use of fireworks is highest.

Dry seasons and droughts are factors that greatly increase fire likelihood. Dry lightning may trigger wildland fires. Severe weather can be predicted, so special attention can be paid during weather events that may include lightning. Reliable National Weather Service lightning warnings are available on average 24 to 48 hours prior to a significant electrical storm.

If a fire does break out and spread rapidly, residents may need to evacuate within days or hours. A fire's peak burning period generally is between 1 p.m. and 6 p.m. Once a fire has started, fire alerting is reasonably rapid in most cases. The rapid spread of cellular and two-way radio communications in recent years has further contributed to a significant improvement in warning time; however, the lack of reliable cell service in many parts of the planning area means that providing warning to those in the path of a fire may still be difficult, particularly if individuals are not in areas with land lines.

14.3 SECONDARY HAZARDS

Wildland fires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. Fires can cause direct economic losses in the reduction of harvestable timber and indirect economic losses in reduced tourism. Wildland fires cause the contamination of reservoirs, destroy transmission lines and contribute to flooding. They strip slopes of vegetation, exposing them to greater amounts of runoff. This in turn can weaken soils and cause failures on slopes. Major landslides can occur several years after a wildland fire. Most wildland fires burn hot and for long durations that can bake soils, especially those high in clay content, thus increasing the imperviousness of the ground. This increases the runoff generated by storm events, thus increasing the chance of flooding.

14.4 EXPOSURE

A quantitative assessment of exposure to the wildland fire hazard was conducted using the fire hazard severity zone mapping shown in Figure 14-3 and the asset inventory developed for this plan (See Section 6.3). Detailed results are provided in Appendix C and summarized below.

14.4.1 Population

Population was estimated using the residential building count in each mapped hazard area and multiplying by the 2016 estimated average population per household. Using this approach, the estimated population living in mapped wildland fire risk areas is 57 percent of the planning area population (15,861 people). The population exposure estimates by risk area are shown in Table 14-3. This includes 97 percent of the population of the Gasquet Planning Unit and 71 percent of the population of the Hiouchi Planning Unit residing in the very high fire hazard severity zone. In addition to populations who reside in risk areas where fires may occur, hikers and campers in the mountains may be exposed to wildland fires and the entire population of the planning area has the potential to be exposed to smoke from nearby wildland fires.

Table 14-3. Del Norte County Population Exposure to the Wildland Fire Hazard

Fire Hazard Severity Zone	Population Exposed	% of Total Population
Moderate	13,659	49%
High	600	2%
Very High	1,602	6%
Total	15,861	57%

14.4.2 Property

Figure 14-7 shows the percentage and count, by land use type, of planning area structures in very high and high severity zones. An estimated 88 percent of these structures (836 structures) are residential. Nearly all of the structures in the Gasquet planning unit (97 percent of structures) are in very high severity zones.

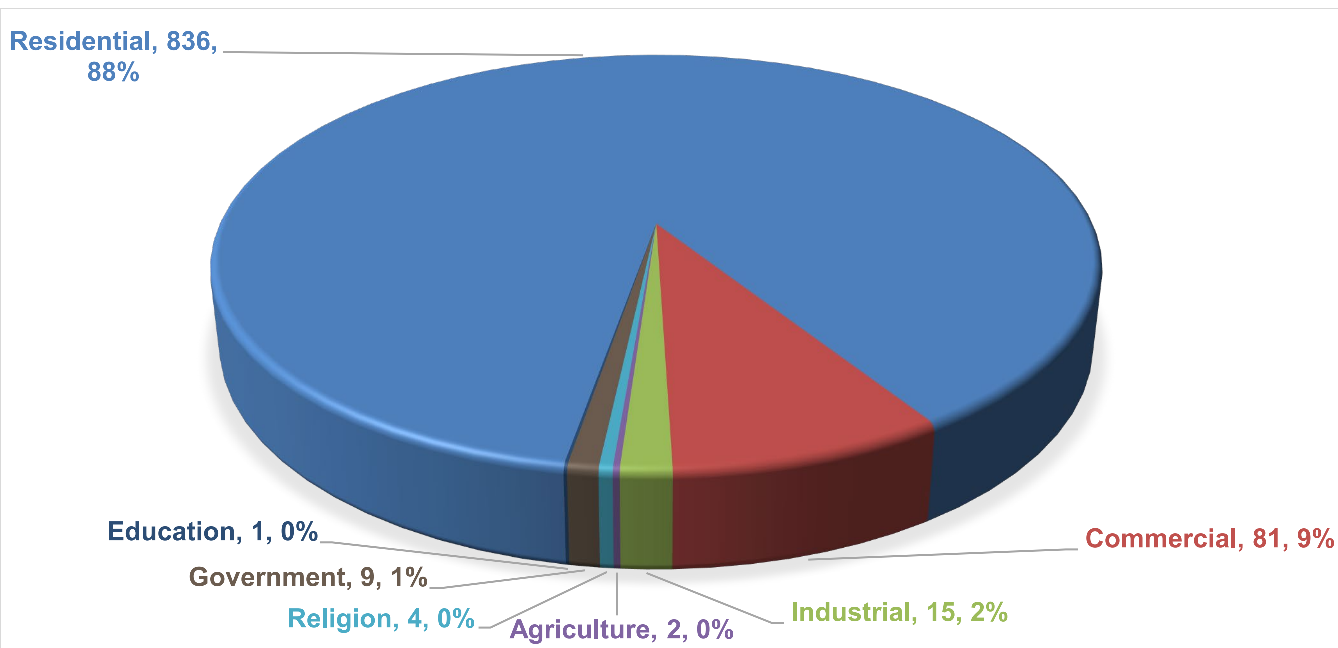


Figure 14-7. Structures in the High or Very High Fire Hazard Severity Zones, by Land Use Type

The total replacement value of property in the wildland fire hazard area is more than $8.6 billion—56 percent of the planning area total:

- Moderate fire hazard severity: $6.73 billion
- High fire hazard severity: $800 million
- Very high fire hazard severity: $1.11 billion

14.4.3 Critical Facilities and Infrastructure

Critical facilities and infrastructure exposed to the wildland fire hazard represent 73 percent of the total critical infrastructure and facilities in the planning area. The breakdown of exposure by severity zone and facility type is shown in Figure 14-8. Almost a third of critical facilities in the planning area are in very high severity zones. Linear, above-ground infrastructure, such as power lines, is also exposed to damage from wildland fire.

14.4.4 Environment

All natural resources and habitats in mapped fire hazard severity zones are exposed to the risk of wildland fire.

14.5 VULNERABILITY

Vulnerability estimates for the wildland fire hazard are described qualitatively. No loss estimation of these facilities was performed because damage functions have not been established for the wildland fire hazard. Modeling based on identified fire hazard areas would overestimate potential losses because it is unlikely that all areas susceptible to wildland fire would experience a fire at the same time.

14.5.1 Population

All people exposed to the wildland fire hazard are potentially vulnerable to wildland fire impacts. Smoke and air pollution from wildland fires can be a severe health hazard, especially for sensitive populations, including children, the elderly and those with respiratory and cardiovascular diseases. In addition, wildland fire may threaten the health and safety of those fighting the fires. First responders are exposed to dangers from the initial incident and after-effects from smoke inhalation and heat stroke. Persons with access and functional needs, the elderly and very young may be especially vulnerable to a wildland fire if there is not adequate warning time before evacuation is needed.

14.5.2 Property

All property exposed to the wildland fire hazard is vulnerable. Structures that were not constructed to standards designed to protect a building from a wildland fire may be especially vulnerable. As of 2008, California State Building code requires minimum standards be met for new buildings in fire hazard severity zones. Most housing in the planning area—84 percent—was built prior to this code requirement (U.S. Census, 2018). It is unknown how many of these structures are in fire hazard zones.

Estimates were developed to indicate the loss that would occur if wildland fire damage were equal to 10, 30 or 50 percent of the exposed property value, as summarized in Table 14-4. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure.

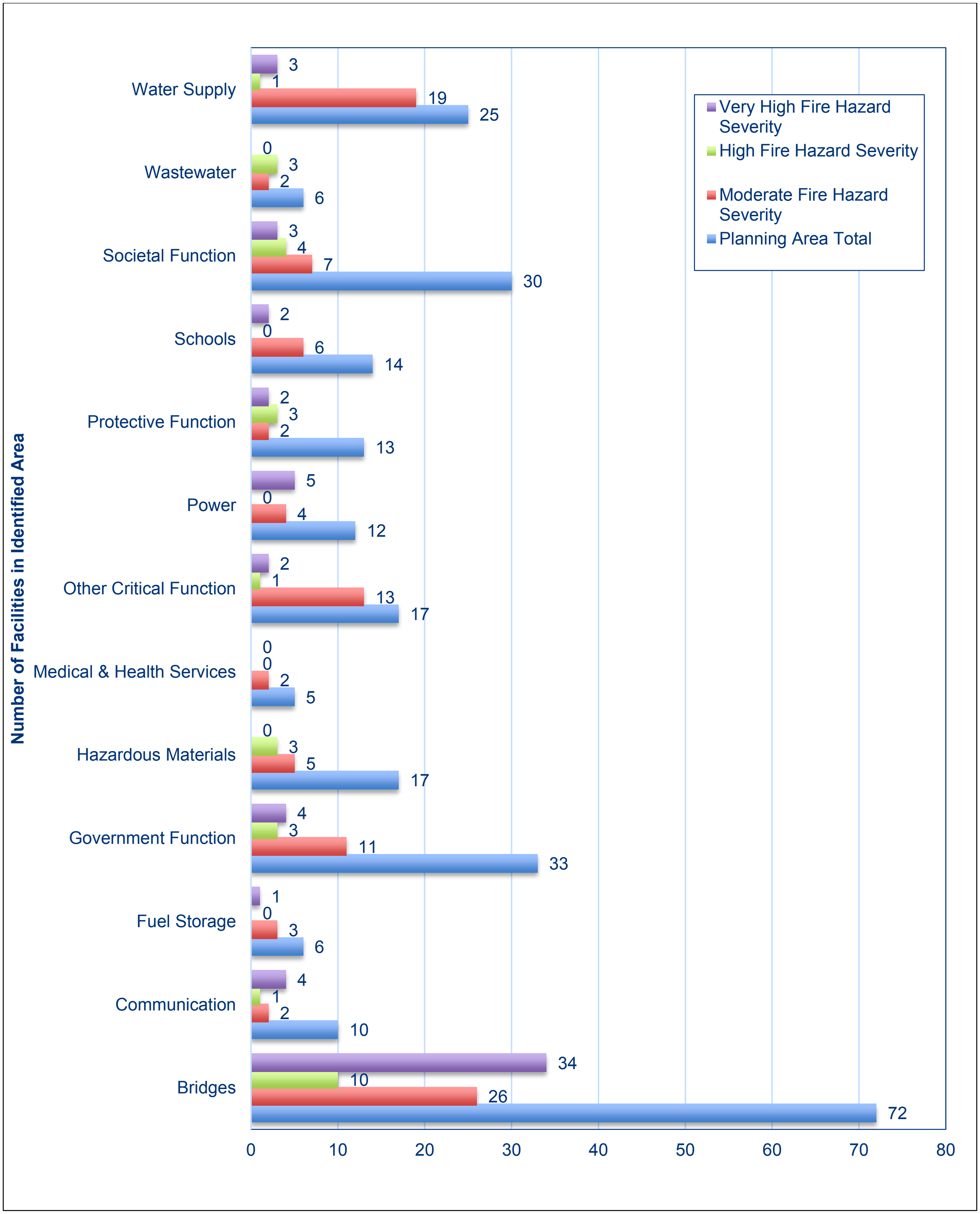


Figure 14-8. Critical Facilities and Infrastructure in Mapped Fire Hazard Severity Zones and Countywide

Table 14-4. Loss Estimates for Fire Hazard Severity Zones

Fire Hazard Severity Zone	Exposed Value	Damage = 10% of Exposed Value		Damage = 30% of Exposed Value		Damage = 50% of Exposed Value	
		Loss	% of Total Replacement Value	Loss	% of Total Replacement Value	Loss	% of Total Replacement Value
Moderate	$6.73 billion	$673 million	4.4%	$2.02 billion	13.1%	$3.36 billion	21.9%
High	$803 million	$80 million	0.5%	$241 million	1.6%	$402 million	2.6%
Very High	$1.11 billion	$111 million	0.7%	$333 million	2.2%	$555 million	3.6%
Total	**$8.64 billion**	**$864 million**	**5.6%**	**$2.59 billion**	**16.8%**	**$4.32 billion**	**28.1%**

14.5.3 Critical Facilities and Infrastructure

Critical facilities not built to fire protection standards, utility poles and lines, and facilities containing hazardous materials are most vulnerable to the wildland fire hazard. Most road and railroads would be without damage except in the worst scenarios, although roads and bridges can be blocked by debris or other wildland fire-related conditions and become impassable. The following critical facilities are located in very high and high severity zones and their vulnerability could complicate response and recovery efforts during and following an event:

- **Hazardous Materials and Fuel Storage—**During a wildland fire event, these materials could rupture due to excessive heat and act as fuel for the fire, causing rapid spreading and escalating the fire to unmanageable levels. In addition, they could leak into surrounding areas, saturating soils and seeping into surface waters, and have a disastrous effect on the environment.
- **Communication Facilities**—If these facilities are damaged and become inoperable, it would exacerbate already difficult communication in the planning area.
- **Fire Stations**—There are three fire stations as well as facilities that support firefighting efforts located in these risk areas.

14.5.4 Environment

Fire is a natural and critical ecosystem process in most terrestrial ecosystems, affecting the types, structure, and spatial extent of native vegetation. However, it also can cause severe environmental impacts:

- **Damaged Fisheries**—Critical fisheries can suffer from increased water temperatures, sedimentation, and changes in water quality.
- **Soil Erosion**—The protective covering provided by foliage and dead organic matter is removed, leaving the soil fully exposed to wind and water erosion. Accelerated soil erosion occurs, causing landslides and threatening aquatic habitats.
- **Spread of Invasive Plant Species—**Non-native woody plant species frequently invade burned areas. When weeds become established, they can dominate the plant cover over broad landscapes, and become difficult and costly to control.
- **Disease and Insect Infestations—**Unless diseased or insect-infested trees are swiftly removed, infestations and disease can spread to healthy forests and private lands. Timely active management actions are needed to remove diseased or infested trees.
- **Destroyed Endangered Species Habitat**—Fire can have negative consequences for endangered species.
- **Soil Sterilization**—Some fires burn so hot that they can sterilize the soil. Topsoil exposed to extreme heat can become water repellant, and soil nutrients may be lost.
- **Reduced Timber Harvesting**—Timber can be destroyed and lead to smaller available timber harvests.
- **Damaged Cultural Resources**—Scenic vistas can be damaged, access to recreational areas can be reduced and destruction of cultural resources may occur.

The sections below provide further detail on environmental elements that can experience harmful impacts from wildland fire.

Natural Resources

Natural resources are highly valued by residents of Del Norte County for their contribution to the local quality of life, and as an economic development asset that attracts tourist-related expenditures. Fire can destroy natural assets that are highly valued by the community.

Many ecosystems are adapted to historical patterns of fire. These patterns, called “fire regimes,” include temporal attributes (e.g., frequency and seasonality), spatial attributes (e.g., size and spatial complexity), and magnitude attributes (e.g., intensity and severity), each of which have ranges of natural variability. Ecosystem stability is threatened when any of the attributes for a given fire regime diverge from its range of natural variability.

Air Quality

Smoke generated by wildland fire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides) and toxics (formaldehyde, benzene). Emissions from wildland fires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildland fire include difficulty in breathing, odor, and reduction in visibility. The North Coast Unified Air Quality Management District monitors smoke impacts from active wildland fires and issues wildland fire smoke air quality notifications ranging from “good” to “hazardous” (North Coast Unified Air Quality Management District, 2018).

Del Norte County is prone to temperature inversions, which occur when a layer of warm air traps cool air near the surface and creates a lid that inhibits the vertical dispersion of smoke and other pollutants. The Megram Fire (Big Bar Complex Fire) burned 135,000 acres between late August and early November 1999 in eastern Humboldt and Trinity Counties, and resulted in the first air quality related state of emergency in California history. Smoke from the fire was trapped by an inversion layer between late September and early October, causing officials to close schools and encourage residents to leave the area. Those who remained in the affected area were encouraged to remain indoors.

Agricultural and Timber Resources

Agricultural resources include rangelands, timberlands, cultivated farmlands and dairy lands. Agricultural lands are an important element of the Del Norte County identity and economy. Although fire has been used as a tool in rangeland and timber management, wildland fire can have disastrous consequences on such resources, removing them from production and necessitating lengthy restoration programs.

Cultural Resources

Culturally sensitive areas exist on both public and private lands. While some locations are publicly identified, others are held as confidential information by local Native American organizations. Many cultural sites are at risk of incidents of wildland fire. Fire can destroy artifacts and structures. However, a light fire can clean an area of litter and ground fuel, exposing new cultural sites and artifacts without causing much damage. The discovery of new cultural sites can be a benefit to archeologists and Native American groups, but can also present problems of looting and vandalism.

14.6 FUTURE TRENDS IN DEVELOPMENT

The California Building Code includes minimum standards related to the design and construction of buildings in fire hazard severity zones. Any newly permitted buildings in these areas must conform to standards that remove flammable materials from around the building and construct buildings from fire resistant material. In addition, the Del Norte County General Plan and the City of Crescent City General Plan include policies that address managing development in fire hazard severity zones.

There are estimated to be 540 undeveloped parcels that intersect very high and high wildland fire hazard areas. Approximately 66 percent of these are designated for residential development (see Figure 14-9). The total land area of the parcels that fall within the mapped inundation areas is 3,392 acres (31 percent of total undeveloped acreage).

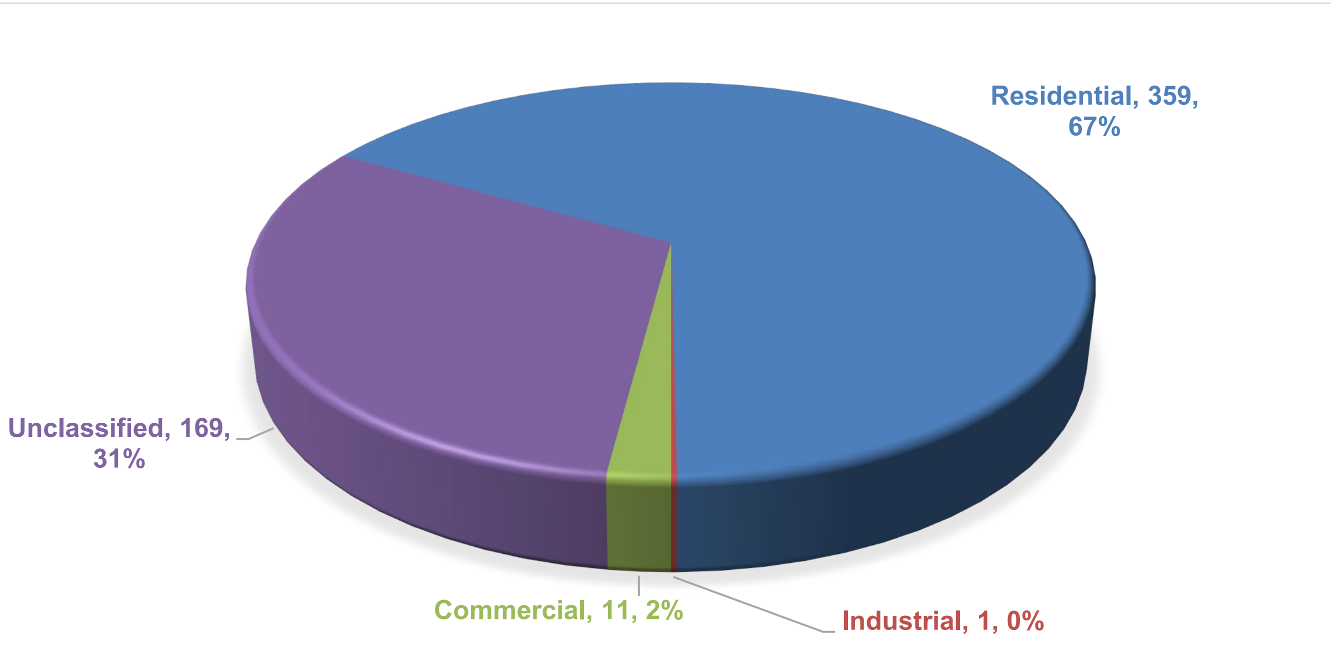


Figure 14-9. Undeveloped Parcels in the High and Very High Fire Hazard Severity Zones, by Land Use Type

14.7 SCENARIO

A major wildland fire in the planning area might begin with a wet spring, adding to fuels already present on the forest floor. Flashy fuels would build throughout the spring. The summer could see the onset of insect infestation. A dry summer could follow the wet spring, exacerbated by dry hot winds. Carelessness with combustible materials or a tossed lit cigarette, or a sudden lighting storm could trigger a multitude of small isolated fires.

The embers from these smaller fires could be carried miles by hot, dry winds. The deposition zone for these embers would be deep in the forests and interface zones. Fires that start in flat areas move slower, but wind still pushes them. It is not unusual for a wildland fire pushed by wind to burn the ground fuel and later climb into the crown and reverse its track. This is one of many ways that fires can escape containment, typically during periods when response capabilities are overwhelmed. These new small fires would most likely merge. Suppression resources would be redirected from protecting the natural resources to saving more remote subdivisions.

The worst-case scenario would include an active fire season throughout the American west, spreading resources thin. Firefighting teams would be exhausted or unavailable. Many federal assets would be responding to other fires that started earlier in the season.

To further complicate the problem, heavy rains could follow, causing flooding and landslides and releasing tons of sediment into rivers, permanently changing floodplains and damaging sensitive habitat and riparian areas. Such a fire followed by rain could release millions of cubic yards of sediment into streams for years, creating new floodplains and changing existing ones. With the forests removed from the watershed, stream flows could easily double. Floods that could be expected every 50 years may occur every couple of years. With the streambeds unable to carry the increased discharge because of increased sediment, the floodplains and floodplain elevations would increase.

14.8 ISSUES

The major issues for wildland fire are the following:

- Human activities have been the cause of 63 percent of wildland fires in the planning area.
- More than 50 percent of the planning area population lives in wildland fire risk areas, including 6 percent in very high fire hazard severity zones.
- Nearly all of the structures in the Gasquet planning unit are in very high fire severity zones.
- Much of the planning area's building stock is of wood-frame construction built before 2008 when California building codes began requiring minimum standards for buildings in fire hazard severity zones. Large clusters of structures are wood-frame structures in high and very high severity zones.
- An estimated 73 percent of the critical facilities and infrastructure in the planning area are located in wildland fire risk areas. A large number of the facilities are believed to be wood-frame structures. These facilities could have a significant amount of functional downtime after a wildland fire. This creates not only a need for mitigation but also a need for continuity of operations planning to develop procedures for providing services without access to critical facilities.
- Several vulnerable and isolated populations are in areas of high and very high risk for wildland fire.
- Public education and outreach to people living in the fire hazard zones should include information about and assistance with mitigation activities such as defensible space, and advance identification of evacuation routes and safe zones.
- Wildland fires could cause landslides as a secondary natural hazard.

15. CLIMATE CHANGE

15.1 GENERAL BACKGROUND

15.1.1 What is Climate Change?

Climate, consisting of patterns of temperature, precipitation, humidity, wind and seasons, plays a fundamental role in shaping natural ecosystems and the human economies and cultures that depend on them. “Climate change” refers to changes over a long period of time. Worldwide, average temperatures have increased 1.8ºF since 1880 (NASA, 2018). Although this change may seem small, it can lead to large changes in climate and weather.

The warming trend and its related impacts are caused by increasing concentrations of carbon dioxide and other greenhouse gases in the earth’s atmosphere. Greenhouse gases are gases that trap heat in the atmosphere, resulting in a warming effect. Carbon dioxide is the most commonly known greenhouse gas; however, methane, nitrous oxide and fluorinated gases also contribute to warming. Emissions of these gases come from a variety of sources, such as the combustion of fossil fuels, agricultural production, changes in land use and volcanic eruptions. Carbon dioxide concentrations measured about 280 parts per million before the industrial era began in the late 1700s and are now recorded at more than 407 parts per million (EPA, 2016 and NASA, 2018) (see Figure 15-1).

Source: EPA, 2016

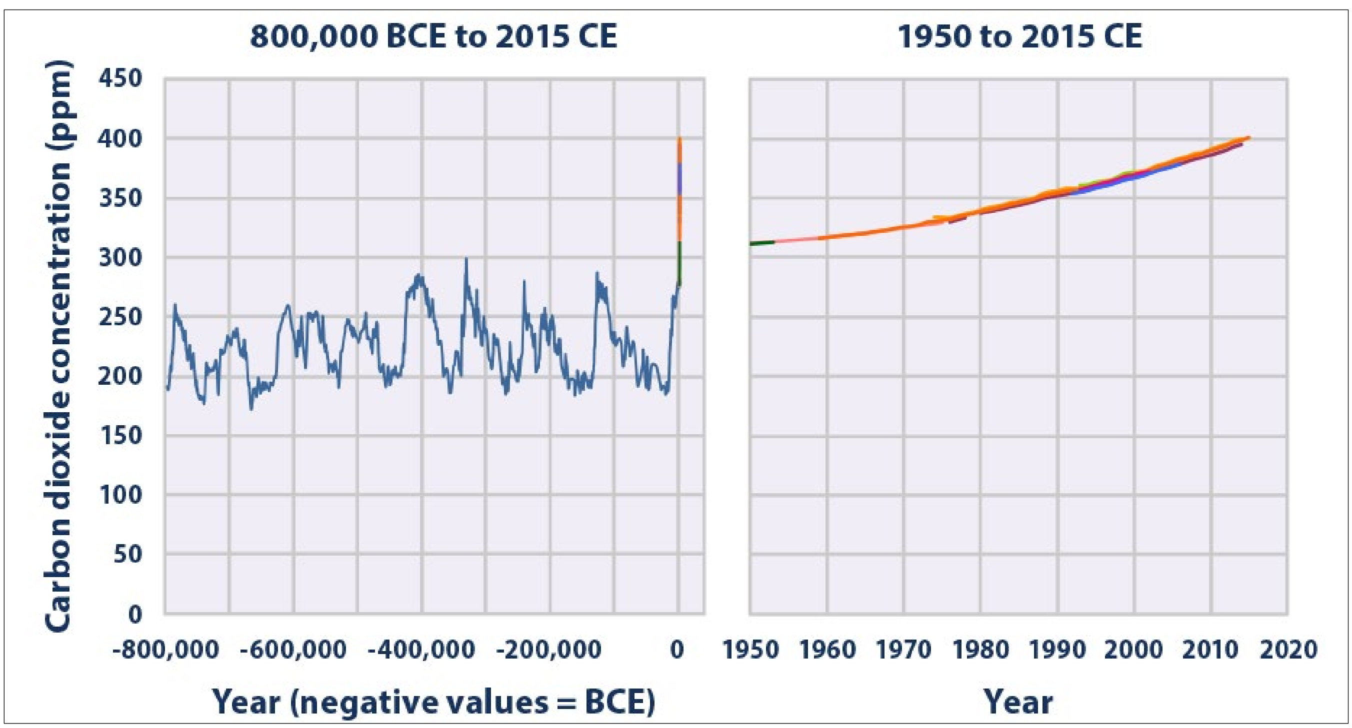


Figure 15-1. Global Carbon Dioxide Concentrations Over Time

In addition, the concentration of methane has almost doubled and nitrous oxide was being measured at a record high of 328 parts per billion as of 2015 (EPA, 2016a). In the United States, electricity generation is the largest source of these emissions, followed by transportation (EPA, 2016b).

Scientists are able to place this rise in carbon dioxide in a longer historical context through the measurement of carbon dioxide in ice cores. According to these records, carbon dioxide concentrations in the atmosphere are the highest that they have been in 650,000 years (NASA, 2016). According to NASA, most of this trend is very likely human-induced and it is proceeding at an unprecedented rate (NASA, 2016). There is broad scientific consensus (97 percent of scientists) that climate-warming trends are extremely likely due to human activities (NASA, 2018). Unless emissions of greenhouse gases are substantially reduced, this warming trend is expected to continue.

Climate change will affect the people, property, economy and ecosystems of the planning area in a variety of ways. Climate change impacts are most frequently associated with negative consequences, such as increased flood vulnerability or increased heat-related illnesses/public health concerns; however, other changes may present opportunities. The most important effect for the development of this plan is that climate change will have a measurable impact on the occurrence and severity of natural hazards.

15.1.2 How Climate Change Affects Hazard Mitigation

An essential aspect of hazard mitigation is predicting the likelihood of hazard events. Typically, predictions are based on statistical projections from records of past events. This approach assumes that the likelihood of hazard events remains essentially unchanged over time. Thus, averages based on the past frequencies of, for example, floods are used to estimate future frequencies: if a river has flooded an average of once every 5 years for the past 100 years, then it can be expected to continue to flood an average of once every 5 years.

For hazards that are affected by climate conditions, the assumption that future behavior will be equivalent to past behavior is not valid if climate conditions are changing. As flooding is generally associated with precipitation frequency and quantity, for example, the frequency of flooding will not remain constant if broad precipitation patterns change over time. Floods currently considered to be 1-percent-annual-chance events might strike more often, leaving many communities at greater risk. The risks of landslide, severe storms, extreme heat and wildfire are all affected by climate patterns as well. For this reason, an understanding of climate change is pertinent to efforts to mitigate natural hazards. Information about how climate patterns are changing provides insight on the reliability of future hazard projections used in mitigation analysis. This chapter summarizes current understandings about climate change in order to provide a context for the recommendation and implementation of hazard mitigation measures.

15.1.3 Current Indicators of Climate Change

The major scientific agencies of the United States and the world—including NASA, NOAA and the Intergovernmental Panel on Climate Change (IPCC)—agree that climate change is occurring. Multiple temperature records from all over the world have shown a warming trend. The IPCC has stated that the warming of the climate system is unequivocal (IPCC, 2014). Seventeen of the 18 warmest years on record occurred since 2001, and 2016 was the warmest year on record (NASA, 2017).

Rising global temperatures have been accompanied by other changes in weather and climate. Many places have experienced changes in rainfall resulting in more intense rain, as well as more frequent and severe heat waves (IPCC, 2014a). The planet’s oceans and glaciers have also experienced changes: oceans are warming and becoming more acidic, ice caps are melting, and sea levels are rising. Global sea level has risen approximately 6.7 inches, on average, in the last 100 years (NASA, 2018). This has already put some coastal homes, beaches, roads, bridges, and wildlife at risk (USGCRP, 2009). At the time of the development of this plan, NASA reports the following trends (NASA, 2017):

- Carbon Dioxide—Increasing trend, currently at 407.61 parts per million
- Global Temperature—Increasing trend, increase of 1.8ºF since 1880
- Arctic Ice Minimum—Decreasing trend, 13.2 percent per decade
- Land Ice—Decreasing trend, 286.0 gigatonnes per year
- Sea Level—Increasing trend, 3.2 millimeters (0.13 inches) per year.

15.1.4 Projected Future Impacts

Qualitative Impacts

The *Third National Climate Assessment Report for the United States* indicates that impacts resulting from climate change will continue through the 21st century and beyond. Although not all changes are understood at this time and the impacts of those changes will depend on global emissions of greenhouse gases and sensitivity in human and natural systems, the following impacts are expected in the United States (NASA, 2014):

- Temperatures will continue to rise.
- Growing seasons will lengthen.
- Precipitation patterns will change.
- Droughts and heat waves will increase.
- Hurricanes will become stronger and more intense.
- Sea level will rise 1 to 4 feet by 2100.
- The Arctic may become ice free.

The *California Climate Adaptation Planning Guide* outlines the following climate change impact concerns for North Coast communities (Cal EMA et al., 2012):

- Reduced snowpack
- Increased wildfires
- Sea level rise and inland flooding
- Threats to sensitive species
- Loss in agricultural productivity
- Public health and safety.

Some of these changes are direct or primary climatic changes, such as increased temperature, while others are indirect climatic changes or secondary impacts resulting from these direct changes, such as heat and air pollution. Some direct changes may interact with one another to create unique secondary impacts. These primary and secondary impacts may then result in impacts on human and natural systems. The primary and secondary impacts likely to affect the planning area are summarized in Table 15-1.

Modeled Climate Changes

Climate change projections contain inherent uncertainty, largely derived from the fact that they depend on future greenhouse gas emission scenarios. Generally, the uncertainty in greenhouse gas emissions is addressed by the presentation of differing scenarios: low-emissions or high-emissions scenarios. In low-emissions scenarios, greenhouse gas emissions are reduced substantially from current levels. In high-emissions scenarios, greenhouse gas emissions generally increase or continue at current levels. Uncertainty in outcomes is generally addressed by averaging a variety of model outcomes.

Table 15-1. Summary of Primary and Secondary Impacts

Primary Impact	Secondary Impact	Example Human and Natural System Impacts
Increased temperature	Heat wave	• Increased frequency of illness and death • Increased stress on mechanical systems, such as HVAC systems
Increased temperature and changes in precipitation	Changed seasonal patterns	• Reduced agricultural productivity • Reduced tourism
	Intense rainstorms	• Increased frequency of flood or flash flood events • Reduction in water quality
Increased temperature and/or reduced precipitation	Drought	• Reduced agricultural productivity • Decreased water supply
	Reduced Snowpack	• Decreased water supply • Reduced tourism
	Wildfire	• Increased incidence of landslide or mudslide • Reduced tourism • Increase in air pollution and related health impacts
Sea level rise	Permanent inundation of previously dry land	• Loss of assets and tax base • Loss of coastal habitat
	Larger area impacted by extreme high tide	• More people and structures impacted by storms • Increased incidence of loss of utilities and lifeline systems
	Increased coastal erosion	• Loss of assets and tax base
	Saltwater intrusion into freshwater systems	• Decreased water supply • Ecosystem disruption
Changes in wind patterns	Increased extreme events, including severe storms and fires	• More frequent disruption to systems resulting from severe storms
Ocean acidification		• Decreased biodiversity in marine ecosystems

Source: Adapted and expanded from California Adaptation Planning Guide: Planning for Adaptive Communities

Despite this uncertainty, climate change projections present valuable information to help guide decision-making for possible future conditions. The following sections summarize information developed for the planning area by Cal-Adapt, a resource for public information on how climate change might impact local communities, based on the most current data available. The projections are averaged across the county-wide planning area and include information from two emissions scenarios, which were developed by the IPCC. Historical (1950-1990) observed climate information for the planning area, as well as projected impacts for 2050 and 2099, are summarized in Table 15-2. By the end of the century under a high-emissions scenario, the following changes are projected:

- Average maximum temperatures and minimum temperatures would rise by almost 9°F.
- There would be more than 10 times as many extreme heat days per year on average.
- Average annual precipitation would increase by almost 4 percent to more than 103 inches.
- Snow water equivalent held in snowpack would decrease by 91 percent.
- Wildfire hectares burned annually would increase by 58 percent.

Sea Level Rise

Sea levels have been rising over the past several decades and are expected to continue to rise. Sea level rise is mostly attributed to two factors: the expansion of water as it warms (thermal expansion) and the melting of ice sheets and glaciers. As average ocean temperatures continue to increase, thermal expansion will continue and can be projected with some degree of certainty. Less certain is how quickly ice sheets will melt, accounting for most of the uncertainty in projections.

Table 15-2. Historical and Future Projections for Climate Information in Del Norte County

Climate Parameter	Historic Average (1950-1990)	Low Emissions Scenario[e] Projection 2006-2050	Low Emissions Scenario[e] Projection 2050-2099	Low Emissions Scenario[e] Difference from Historical Average 2006-2050	Low Emissions Scenario[e] Difference from Historical Average 2050-2099	High Emissions Scenario[f] Projection 2006-2050	High Emissions Scenario[f] Projection 2050-2099	High Emissions Scenario[f] Difference from Historical Average 2006-2050	High Emissions Scenario[f] Difference from Historical Average 2050-2099
Maximum Average Temperature (°F)	57.5	60.6	62.1	+3.1	+4.6	60.9	66.1	+3.4	+8.6
Minimum Average Temperature (°F)	37.9	41.0	42.3	+3.1	+4.4	41.4	46.8	+3.5	+8.9
Extreme Heat Days[a]	4.2	8	17	+3.8	+12.8	8	42	+3.8	+37.8
Precipitation (inches)[b]	99.8	101.1	102.2	+1.3	+2.4	101.1	103.4	+1.3	+3.6
Snow Water Equivalent in Snowpack (inches)[c]	4.5	1.7	0.8	-2.8	-3.7	1.6	0.4	-2.9	-4.1
Wildfire (hectares)[d]	1,309	2,491	3,554	+1,182	+2,245	3,065	3,568	+1,756	+2,259

a. Extreme heat day threshold for the planning area is 76.8°F
b. On average, total annual precipitation in the state is not projected to change substantially; however, modeled projections do not show a consistent trend. In general, most precipitation is expected to continue to fall during the winter. Small changes in precipitation patterns in the state will have the potential to cause significant disruption to built and natural systems.
c. Measured in April
d. Assumes central population projection trends.
e. Emissions peak around 2040 and then decline (this was designated Scenario B1 in older IPCC analyses and Scenario RCP 4.5 under more recent IPCC analyses)
f. Emissions rise strongly through 2050 and plateau around 2100 (this was designated Scenario A2 in older IPCC analyses and Scenario RCP 8.5 under more recent IPCC analyses).

Source: Cal-Adapt

Sea level rise will cause currently dry areas to be permanently or chronically inundated. Temporary inundation from extreme tide events and storm surge also will change. Unlike many other impacts resulting from climate change, sea level rise will have a defined extent and location. This allows for a more-detailed risk assessment to be conducted for this climate change impact (see Section 15.3). Although the extent and timing of sea level rise is still uncertain, assessing potential areas at risk provides information appropriate for planning purposes.

15.1.5 Responses to Climate Change

Communities and governments worldwide are working to address, evaluate and prepare for climate changes that are likely to impact communities in coming decades. Generally, climate change discussions encompass two separate but inter-related considerations: mitigation and adaptation. The term "mitigation" can be confusing, because its meaning changes across disciplines:

- Mitigation in restoration ecology and related fields generally refers to policies, programs or actions that are intended to reduce or to offset the negative impacts of human activities on natural systems. Generally, mitigation can be understood as avoiding, minimizing, rectifying, reducing or eliminating, or compensating for known impacts.
- Mitigation in climate change discussions is defined as "a human intervention to reduce the impact on the climate system." It includes strategies to reduce greenhouse gas sources and emissions and enhance greenhouse gas sinks.
- Mitigation in emergency management is typically defined as the effort to reduce loss of life and property by lessening the impact of disasters.

In this chapter, mitigation is used as defined by the climate change community. In the other chapters of this plan, mitigation is primarily used in an emergency management context.

The IPCC defines adaptation as “the process of adjustment to actual or expected climate and its effects.” Mitigation and adaptation are related, as the world’s ability to reduce greenhouse gas emissions will affect the degree of adaptation that will be necessary. Some actions can both reduce greenhouse gas emissions and support adaptation to likely future conditions. Some adaptation actions also help communities reach other community goals (often referred to as co-benefits). The ability to adapt to changing conditions is often referred to as adaptive capacity, which is “the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences” (IPCC, 2014a).

Societies across the world are facing the need to adapt to changing conditions and to identify ways to increase their adaptive capacity. Some efforts are already underway. Farmers are altering crops and agricultural methods to deal with changing rainfall and rising temperature; architects and engineers are redesigning buildings; planners are looking at managing water supplies to deal with droughts or flooding.

Adaptive capacity goes beyond human systems, as some ecosystems are able to adapt to change and to buffer surrounding areas from the impacts of change. Forests can bind soils and hold large volumes of water during times of plenty, releasing it through the year; floodplains can absorb vast volumes of water during peak flows; coastal ecosystems can hold out against storms, attenuating waves and reducing erosion. Other ecosystem services—such as food provision, timber, materials, medicines and recreation—can provide a buffer to societies in the face of changing conditions. Ecosystem-based adaptation is the use of biodiversity and ecosystem services as part of an overall strategy to help people adapt to the adverse effects of climate change. This includes the sustainable management, conservation and restoration of specific ecosystems that provide key services.

Assessment of the current efforts and adaptive capacity of the planning partners participating in this hazard mitigation plan are included in the jurisdiction-specific annexes in Volume 2.

15.2 VULNERABILITY ASSESSMENT— HAZARDS OF CONCERN

The following sections provide information on how each identified hazard of concern for this planning process may be impacted by climate change and how these impacts may alter current exposure and vulnerability to these hazards for the people, property, critical facilities and the environment in the planning area.

15.2.1 Dam Failure

Climate Change Impacts on the Hazard

On average, changes in California’s annual precipitation levels are not expected to be dramatic; however, small changes may have significant impacts for water resource systems, including dams. Dams are designed partly based on assumptions about a river’s flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. If the hygrograph changes, it is conceivable that the dam can lose some or all of its designed margin of safety, also known as freeboard.

If freeboard is reduced, dam operators may be forced to release increased volumes earlier in a storm cycle in order to maintain the required margins of safety. Such early releases of increased volumes can increase flood potential downstream. According to the California Department of Water Resources, flood flows on many California rivers have been record-setting since the 1950s. This means that water infrastructure, such as dams, have been forced to manage flows for which they were not designed. The California Division of Dam Safety has indicated that climate change may result in the need for increased safety precautions to address higher winter runoff, frequent fluctuations of water levels, and increased potential for sedimentation and debris accumulation from changing erosion patterns and increases in wildfires. According to the Division, climate change also will impact the ability of dam operators to estimate extreme flood events (DWR, 2008).

Dams are constructed with safety features known as "spillways." Spillways are put in place on dams as a safety measure in the event of the reservoir filling too quickly. Spillway overflow events, often referred to as "design failures," result in increased discharges downstream and increased flooding potential. Although climate change will not increase the probability of catastrophic dam failure, it may increase the probability of design failures.

Exposure, Sensitivity and Vulnerability

The following summarizes changes in exposure and vulnerability to the dam failure hazard resulting from climate change:

- **Population**—Population exposure and vulnerability to the dam failure hazard are unlikely to change as a result of climate change.
- **Property**—Property exposure and vulnerability to the dam failure hazard are unlikely to change as a result of climate change.
- **Critical facilities**—The exposure and vulnerability of critical facilities are unlikely to change as result of climate change. Dam owners and operators are sensitive to the risk and may need to alter maintenance and operations to account for changes in the hydrograph and increased sedimentation. Critical facility owners and operators in levee failure inundation areas should always be aware of residual risk from flood events that may overtop the levee system.
- **Environment**—The exposure and vulnerability of the environment to dam and levee failure are unlikely to change as a result of climate change. Ecosystem services may be used to mitigate some factors that could increase the risk of design failures, such as increasing the natural water storage capacity in watersheds above dams.
- **Economy**—Changes in the dam failure hazard related to climate change are unlikely to affect the local economy. Economic impacts may result from changes to the levee failure hazard if accreditation is lost.

15.2.2 Drought

Climate Change Impacts on the Hazard

The long-term effects of climate change on regional water resources are unknown, but global water resources are already experiencing the following stresses without climate change:

- Growing populations
- Increased competition for available water
- Poor water quality
- Environmental claims
- Uncertain reserved water rights
- Groundwater overdraft
- Aging urban water infrastructure.

With a warmer climate, droughts could become more frequent, more severe, and longer-lasting. According to the National Climate Assessment, "higher surface temperatures brought about by global warming increase the potential for drought. Evaporation and the higher rate at which plants lose moisture through their leaves both increase with temperature. Unless higher evapotranspiration rates are matched by increases in precipitation, environments will tend to dry, promoting drought conditions" (U.S. Climate Resilience Toolkit, 2018).

Because changes in precipitation patterns are still uncertain, the potential impacts and likelihood of drought are uncertain. DWR has noted impacts of climate change on statewide water resources by charting changes in snowpack, sea level, and river flow. As temperatures rise and more precipitation comes in the form of rain instead of snow, these changes will likely continue or grow even more significant. DWR estimates that the Sierra Nevada snowpack, which provides a large amount of the water supply for other parts of the state, will experience a 48- to 65-percent loss by the end of the century compared to historical averages (DWR, 2016b). Projections for the planning area show a significant decline in projected snow water equivalent in April snowpack. Increasing temperatures may also increase net evaporation from reservoirs by 15 to 37 percent (DWR, 2013).

Exposure, Sensitivity and Vulnerability

The following summarizes changes in exposure and vulnerability to the drought hazard resulting from climate change:

- **Population**—Population exposure and vulnerability to drought are unlikely to increase as a result of climate change. While greater numbers of people may need to engage in behavior change, such as water saving efforts, significant life or health impacts are unlikely.
- **Property**—Property exposure and vulnerability may increase as a result of increased drought resulting from climate change, although this would most likely occur in non-structural property such as crops and landscaping. It is unlikely that structure exposure and vulnerability would increase as a direct result of drought, although secondary impacts of drought, such as wildfire, may increase and threaten structures.
- **Critical facilities**—Critical facility exposure and vulnerability are unlikely to increase as a result of increased drought resulting from climate change; however, critical facility operators may be sensitive to changes and need to alter standard management practices and actively manage resources, particularly in water-related service sectors
- **Environment**—The vulnerability of the environment may increase as a result of increased drought resulting from climate change. Prolonged or more frequent drought resulting from climate change may stress ecosystems in the region, which include many special-status species.
- **Economy**—Increased incidence of drought could increase the potential for impacts on the local economy. Drought may reduce timber production and increase the number of acres of timber lost to wildfire.

15.2.3 Earthquake

Climate Change Impacts on the Hazard

The impacts of global climate change on earthquake probability are unknown. Some scientists say that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the earth’s crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity, according to research into prehistoric earthquakes and volcanic activity. NASA and USGS scientists found that retreating glaciers in southern Alaska may be opening the way for future earthquakes (NASA, 2004).

Secondary impacts of earthquakes could be magnified by climate change. Soils saturated by repetitive storms or heavy precipitation could experience liquefaction or an increased propensity for slides during seismic activity due to the increased saturation. Dams storing increased volumes of water due to changes in the hydrograph could fail during seismic events.

Exposure, Sensitivity and Vulnerability

Because impacts on the earthquake hazard are not well understood, increases in exposure and vulnerability of local resources are not able to be determined.

15.2.4 Flood

Climate Change Impacts on the Hazard

Use of historical hydrologic data has long been the standard of practice for designing and operating water supply and flood protection projects. For example, historical data are used for flood forecasting models and to forecast snowmelt runoff for water supply. This method of forecasting assumes that the climate of the future will be similar to that of the period of historical record. However, the hydrologic record cannot be used to predict changes in frequency and severity of extreme climate events such as floods. Scientists project greater storm intensity with climate change, resulting in more direct runoff and flooding. High frequency flood events in particular will likely increase with a changing climate. What is currently considered a 1-percent-annual-chance also may strike more often, leaving many communities at greater risk. Going forward, model calibration must happen more frequently, new forecast-based tools must be developed, and a standard of practice that explicitly considers climate change must be adopted.

Climate change is already impacting water resources, and resource managers have observed the following:

- Historical hydrologic patterns can no longer be solely relied upon to forecast the water future.
- Precipitation and runoff patterns are changing, increasing the uncertainty for water supply and quality, flood management and ecosystem functions.
- Extreme climatic events will become more frequent, necessitating improvement in flood protection, drought preparedness and emergency response.

The amount of snow is critical for water supply and environmental needs, but so is the timing of snowmelt runoff into rivers and streams. Rising snowlines caused by climate change will allow more mountain areas to contribute to peak storm runoff. Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As stream flows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildfires due to climate change, there is potential for more floods following fire, which increase sediment loads and water quality impacts.

Exposure, Sensitivity and Vulnerability

The following summarizes changes in exposure and vulnerability to the flood hazard resulting from climate change:

- **Population and Property**—Population and property exposure and vulnerability may increase as a result of climate change impacts on the flood hazard. Runoff patterns may change, resulting in flooding in areas where it has not previously occurred.
- **Critical facilities**—Critical facility exposure and vulnerability may increase as a result of climate change impacts on the flood hazard. Runoff patterns may change, resulting in risk to facilities that have not historically been at risk from flooding. Changes in the management and design of flood protection critical facilities may be needed as additional stress is placed on these systems. Planners will need to factor a new level of safety into the design, operation, and regulation of flood protection facilities such as dams, bypass channels and levees, as well as the design of local sewers and storm drains.
- **Environment**—The exposure and vulnerability of the environment may increase as a result of climate change impacts on the flood hazard. Changes in the timing and frequency of flood events may have broader ecosystem impacts that alter the ability of already stressed species to survive.
- **Economy**—If flooding becomes more frequent, there may be impacts on the local economy. More resources may need to be directed to response and recovery efforts, and businesses may need to close more frequently due to loss of service or access during flood events.

15.2.5 Landslide

Climate Change Impacts on the Hazard

Climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration. Increase in global temperature is likely to affect the snowpack and its ability to hold and store water. Warming temperatures also could increase the occurrence and duration of droughts, which would increase the probability of wildfire, reducing the vegetation that helps to support steep slopes. All of these factors would increase the probability for landslide occurrences.

Exposure, Sensitivity and Vulnerability

The following summarizes changes in exposure and vulnerability to the landslide hazard resulting from climate change:

- **Population and Property**—Population and property exposure and vulnerability would be unlikely to increase as a result of climate change impacts on the landslide hazard. Landslide events may occur more frequently, but the extent and location should be contained within mapped hazard areas or recently burned areas.
- **Critical facilities**—Critical facility exposure and vulnerability would be unlikely to increase as a result of climate change impacts on the landslide hazard; however, critical facility owners and operators may experience more frequent disruption to service provision as a result of landslide hazards. For example, transportation systems may experience more frequent delays if slides blocking these systems occur more frequently. In addition, increased sedimentation resulting from landslides may negatively impact flood control facilities, such as dams.
- **Environment**—Exposure and vulnerability of the environment would be unlikely to increase as a result of climate change, but more frequent slides in river systems may impact water quality and have negative impacts on stressed species.
- **Economy**—Changes to the landslide hazard resulting from climate change are unlikely to result in impacts on the local economy; but impacts may be felt if the limited major highways in the planning area are repeatedly impacted.

15.2.6 Severe Weather

Climate Change Impacts on the Hazard

Climate change presents a challenge for risk management associated with severe weather. The number of weather-related disasters during the 1990s was four times that of the 1950s and led to 14 times as much in economic losses. The science for linking the severity of specific severe weather events to climate change is still evolving; however, a number or trends provide some indication of how climate change may be impacting these events. According to the *U.S. National Climate Change Assessment* (2014), there were more than twice as many high temperature records as low temperature records broken between 2001 and 2012, and heavy rainfall events are becoming more frequent and more severe.

The increase in average surface temperatures can also lead to more intense heat waves. Evidence suggests that heat waves are already increasing, especially in western states. Extreme heat days in the planning area are likely to increase.

Climate change impacts on other severe weather events such as thunderstorms and high winds are still not well understood.

Exposure, Sensitivity and Vulnerability

The following summarizes changes in exposure and vulnerability to the severe weather hazard resulting from climate change:

- **Population and Property**—Population and property exposure and vulnerability would be unlikely to increase as a direct result of climate change impacts on the severe weather hazard. Severe weather events may occur more frequently, but exposure and vulnerability will remain the same. Secondary impacts, such as the extent of localized flooding, may increase, impacting greater numbers of people and structures.
- **Critical facilities**—Critical facility exposure and vulnerability would be unlikely to increase as a result of climate change impacts on the severe weather hazard; however, critical facility owners and operators may experience more frequent disruption to service provision. For example, more frequent and intense storms may cause more frequent disruptions in power service.
- **Environment**—Exposure and vulnerability of the environment would be unlikely to increase; however, more frequent storms and heat events and more intense rainfall may place additional stress on already stressed systems.
- **Economy**—Climate change impacts on the severe weather hazard may impact the local economy through more frequent disruption to services, such as power outages.

15.2.7 Tsunami

Climate Change Impacts on the Hazard

The impacts of global climate change on tsunami probability are unknown. Some scientists say that melting glaciers could induce tectonic activity, inducing earthquakes. Other scientists have indicated that underwater avalanches (also caused by melting glaciers), may also result in tsunamis. Even if climate change does not increase the frequency with which tsunamis occur, it may result in more destructive waves. As sea levels continue to rise, tsunami inundation areas would likely reach further into communities than current mapping indicates.

Exposure, Sensitivity and Vulnerability

As land area likely to be inundated by tsunami waves increases, exposure and vulnerability to the tsunami hazard may increase for population, property, critical facilities and the environment. Changes to the tsunami hazard from climate change may result in more direct economic impacts on a greater number of businesses and economic centers, as well as the infrastructure systems that support those businesses.

15.2.8 Wildland Fire

Climate Change Impacts on the Hazard

Climate change has the potential to affect multiple elements of the wildland fire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot dry spells create the highest fire risk. Increased temperatures may intensify wildland fire danger by warming and drying out vegetation.

Changes in climate patterns may impact the distribution and perseverance of insect outbreaks that create dead trees (increase fuel). When climate alters fuel loads and fuel moisture, forest susceptibility to wildland fires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

Exposure, Sensitivity and Vulnerability

The following summarizes changes in exposure and vulnerability to the wildland fire hazard resulting from climate change:

- **Population**—It is unlikely that the population exposed to the wildland fire risk would increase directly; however, more people may be impacted by wildland fire events on average as more acreage burns each year. In addition, increased burning would result in more smoke impacts, potentially increasing the risk from poor air quality in the planning area.
- **Property and Critical facilities**—The exposure and vulnerability of property and critical facilities would be the same.
- **Environment**— It is possible that the exposure and vulnerability of the environment will be impacted by changes in wildland fire risk due to climate change. Natural fire regimes may change, resulting in more or less frequent or higher intensity burns. These impacts may alter the composition of the ecosystems in areas in and surrounding planning area. If more acres are burned every year, wildlife may be more stressed as the suitable habitat is lost.
- **Economy**—If more acres of timber burn every year, the local economy may be impacted.

15.3 VULNERABILITY ASSESSMENT—SEA LEVEL RISE

The NOAA Coastal Services Center has developed a dataset to show potential sea level rise inundation ranging from 1 to 6 feet above current levels. The dataset provides a preliminary look at sea level rise and coastal flooding impacts. According to NOAA, the data illustrate the scale of potential flooding, not the exact location, and do not account for erosion, subsidence, or future construction. Water levels are shown as they would appear during the highest high tides, excluding wind driven tides (NOAA, 2015).

An exposure analysis was performed using the 1-foot and 4-foot sea level rise data to estimate the potential chronic flooding impacts in the planning area. This assessment assumes that these impacts occur in present-day Del Norte County, rather than gradually over years or decades. The dataset is not associated with any specific time horizons, but the 1-foot rise data can be understood to indicate near-term sea level rise, while the 4-foot analysis more closely aligns with projections for the mid- to end of the century.

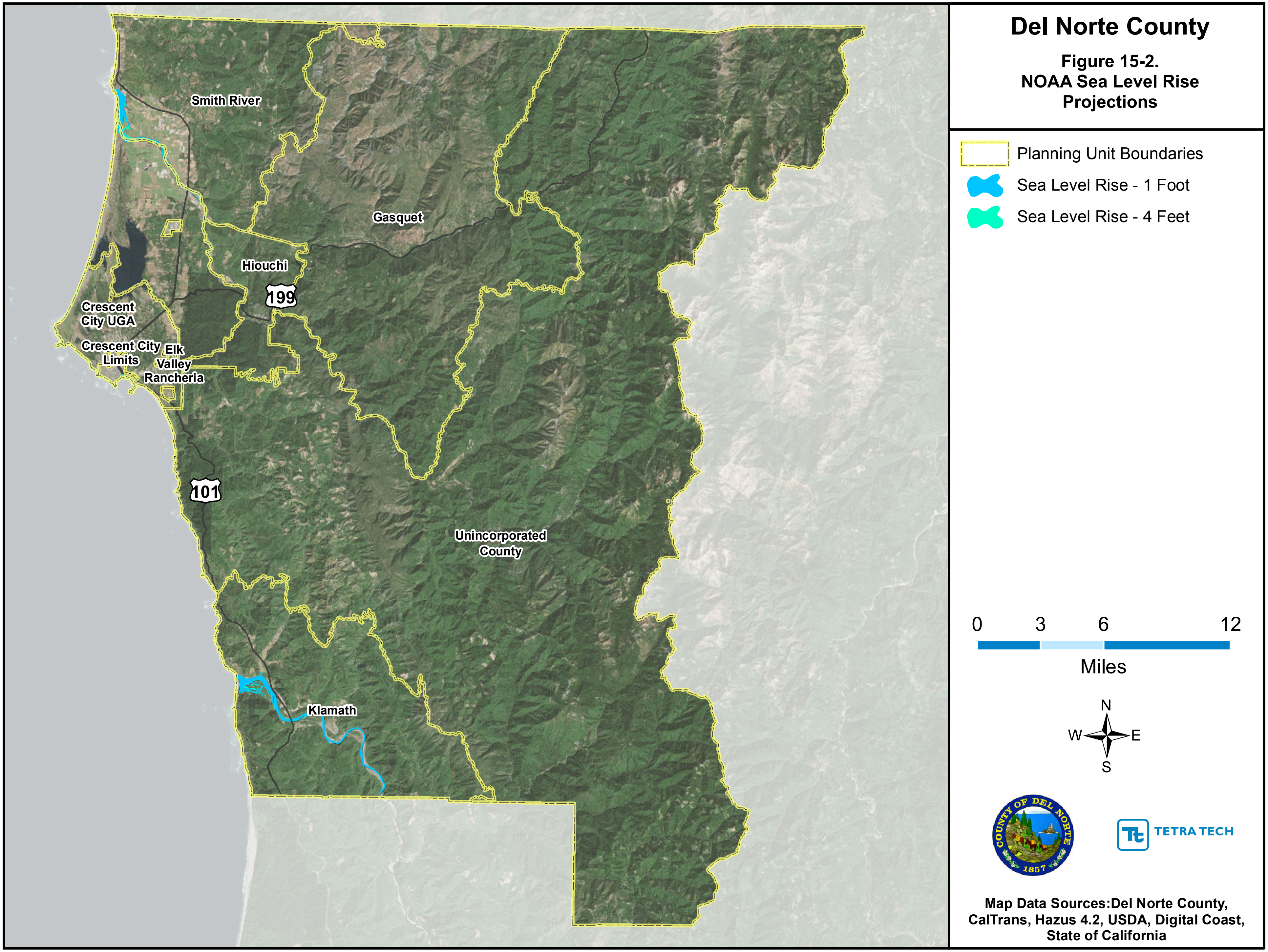
Figure 15-2 shows the inundation areas for the 1-foot and 4-foot sea level rise scenarios. Only the Klamath, Smith River and Unincorporated County planning units have exposure to these sea level rise scenarios.

15.3.1 Population

Population was estimated using the residential building count in the flood hazard areas and multiplying by the 2016 estimated average population per household. Using this approach, the estimated population residing in the 1-foot and 4-foot sea level rise exposure areas is less than 1 percent of the total population of the planning area: 9 and 18 people, respectively.

15.3.2 Property

There are three structures in the 1-foot sea level rise exposure area and six in the 4-foot sea level rise exposure area. This amounts to $917,000 in and $1.75 million of exposure, respectively, which is less than 0.1 percent of the total replacement value of the planning area. All structures in the 1-foot and 4-foot sea level rise flood zones are residential structures. They are distributed as shown in Figure 15-3.



Del Norte County
Figure 15-2.
NOAA Sea Level Rise Projections
Planning Unit Boundaries
Sea Level Rise - 1 Foot
Sea Level Rise - 4 Feet
0
3
6
12
Miles
N
S
E
W
Smith River
Gasquet
Hiouchi
199
Crescent City UGA
Crescent City Limits
Elk Valley Rancheria
101
Unincorporated County
Klamath
COUNTY OF DEL NORTE
1857
TETRA TECH
Map Data Sources:Del Norte County, CalTrans, Hazus 4.2, USDA, Digital Coast, State of California

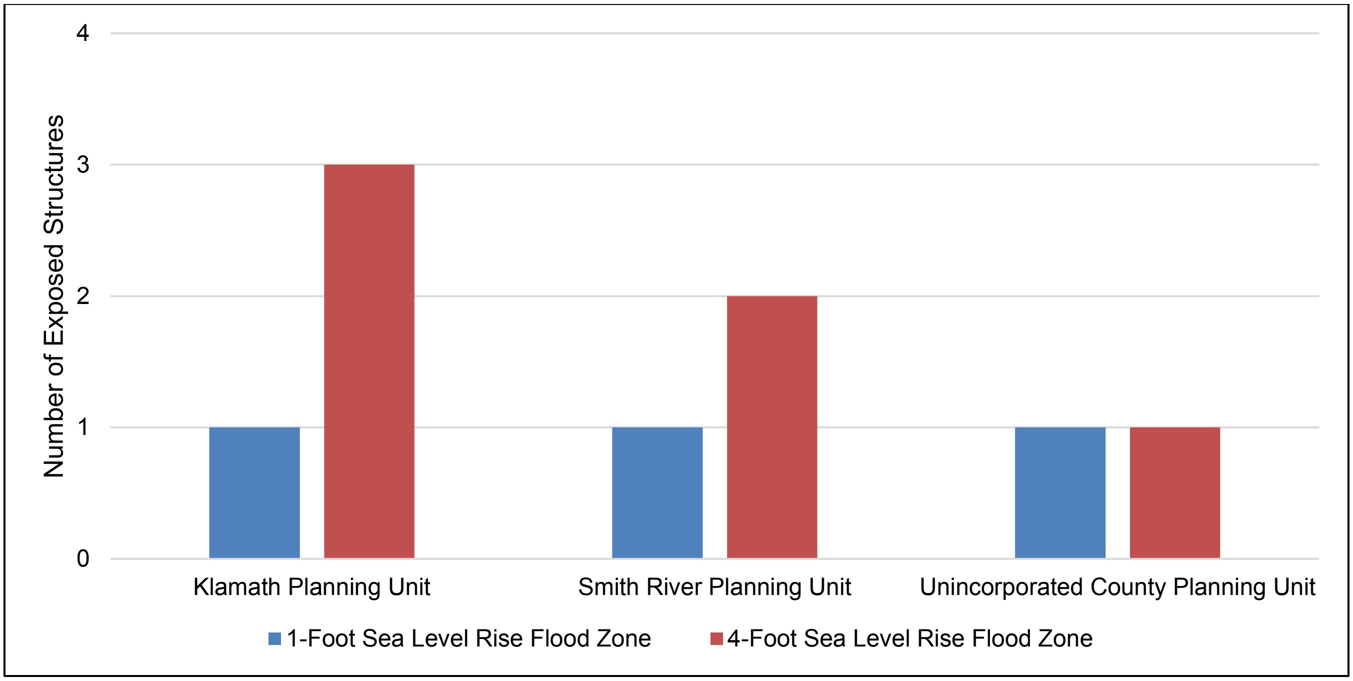


Figure 15-3. Distribution of Structures in the Sea Level Rise Flood Zones

15.3.3 Critical Facilities and Roads

There are four critical facilities located in the 1-foot sea level rise inundation area and one additional facility located in the 4-foot sea level rise inundation area, accounting for 2 percent of the total critical facilities in the planning area. The breakdown of exposure by sea level rise flood zone and facility type is shown in Figure 15-4. All of the bridges in the exposure area are owned by Caltrans. Both other critical function facilities are water-dependent uses.

In addition to these facilities, storm drainage systems may experience backups as a result of higher level of daily tidal flooding, especially if outfalls are located within sea level rise inundation areas.

15.3.4 Environment

All sea level rise inundation areas are exposed and vulnerable to impacts. Important coastal habitat may be lost as sea level rise permanently inundates areas, or it may be damaged due to extreme tide and storm surge events. Saltwater intrusion into freshwater resources may occur, further altering habitat and ecosystems. Protective ecosystem services may be lost as land area and wetlands are permanently inundated.

15.3.5 Economy

Sea level rise may impact the local economy; however, there are only limited critical facilities and no commercial facilities located in sea level rise inundation areas, so impacts are not likely to be extensive.

15.3.6 Future Development

There are estimated to be 55 undeveloped parcels that intersect the 1-foot sea level rise hazard area. Of these, 55 percent are designated for residential development (see Figure 15-5). The total land area of the parcels that fall within the mapped inundation areas is 144 acres (1 percent of total undeveloped acreage).

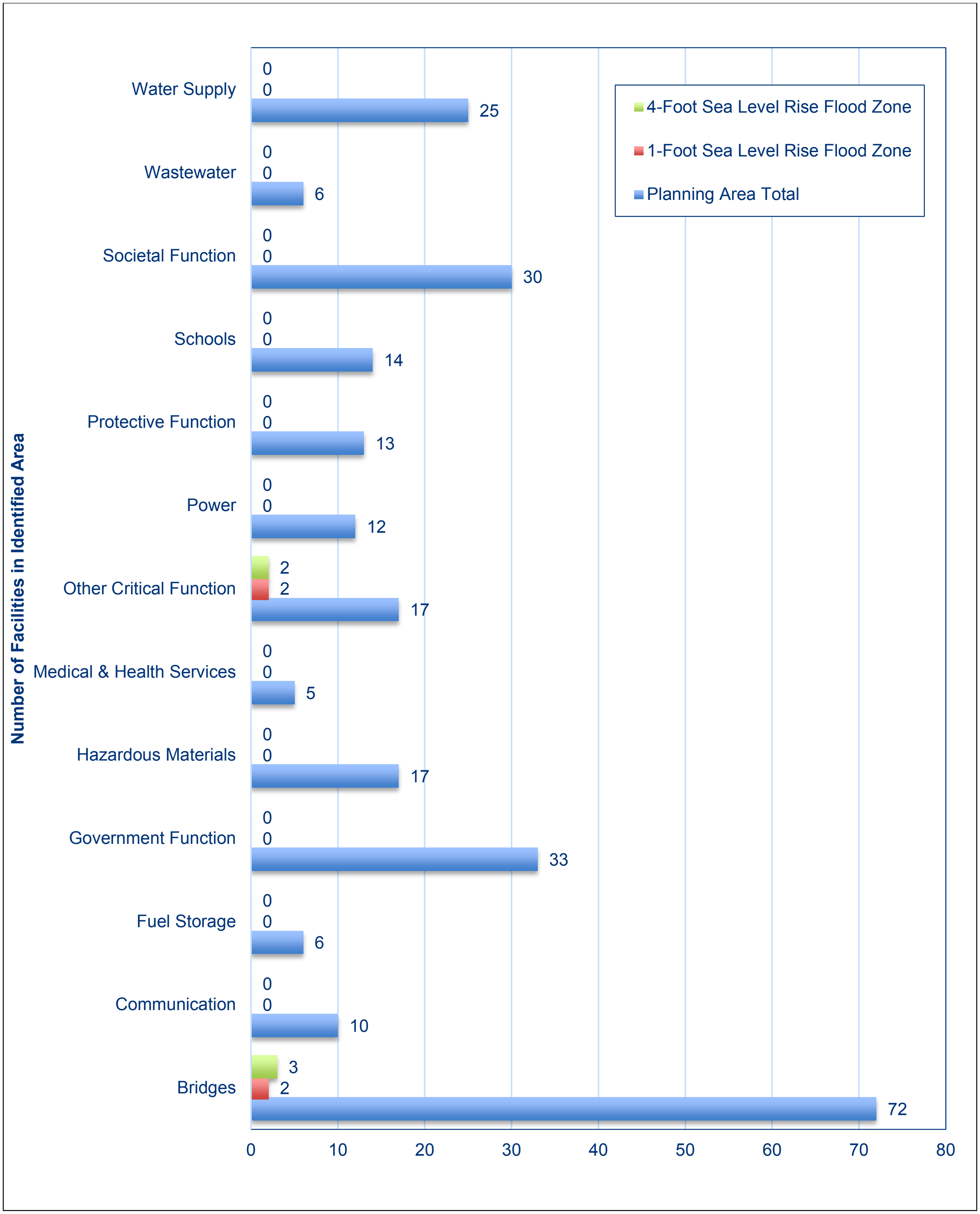


Figure 15-4. Critical Facilities and Infrastructure in Mapped Sea Level Rise Flood Zones and Countywide

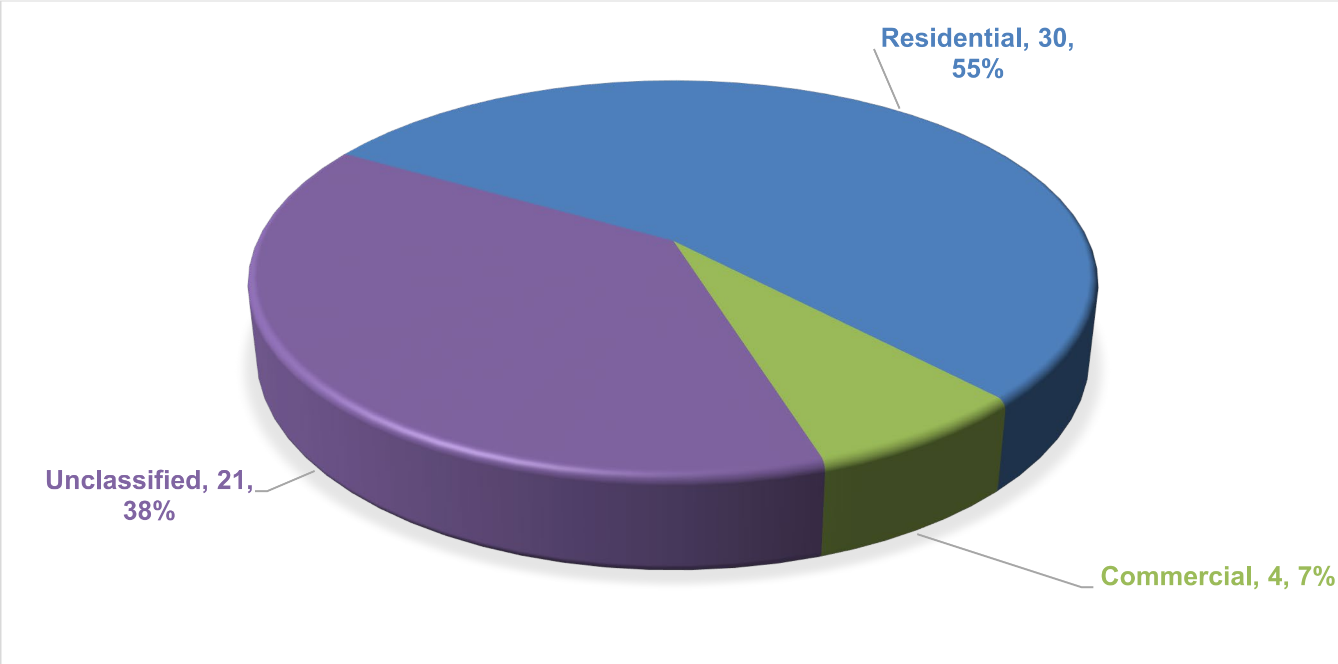


Figure 15-5. Undeveloped Parcels in the 1-Foot Sea Level Rise Flood Zone, by Land Use Type

There are estimated to be 63 undeveloped parcels that intersect the 4-foot sea level rise hazard area. Of these, 54 percent are designated for residential development (see Figure 15-6). The total land area of the parcels that fall within the mapped inundation areas is 180 acres (2 percent of total undeveloped acreage).

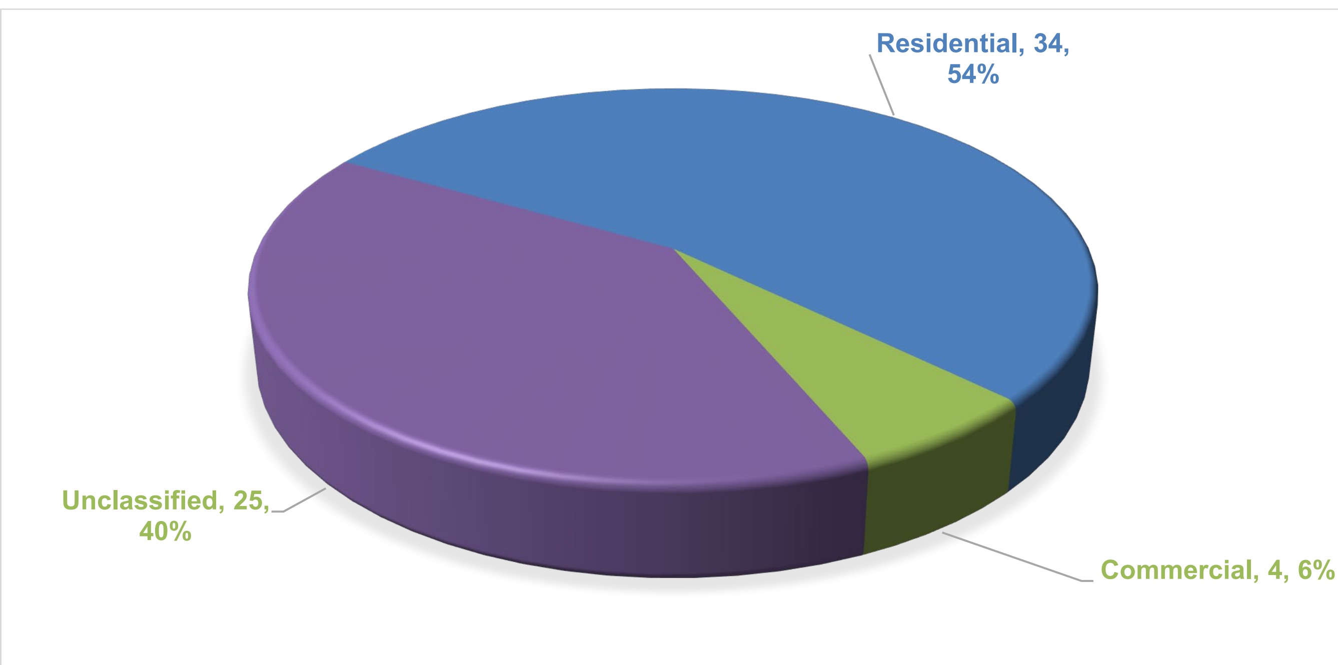


Figure 15-6. Undeveloped Parcels in the 4-Foot Sea Level Rise Flood Zone, by Land Use Type

15.4 ISSUES

The major issues for climate change are the following:

- Planning for climate change related impacts can be difficult due to inherent uncertainties in projection methodologies.
- Average temperatures are expected to continue to increase in the planning area, which may lead to a host of primary and secondary impacts, such as an increased incidence of heat waves.
- Expected changes in precipitation patterns are still poorly understood and could have significant impacts on the water supply and flooding in the planning area.
- Some impacts of climate change are poorly understood such as potential impacts on the frequency and severity of earthquakes, thunderstorms and tsunamis.
- Heavy rain events may result in inland stormwater flooding after stormwater management systems are overwhelmed.
- Permanent and temporary inundation resulting from sea level rise has the potential to impact portions of the population and assets in the planning area.

16. HAZARDS OF NOTE: HAZARDOUS MATERIALS

Although the DMA does not require an assessment of human-caused hazards, the Steering Committee decided to include a discussion of hazardous material spills in this hazard mitigation plan for the following reasons:

- There is significant concern in the planning area about the impact of a hazardous material spill. If such a spill were to occur on a major highway, it could disrupt transportation in the planning area and north-south transport along the west coast in general. A spill also could result in significant damage to rivers and other water resources.
- The multi-hazard mitigation planning effort is an opportunity to inform the public about the risk from hazardous material spills.
- The likelihood of a hazardous material spill event in the planning area is greater than that of several of the natural hazards assessed in this plan.

16.1 GENERAL BACKGROUND

A hazardous material is a substance or combination of substances that, because of quantity, concentration, or physical, chemical, or infectious characteristics, may cause or contribute to an increase in mortality or an increase in serious illness, or otherwise pose a hazard to human life, property, or the environment. Hazardous materials are present in nearly every city and county in the United States in facilities that produce, store, or use them:

- Water treatment plants use chlorine to eliminate bacterial contaminants.
- Hazardous materials are transported along interstate highways and railways daily.
- The natural gas used in homes and businesses 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 communities are listed in the CCR, Title 19.

16.1.1 Types of Incidents

The following are the most common type of hazardous material incidents:

- **Fixed-Facility Hazardous Materials Incident**—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.
- **Hazardous Materials Transportation Incident**—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 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.

- **Interstate Pipeline Hazardous Materials Incident**—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. There are no major natural gas pipelines that pass through the planning area.

16.1.2 Oversight

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, 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 Department of Toxic Substances Control 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. Any release or possible release of hazardous material must be reported to the Cal OES Warning Center.

The State Water Resources Control Board oversees hazardous materials that are stored in underground storage tanks. The board addresses how those hazardous materials are stored and handled, as well as clean-up of any contamination created by leaking underground storage tanks. The Office of the State Fire Marshal oversees petroleum products that are stored in aboveground storage tanks.

The California Environmental Protection Agency certifies 81 local Certified Unified Program Agencies statewide to oversee the following hazardous materials programs:

- Aboveground Petroleum Storage Act Program
- Area Plans for Hazardous Materials Emergencies
- California Accidental Release Prevention Program
- Hazardous Materials Release Response Plans and Inventories
- Hazardous Material Management Plan and Hazardous Material Inventory Statements
- Hazardous Waste Generator and Onsite Hazardous Waste Treatment Programs
- Underground Storage Tank Program

The Certified Unified Program Agency in Del Norte County is the County's Environmental Health Division. This agency helps businesses meet state requirements for reporting hazardous materials and waste above certain designated quantities that they use, store, or handle at their facility. The California Environmental Reporting System is the statewide web-based system that supports the electronic exchange of required information among businesses, local governments and the U.S. EPA.

Businesses must prepare chemical inventory and business emergency plans, review the plans regularly, and perform annual training. Businesses using any of a list of about 260 flammable or toxic regulated 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.

16.2 HAZARD PROFILE

16.2.1 Past Events

Table 16-1 lists the number of hazardous material incidents in Del Norte County reported to the Cal OES Warning Center from 2013 through 2017. Additional historical hazardous material spill report data is available on the Cal OES website. The records show 65 hazardous materials spills in Del Norte County over the 5-year timeframe. Most of these incidents involved petroleum (48 incidents), followed by sewage (8 incidents). The most common spill sites were roads (34 percent), followed by waterways (32 percent).

Table 16-1. Hazard Materials Spills in Del Norte County Reported to Cal OES

Spill Site	2013	2014	2015	2016	2017	Total
Airport	0	0	0	0	0	**0**
Industrial Plant	0	0	0	0	0	**0**
Merchant/Business	3	1	0	0	1	**5**
Military Base	0	1	0	0	0	**1**
Oil Field	0	0	0	0	0	**0**
Other	2	1	1	1	0	**5**
Pipeline	0	0	0	0	0	**0**
Rail Road	0	0	0	0	0	**0**
Refinery	0	0	0	0	0	**0**
Residence	1	2	0	2	2	**7**
Road	4	5	3	5	5	**22**
School	1	0	0	0	0	**1**
Service Station	0	0	0	0	0	**0**
Ship/Harbor/Port	0	0	1	1	0	**2**
Treatment/Sewage Facility	1	0	0	0	0	**1**
Utilities/Substation	0	0	0	0	0	**0**
Waterways	6	4	3	6	2	**21**
Total	**18**	**14**	**8**	**15**	**10**	**65**

Source: Cal OES, 2018

16.2.2 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 due to their manufacturing operations. Each business is required to file a detailed plan 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 humans and the environment. Agricultural pesticides are transported daily in and around the planning area.
- **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 and airports that all have the potential for hazardous material incidents. Of particular concern are Highways 101 and 199.

Hazardous material-containing facilities were included in the critical facility inventory developed in this plan. Location of these facilities can be seen on Figure 4-3.

16.2.3 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, and the improper disposal of hazardous waste. Table 16-1 lists 65 incidents that occurred in the planning area over a 5-year timeframe. There are 196 incidents listed as having occurred in the planning area since 2006. This means that an average of 18 incidents occur in the planning area every year. Of these, 73 percent occurred on roads, in waterways or in harbor facilities.

16.2.4 Severity

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 receive instruction on that procedure. There has been no recorded fatality in the planning area.

16.2.5 Warning Time

Hazardous material incidents occur without predictability under circumstances that give responders little time to prepare.

16.3 SECONDARY HAZARDS

Roadway closures due to a transportation-related hazardous material spill would have serious effects on the local economy and ability to provide services. Loss of major travel routes would result in loss of commerce, and could impact the ability to provide emergency services to citizens.

16.4 EXPOSURE

16.4.1 Population and Property

All people and property have potential exposure to hazardous material spills. Variables affecting exposure in the event of a hazardous materials incident include the type of product, its physical and chemical properties, the physical state of the product (solid, liquid, or gas), the ambient temperature, wind speed, wind direction, barometric pressure, and humidity. With so many variables, distances are difficult to forecast. In general, those close to transportation corridors or businesses with acutely hazardous materials are more at risk.

Hazardous materials pose a significant risk to emergency response personnel. All potential first responders and follow-on emergency personnel in the planning area are trained to the level of emergency response actions required of their position at a response scene. Hazardous materials also pose a serious long-term threat to public health and safety, property and the environment.

16.4.2 Critical Facilities and Infrastructure

Hazardous materials may be stored at critical facilities or transported along critical infrastructure. Facilities known to be producing or storing quantities of hazardous materials are included in the critical facility inventory developed for this plan. Seventeen such facilities were identified in the planning area.

16.4.3 Environment

The risk of hazardous material spills to the environment is considerable. Hazardous materials spilled along roads can pollute rivers, streams, wetlands, riparian areas and adjoining fields. Other hazardous materials released into the air can severely impact plant and animal species. Reducing risk exposure to the built environment will also mitigate potential losses to the natural environment.

16.5 VULNERABILITY

Weather conditions directly affect how the hazard develops. The micro-meteorological effects of buildings and terrain can alter travel and duration of materials. Shielding in the form of sheltering in place can protect people and property from harmful effects. Non-compliance with fire and building codes, as well as failure to maintain existing fire protection and containment features, can substantially increase damage from a hazardous materials release.

16.5.1 Population

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.

16.5.2 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.

16.5.3 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, 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.

16.5.4 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.

16.5.5 Future Trends in Development

The number and types of hazardous chemicals stored in and transported through Del Norte County will likely continue to increase. As population grows, the number of people vulnerable to the impacts of hazardous materials spills and transportation incidents will increase. Population and business growth along major transportation corridors increases the vulnerability to transportation-related hazardous material spills.

16.6 SCENARIO

An incident involving hazardous materials being transported via U.S. Highway 101 or CA 199 could have a significant impact on the planning area. Environmental damage to rivers resulting from such an event could impact property values and produce other long-lasting economic and environmental impacts.

16.7 ISSUES

The following are important issues related to hazard materials spills in the planning area:

- Maintain any and all citizen advisory groups and periodically e-mail emergency preparedness information including human-caused hazard preparedness instructions and reminders.
- Continue all facets of emergency preparedness training for police, fire, public works, and public information staff in order to respond quickly in the event of a human-caused disaster.
- Train first responders and all appropriate local government staff to implement protocols appropriate for a hazardous material release.
- Work proactively with hazardous materials facilities to follow best management practices:
    - Placards and labeling of containers
    - Emergency plans and coordination
    - Standardized response procedures
    - Notification of the types of materials being transported through the planning area at least annually
    - Random inspections of transporters as allowed by each company
    - Installation of mitigating techniques along critical locations
    - Routine hazard communication initiatives
    - Consideration of using alternative products that are safer.
- Work with the private sector to enhance and create business continuity plans in the event of an emergency.
- Coordinate with planning area school districts to ensure that their emergency preparedness plans include preparation for hazardous material spills.

17. RISK RANKING

FEMA requires all hazard mitigation planning partners to have jurisdiction-specific mitigation actions based on local risk, vulnerability and community priorities (FEMA, 2011). This plan included a risk ranking protocol for each planning partner, in which “risk” was calculated by multiplying probability by impact on people, property and the economy. The risk estimates were generated using methodologies promoted by FEMA. The Steering Committee reviewed, discussed and approved the methodology and results. All planning partners ranked risk for their own jurisdictions following the same methodology.

Numerical ratings of probability and impact were based on the hazard profiles and exposure and vulnerability evaluations presented in Chapters 7 through 15. Using that data, each planning partner ranked the risk of all the natural hazards of concern described in this plan. When available, estimates of risk were generated with data from Hazus or GIS. For hazards of concern with less specific data available, qualitative assessments were used. As appropriate, results were adjusted based on local knowledge and other information not captured in the quantitative assessments. The hazards of interest described in Chapter 15 were not ranked for the following reasons:

- A key component of risk as defined for the planning effort is probability of occurrence. While it is possible to assign a recurrence interval for natural hazards because of historical occurrence, it is not feasible to assign recurrence intervals for the other hazards of interest, which lack such historical precedent.
- Federal hazard mitigation planning regulations do not require the assessment of non-natural hazards (44 CFR, 201.6 and 201.7). It is FEMA’s position that this is a local decision.

Risk ranking results are used to help establish mitigation priorities. Each partner used its risk ranking to inform the development of its action plan. Planning partners were directed to identify mitigation actions, at a minimum, to address each hazard with a “high” or “medium” risk ranking. Actions that address hazards with a low or no hazard ranking are optional.

Volume 2 presents the risk rankings for each planning partner. The following planning-area-wide risk ranking was prepared by the planning team.

17.1 PROBABILITY OF OCCURRENCE

The probability of occurrence of a hazard is indicated by a probability factor based on likelihood of annual occurrence:

- High—Hazard event is likely to occur within 25 years (Probability Factor = 3)
- Medium—Hazard event is likely to occur within 100 years (Probability Factor =2)
- Low—Hazard event is not likely to occur within 100 years (Probability Factor =1)
- No exposure—There is no probability of occurrence (Probability Factor = 0)

The assessment of hazard frequency is based on past hazard events in the area and the potential for changes in the frequency of these events resulting from climate change. Table 17-1 summarizes the probability assessment for each natural hazard of concern for this plan.

Table 17-1. Probability of Hazards

Hazard Event	Probability (high, medium, low)	Probability Factor
Dam Failure	Low	1
Drought	High	3
Earthquake[a]	High	3
Flooding[b]	High	3
Landslide	High	3
Sea Level Rise[c]	Medium	2
Severe Weather	High	3
Tsunami	High	3
Wildland Fire	High	3

a. Earthquake risk ranking is based on the Big Lagoon Bald Mountain M7.9 scenario.
b. Flood risk ranking is based on 1 percent-annual-chance flood zone (otherwise known as the special flood hazard area).
c. Sea level rise risk ranking is based on 4 feet of sea level rise.

17.2 IMPACT

Hazard impacts were assessed in three categories: impacts on people, impacts on property and impacts on the local economy. Numerical impact factors were assigned as follows:

- **People**—Values were assigned based on the percentage of the total ***population exposed*** to the hazard event. The degree of impact on individuals will vary and is not measurable, so the calculation assumes for simplicity and consistency that all people exposed to a hazard because they live in a hazard zone will be equally impacted when a hazard event occurs. It should be noted that planners can use an element of subjectivity when assigning values for impacts on people. Impact factors were assigned as follows:
  - High—25 percent or more of the population is exposed to a hazard (Impact Factor = 3)
  - Medium—10 percent to 25 percent of the population is exposed to a hazard (Impact Factor = 2)
  - Low—10 percent or less of the population is exposed to the hazard (Impact Factor = 1)
  - No impact—None of the population is exposed to a hazard (Impact Factor = 0)
- **Property**—Values were assigned based on the percentage of the total ***property value exposed*** to the hazard event:
  - High—25 percent or more of the total assessed property value is exposed to a hazard (Impact Factor = 3)
  - Medium—10 percent to 25 percent of the total assessed property value is exposed to a hazard (Impact Factor = 2)
  - Low—10 percent or less of the total assessed property value is exposed to the hazard (Impact Factor = 1)
  - No impact—None of the total assessed property value is exposed to a hazard (Impact Factor = 0)
- **Economy**—Values were assigned based on the percentage of the total ***property value vulnerable*** to the hazard event. Values represent estimates of the loss from a major event of each hazard in comparison to the total replacement value of the property exposed to the hazard. Loss estimates separate from the exposure estimates were generated for the earthquake, flooding, and tsunami hazards using Hazus. For other hazards, such as dam failure, landslide and wildland fire, vulnerability was estimated as a percentage of exposure, due to the lack of loss estimation tools specific to those hazards.

- High—Estimated loss from the hazard is 10 percent or more of the total exposed property value (Impact Factor = 3)
- Medium—Estimated loss from the hazard is 5 percent to 10 percent of the total exposed property value (Impact Factor = 2)
- Low—Estimated loss from the hazard is 5 percent or less of the total exposed property value (Impact Factor = 1)
- No impact—No loss is estimated from the hazard (Impact Factor = 0)

The impacts of each hazard category were assigned a weighting factor to reflect the significance of the impact. These weighting factors are consistent with those typically used for measuring the benefits of hazard mitigation actions: impact on people was given a weighting factor of 3; impact on property was given a weighting factor of 2; and impact on the economy was given a weighting factor of 1. Table 17-2, Table 17-3 and Table 17-4 summarize the impacts for each hazard.

Table 17-2. Impact on People from Hazards

Hazard Event	Impact (high, medium, low)	Impact Factor	Multiplied by Weighting Factor (3)
Dam Failure	Low	1	3
Drought[a]	None	0	0
Earthquake	High	3	9
Flooding	Low	1	3
Landslide[b]	Low	1	3
Sea Level Rise	Low	1	3
Severe Weather	Medium	2	6
Tsunami	Low	1	3
Wildland Fire[c]	Low	1	3

a. Drought generally does not directly cause death or injury to people.
b. Landslide risk ranking impacts are based on very high and high landslide susceptibility zones.
c. Wildfire risk ranking impacts are based on very high and high fire severity zones.

Table 17-3. Impact on Property from Hazards

Hazard Event	Impact (high, medium, low)	Impact Factor	Multiplied by Weighting Factor (2)
Dam Failure	Low	1	2
Drought[a]	Low	1	2
Earthquake	High	3	6
Flooding	Low	1	2
Landslide	Low	1	2
Sea Level Rise	Low	1	2
Severe Weather	Low	1	2
Tsunami	High	3	6
Wildland Fire	Medium	2	4

a. Although all property is exposed to drought, direct impacts on property are limited.

Table 17-4. Impact on Economy from Hazards

Hazard Event	Impact (high, medium, low)	Impact Factor	Multiplied by Weighting Factor (1)
Dam Failure	Low	1	1
Drought[a]	Medium	2	2
Earthquake	High	3	3
Flooding	Low	1	1
Landslide[b]	Low	1	1
Sea Level Rise[c]	Low	1	1
Severe Weather	Low	1	1
Tsunami	Medium	2	2
Wildland Fire[b]	Low	1	1

a. Drought may have economic impacts on water using industries
b. Impacts on economy were assumed to be half of exposure for landslide and wildland fire
c. Impacts on economy were assumed to be equal to exposure for sea level rise.

17.3 RISK RATING AND RANKING

The risk rating for each hazard was determined by multiplying the probability factor by the sum of the weighted impact factors, as summarized in Table 17-5. Based on these ratings, a priority of high, medium or low was assigned to each hazard. The hazards of highest concern are earthquake and tsunami. Hazards ranked as being of medium concern are severe weather, wildland fire, flooding, and landslide. The hazards ranked as being of lowest concern are drought, sea level rise, and dam failure. Table 17-6 shows the hazard risk ranking for the planning area. Hazard risk ranking for each participating planning partner can be found in Volume 2 of this plan.

Table 17-5. Hazard Risk Rating

Hazard Event	Probability Factor	Sum of Weighted Impact Factors	Total (Probability x Impact)
Dam Failure	1	(3 + 2 + 1) = 6	(1 x 6) = 6
Drought	3	(0 + 2 + 2) = 4	(3 x 4) = 12
Earthquake	3	(9 + 6 + 3) = 18	(3 x 18) = 36
Flooding	3	(3 + 2 + 1) = 6	(3 x 6) = 18
Landslide	3	(3 + 2 + 1) = 6	(3 x 6) = 18
Sea Level Rise	2	(3 + 2 + 1) = 6	(2 x 6) = 12
Severe Weather	3	(6 + 2 + 1) = 9	(3 x 9) = 27
Tsunami	3	(3 + 6 + 2) = 11	(3 x 11) = 33
Wildland Fire	3	(3 + 4 + 1) = 8	(3 x 8) = 24

Table 17-6. Hazard Risk Ranking

Hazard Ranking	Hazard Event	Category[a]
1	Earthquake	High
2	Tsunami	High
3	Severe weather	Medium
4	Wildland Fire	Medium
5	Flooding	Medium
5	Landslide	Medium
6	Drought	Low
6	Sea Level Rise	Low
7	Dam Failure	Low

a. Scores of 30 or greater are rated as “high,” scores of 15 to 29 are “medium,” and scores of less than 15 are “low”

Del Norte County Operational Area Hazard Mitigation Plan

PART 3—MITIGATION STRATEGY

18. GUIDING PRINCIPLE, GOALS AND OBJECTIVES

Hazard mitigation plans must identify goals for reducing long-term vulnerabilities to identified hazards (44 CFR Section 201.6(c)(3)(i) and Section 201.7(c)(3)(i)). The Steering Committee reviewed the guiding principle, goals and objectives from the 2010 Hazard Mitigation Plan. It was determined that the 2010 plan's guiding principle, goals, and objectives still reflect community priorities and the results of the risk assessment. Therefore, only minor changes were made, to clarify intent and meaning. The guiding principle, goals, objectives and actions in this plan all support each other. Goals were selected to support the guiding principle. Objectives were selected that met multiple goals. Actions (presented in Chapter 19) were prioritized based on their ability to meet multiple objectives.

18.1 GUIDING PRINCIPLE

A guiding principle focuses the range of objectives and actions to be considered. This is not a goal because it does not describe a hazard mitigation outcome, and it is broader than a hazard-specific objective. The guiding principle for this hazard mitigation plan is as follows:

> *Reduce the vulnerability to natural hazards in order to protect the health, safety, welfare and economy of Del Norte County.*

18.2 GOALS

The following are the mitigation goals for this plan:

6. Save or protect lives from the impact of hazards.
7. Protect the environment.
8. Protect property from the impact of hazards.
9. Maintain economic viability after a disaster event.
10. Promote efficient use of public funds.

The effectiveness of a mitigation strategy is assessed by determining how well these goals are achieved.

18.3 OBJECTIVES

The selected objectives meet multiple goals, as listed in Table 18-1. Therefore, the objectives serve as a stand-alone measurement of the effectiveness of a mitigation action, rather than as a subset of a goal. The objectives also are used to help establish priorities.

Table 18-1. Objectives for the Hazard Mitigation Plan

Objective Number	Objective Statement	Goals for Which It Can Be Applied
O-1	Consider the impacts of hazards in all planning mechanisms that address current and future land uses within Del Norte County.	1, 2, 3
O-2	Sustain reliable local emergency operations and facilities before during and after a disaster.	1, 3
O-3	Pursue implementation of all feasible measures that reduce the risk exposure and promote the adaptive capacity of public and private property within Del Norte County.	1, 2, 3, 4, 5
O-4	Seek mitigation projects that provide the highest degree of hazard protection in a cost-effective manner.	3, 5
O-5	Inform the public on the hazard risk exposure and ways to increase the public's capability and adaptive capacity to prepare for, respond to, recover from, and mitigate the impacts of natural-hazard events.	1, 3, 4
O-6	Increase resilience and the continuity of operations of identified critical facilities within Del Norte County.	1, 4
O-7	Consider codes that require new construction to consider the impacts of hazards.	1, 3
O-8	Utilize the best available data, science and technologies to improve understanding of the location and potential impacts of hazards, the vulnerability of building types, community development patterns, and the measures needed to protect life safety.	1, 2, 3
O-9	Enhance emergency management capability within the planning area.	1, 5
O-10	Address identified/known repetitive losses within the planning area.	1, 2, 3, 4, 5

19. MITIGATION BEST PRACTICES AND ADAPTIVE CAPACITY

19.1 MITIGATION BEST PRACTICES

Catalogs of hazard mitigation best practices were developed that present a broad range of alternatives to be considered for use in Del Norte County, in compliance with 44 CFR (Section 201.6(c)(3)(ii) and Section 201.7(c)(3)(ii)). One catalog was developed for each hazard of concern evaluated in this plan. The catalogs present alternatives that are categorized in two ways:

- By who would have responsibility for implementation:
  - Individuals (personal scale)
  - Businesses (corporate scale)
  - Government (government scale).
- By what the alternative would do:
  - Manipulate the hazard
  - Reduce exposure to the hazard
  - Reduce vulnerability to the hazard
  - Build local capacity to respond to or be prepared for the hazard.

The alternatives presented include actions that will mitigate current risk from hazards and actions that will help reduce risk from changes in the impacts of these hazards resulting from climate change. Hazard mitigation actions recommended in this plan were selected from an analysis of the alternatives presented in the catalogs. The catalogs provide a baseline of mitigation alternatives that are backed by a planning process, are consistent with the established goals and objectives, and are generally within the capabilities of the planning partners to implement. Some of these actions may not be feasible based on the selection criteria identified for this plan. The purpose of the catalogs was to provide a list of what could be considered to reduce risk from natural hazards within the planning area. Actions selected out of the catalogs were based on an analysis of the planning partner's ability to implement the action and general feasibility. Actions in the catalog that are not included for the partnership's action plan were not selected for one or more of the following reasons:

- The action is not feasible.
- The action is already being implemented.
- The planning partner does not have the capability to implement the action.
- There is an apparently more cost-effective alternative.
- The action does not have public or political support.

The catalogs for each hazard are presented in Table 19-1 through Table-19-8.

Table 19-1. Alternatives to Mitigate the Dam Failure Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ None • **Reduce exposure to the hazard:** ❖ Relocate out of dam failure inundation areas • **Reduce vulnerability to the hazard:** ❖ Elevate home to appropriate levels • **Build local capacity to respond to or be prepared for the hazard:** ❖ Learn about risk reduction for the dam failure hazard ❖ Learn the evacuation routes for a dam failure event ❖ Educate yourself on early warning systems and the dissemination of warnings	• **Manipulate the hazard:** ❖ Remove dams ❖ Harden dams • **Reduce exposure to the hazard:** ❖ Replace earthen dams with hardened structures • **Reduce vulnerability to the hazard:** ❖ Flood-proof facilities within dam failure inundation areas • **Build local capacity to respond to or be prepared for the hazard:** ❖ Educate employees on the probable impacts of a dam failure ❖ Develop a continuity of operations plan	• **Manipulate the hazard:** ❖ Remove dams ❖ Harden dams • **Reduce exposure to the hazard:** ❖ Replace earthen dams with hardened structures ❖ Relocate critical facilities out of dam failure inundation areas ❖ Consider open space land use in designated dam failure inundation areas • **Reduce vulnerability to the hazard:** ❖ Adopt higher floodplain standards in mapped dam failure inundation areas ❖ Retrofit critical facilities within dam failure inundation areas • **Build local capacity to respond to or be prepared for the hazard:** ❖ Map dam failure inundation areas ❖ Enhance emergency operations plan to include a dam failure component ❖ Institute monthly communications checks with dam operators ❖ Inform the public on risk reduction techniques ❖ Adopt real-estate disclosure requirements for the re-sale of property located within dam failure inundation areas ❖ Consider the probable impacts of climate change in assessing the risk associated with the dam failure hazard ❖ Establish early warning capability downstream of listed high hazard dams ❖ Consider the residual risk associated with protection provided by dams in future land use decisions

Table-19-2. Alternatives to Mitigate the Drought Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ None • **Reduce exposure to the hazard:** ❖ None • **Reduce vulnerability to the hazard:** ❖ Drought-resistant landscapes ❖ Reduce water system losses ❖ Modify plumbing systems (through water saving kits) • **Build local capacity to respond to or be prepared for the hazard:** ❖ Practice active water conservation	• **Manipulate the hazard:** ❖ None • **Reduce exposure to the hazard:** ❖ None • **Reduce vulnerability to the hazard:** ❖ Drought-resistant landscapes ❖ Reduce private water system losses ❖ Support alternative irrigation techniques to reduce water use and encourage use of climate-sensitive water supplies • **Build local capacity to respond to or be prepared for the hazard:** ❖ Practice active water conservation	• **Manipulate the hazard:** ❖ Groundwater recharge through stormwater management ❖ Develop a water recycling program ❖ Increase “above-the-dam” regional natural water storage systems • **Reduce exposure to the hazard:** ❖ Identify and create groundwater backup sources • **Reduce vulnerability to the hazard:** ❖ Water use conflict regulations ❖ Reduce water system losses ❖ Distribute water saving kits • **Build local capacity to respond to or be prepared for the hazard:** ❖ Public education on drought resistance ❖ Identify alternative water supplies for times of drought; mutual aid agreements with alternative suppliers ❖ Develop drought contingency plan ❖ Develop criteria “triggers” for drought-related actions ❖ Improve accuracy of water supply forecasts ❖ Modify rate structure to influence active water conservation techniques

Table-19-3. Alternatives to Mitigate the Earthquake Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ None • **Reduce exposure to the hazard:** ❖ Locate outside of hazard area (off soft soils) • **Reduce vulnerability to the hazard:** ❖ Retrofit structure (anchor house structure to foundation) ❖ Secure household items that can cause injury or damage (such as water heaters, bookcases, and other appliances) ❖ Build to higher design • **Build local capacity to respond to or be prepared for the hazard:** ❖ Practice “drop, cover, and hold” ❖ Develop household mitigation plan, such as creating a retrofit savings account, communication capability with outside, 72-hour self-sufficiency during an event ❖ Keep cash reserves for reconstruction ❖ Become informed on the hazard and risk reduction alternatives available. ❖ Develop a post-disaster action plan for your household	• **Manipulate the hazard:** ❖ None • **Reduce exposure to the hazard:** ❖ Locate or relocate mission-critical functions outside hazard area where possible • **Reduce vulnerability to the hazard:** ❖ Build redundancy for critical functions and facilities ❖ Retrofit critical buildings and areas housing mission-critical functions • **Build local capacity to respond to or be prepared for the hazard:** ❖ Adopt higher standard for new construction; consider “performance-based design” when building new structures ❖ Keep cash reserves for reconstruction ❖ Inform your employees on the possible impacts of earthquake and how to deal with them at your work facility. ❖ Develop a continuity of operations plan	• **Manipulate the hazard:** ❖ None • **Reduce exposure to the hazard:** ❖ Locate critical facilities or functions outside hazard area where possible • **Reduce vulnerability to the hazard:** ❖ Harden infrastructure ❖ Provide redundancy for critical functions ❖ Adopt higher regulatory standards • **Build local capacity to respond to or be prepared for the hazard:** ❖ Provide better hazard maps ❖ Provide technical information and guidance ❖ Enact tools to help manage development in hazard areas (e.g., tax incentives, information) ❖ Include retrofitting and replacement of critical system elements in capital improvement plan ❖ Develop strategy to take advantage of post-disaster opportunities ❖ Warehouse critical infrastructure components such as pipe, power line, and road repair materials ❖ Develop and adopt a continuity of operations plan ❖ Initiate triggers guiding improvements (such as <50% substantial damage or improvements) ❖ Further enhance seismic risk assessment to target high hazard buildings for mitigation opportunities. ❖ Develop a post-disaster action plan that includes grant funding and debris removal components. ❖ Consider the probable impacts of climate change on the risk associated with the drought hazard

Table-19-4. Alternatives to Mitigate the Flooding Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ Clear storm drains and culverts ❖ Use low-impact development techniques • **Reduce exposure to the hazard:** ❖ Locate outside of hazard area ❖ Elevate utilities above base flood elevation ❖ Use low-impact development techniques • **Reduce vulnerability to the hazard:** ❖ Raise structures above base flood elevation ❖ Elevate items within house above base flood elevation ❖ Build new homes above base flood elevation ❖ Flood-proof structures • **Build local capacity to respond to or be prepared for the hazard:** ❖ Buy flood insurance ❖ Develop household plan, such as retrofit savings, communication with outside, 72-hour self-sufficiency during and after an event	• **Manipulate the hazard:** ❖ Clear storm drains and culverts ❖ Use low-impact development techniques • **Reduce exposure to the hazard:** ❖ Locate critical facilities or functions outside hazard area ❖ Use low-impact development techniques • **Reduce vulnerability to the hazard:** ❖ Build redundancy for critical functions or retrofit critical buildings ❖ Provide flood-proofing when new critical infrastructure must be located in floodplains • **Build local capacity to respond to or be prepared for the hazard:** ❖ Keep cash reserves for reconstruction ❖ Support and implement hazard disclosure for sale of property in risk zones. ❖ Solicit cost-sharing through partnerships with others on projects with multiple benefits.	• **Manipulate the hazard:** ❖ Maintain drainage system ❖ Institute low-impact development techniques on property ❖ Dredging, levee construction, and providing regional retention areas ❖ Structural flood control, levees, channelization, or revetments. ❖ Stormwater management regulations and master planning ❖ Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff • **Reduce exposure to the hazard:** ❖ Locate or relocate critical facilities outside of hazard area ❖ Acquire or relocate identified repetitive loss properties ❖ Promote open space uses in identified high hazard areas via techniques such as: planned unit developments, easements, setbacks, greenways, sensitive area tracks. ❖ Adopt land development criteria such as planned unit developments, density transfers, clustering ❖ Institute low impact development techniques on property ❖ Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff ❖ Preserve undeveloped and vulnerable shoreline ❖ Restore existing flood control and riparian corridors • **Reduce vulnerability to the hazard:** ❖ Harden infrastructure, bridge replacement program ❖ Provide redundancy for critical functions and infrastructure ❖ Adopt regulatory standards such as freeboard standards, cumulative substantial improvement or damage, lower substantial damage threshold; compensatory storage, non-conversion deed restrictions. ❖ Stormwater management regulations and master planning. ❖ Adopt "no-adverse impact" floodplain management policies that strive to not increase the flood risk on downstream communities ❖ Facilitate managed retreat from, or upgrade of, the most at-risk areas ❖ Require accounting of sea level rise in all applications for new development in shoreline areas ❖ Implement Assembly Bill 162 (2007) requiring flood hazard information in local general plans • **Build local capacity to respond to or be prepared for the hazard:** ❖ Produce better hazard maps ❖ Provide technical information and guidance ❖ Enact tools to help manage development in hazard areas (stronger controls, tax incentives, and information) ❖ Incorporate retrofitting or replacement of critical system elements in capital improvement plan ❖ Develop strategy to take advantage of post-disaster opportunities ❖ Warehouse critical infrastructure components ❖ Develop and adopt a continuity of operations plan ❖ Consider participation in the Community Rating System ❖ Maintain and collect data to define risks and vulnerability ❖ Train emergency responders ❖ Create an elevation inventory of structures in the floodplain ❖ Develop and implement a public information strategy ❖ Charge a hazard mitigation fee ❖ Integrate floodplain management policies into other planning mechanisms within the planning area. ❖ Consider the probable impacts of climate change on the risk associated with the flood hazard ❖ Consider the residual risk associated with structural flood control in future land use decisions ❖ Enforce National Flood Insurance Program requirements ❖ Adopt a Stormwater Management Master Plan ❖ Develop an adaptive management plan to address the long-term impacts of sea level rise

Table-19-5. Alternatives to Mitigate the Landslide Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ Stabilize slope (dewater, armor toe) ❖ Reduce weight on top of slope ❖ Minimize vegetation removal and the addition of impervious surfaces. • **Reduce exposure to the hazard:** ❖ Locate structures outside of hazard area (off unstable land and away from slide-run out area) • **Reduce vulnerability to the hazard:** ❖ Retrofit home • **Build local capacity to respond to or be prepared for the hazard:** ❖ Institute warning system, and develop evacuation plan ❖ Keep cash reserves for reconstruction ❖ Educate yourself on risk reduction techniques for landslide hazards	• **Manipulate the hazard:** ❖ Stabilize slope (dewater, armor toe) ❖ Reduce weight on top of slope • **Reduce exposure to the hazard:** ❖ Locate structures outside of hazard area (off unstable land and away from slide-run out area) • **Reduce vulnerability to the hazard:** ❖ Retrofit at-risk facilities • **Build local capacity to respond to or be prepared for the hazard:** ❖ Institute warning system, and develop evacuation plan ❖ Keep cash reserves for reconstruction ❖ Develop a continuity of operations plan ❖ Educate employees on the potential exposure to landslide hazards and emergency response protocol.	• **Manipulate the hazard:** ❖ Stabilize slope (dewater, armor toe) ❖ Reduce weight on top of slope • **Reduce exposure to the hazard:** ❖ Acquire properties in high-risk landslide areas. ❖ Adopt land use policies that prohibit the placement of habitable structures in high-risk landslide areas. • **Reduce vulnerability to the hazard:** ❖ Adopt higher regulatory standards for new development within unstable slope areas. ❖ Armor/retrofit critical infrastructure against the impact of landslides. • **Build local capacity to respond to or be prepared for the hazard:** ❖ Produce better hazard maps ❖ Provide technical information and guidance ❖ Enact tools to help manage development in hazard areas: better land controls, tax incentives, information ❖ Develop strategy to take advantage of post-disaster opportunities ❖ Warehouse critical infrastructure components ❖ Develop and adopt a continuity of operations plan ❖ Educate the public on the landslide hazard and appropriate risk reduction alternatives. ❖ Consider the probable impacts of climate change on the risk associated with the landslide hazard

Table-19-6. Alternatives to Mitigate the Severe Weather Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ None • **Reduce exposure to the hazard:** ❖ None • **Reduce vulnerability to the hazard:** ❖ Insulate house ❖ Provide redundant heat and power ❖ Insulate structure ❖ Plant appropriate trees near home and power lines ("Right tree, right place" National Arbor Day Foundation Program) • **Build local capacity to respond to or be prepared for the hazard:** ❖ Trim or remove trees that could affect power lines ❖ Promote 72-hour self-sufficiency ❖ Obtain a NOAA weather radio. ❖ Obtain an emergency generator.	• **Manipulate the hazard:** ❖ None • **Reduce exposure to the hazard:** ❖ None • **Reduce vulnerability to the hazard:** ❖ Relocate critical infrastructure (such as power lines) underground ❖ Reinforce or relocate critical infrastructure such as power lines to meet performance expectations ❖ Install tree wire • **Build local capacity to respond to or be prepared for the hazard:** ❖ Trim or remove trees that could affect power lines ❖ Create redundancy ❖ Equip facilities with a NOAA weather radio ❖ Equip vital facilities with emergency power sources.	• **Manipulate the hazard:** ❖ None • **Reduce exposure to the hazard:** ❖ Develop an urban heat island reduction program that includes an urban forest program or plan • **Reduce vulnerability to the hazard:** ❖ Harden infrastructure such as locating utilities underground ❖ Trim trees back from power lines ❖ Designate snow routes and strengthen critical road sections and bridges • **Build local capacity to respond to or be prepared for the hazard:** ❖ Support programs such as "Tree Watch" that proactively manage problem areas through use of selective removal of hazardous trees, tree replacement, etc. ❖ Establish and enforce building codes that require all roofs to withstand snow loads ❖ Increase communication alternatives ❖ Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors. ❖ Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines ❖ Provide NOAA weather radios to the public ❖ Consider the probable impacts of climate change on the risk associated with the severe weather hazard ❖ Review and update heat response plan in light of climate change (heat events) projections

Table 19-7. Alternatives to Mitigate the Tsunami Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ None • **Reduce exposure to the hazard:** ❖ Locate outside of hazard area • **Reduce vulnerability to the hazard:** ❖ Apply personal property mitigation techniques to your home such as anchoring your foundation and foundation openings to allow flow though. • **Build local capacity to respond to or be prepared for the hazard:** ❖ Develop and practice a household evacuation plan ❖ Educate yourself on the risk exposure from the tsunami hazard and ways to minimize that risk	• **Manipulate the hazard:** ❖ None • **Reduce exposure to the hazard:** ❖ Locate structure or mission critical functions outside of hazard area whenever possible • **Reduce vulnerability to the hazard:** ❖ Mitigate personal property for the impacts of tsunami • **Build local capacity to respond to or be prepared for the hazard:** ❖ Develop and practice a corporate evacuation plan ❖ Educate employees on the risk exposure from the tsunami hazard and ways to minimize that risk	• **Manipulate the hazard:** ❖ Build wave abatement structures (e.g. the "Jacks" looking structure designed by the Japanese) • **Reduce exposure to the hazard:** ❖ Locate structure or functions outside of hazard area whenever possible ❖ Harden infrastructure for tsunami impacts ❖ Relocate identified critical facilities located in tsunami high hazard areas • **Reduce vulnerability to the hazard:** ❖ Adopt higher regulatory standards that will provide higher levels of protection to structures built in a tsunami inundation area ❖ Utilize tsunami mapping to guide development away from high risk areas through land use planning • **Build local capacity to respond to or be prepared for the hazard:** ❖ Create a probabilistic tsunami map for the planning area ❖ Provide incentives to guide development away from hazard areas ❖ Develop a tsunami warning and response system ❖ Provide residents with tsunami inundation maps ❖ Join NOAA's Tsunami Ready program ❖ Develop and communicate evacuation routes ❖ Enhance the public information program to include risk reduction options for the tsunami hazard

Table-19-8. Alternatives to Mitigate the Wildland Fire Hazard

Personal-Scale	Corporate-Scale	Government-Scale
• **Manipulate the hazard:** ❖ Clear potential fuels on property such as dry overgrown underbrush and diseased trees • **Reduce exposure to the hazard:** ❖ Create and maintain defensible space around structures ❖ Locate outside of hazard area ❖ Mow regularly • **Reduce vulnerability to the hazard:** ❖ Create and maintain defensible space around structures and provide water on site ❖ Use fire-retardant building materials ❖ Create defensible spaces around home • **Build local capacity to respond to or be prepared for the hazard:** ❖ Employ techniques from the National Fire Protection Association's Firewise USA program to safeguard home ❖ Identify alternative water supplies for fire fighting ❖ Install/replace roofing material with non-combustible roofing materials.	• **Manipulate the hazard:** ❖ Clear potential fuels on property such as dry underbrush and diseased trees • **Reduce exposure to the hazard:** ❖ Create and maintain defensible space around structures and infrastructure ❖ Locate outside of hazard area • **Reduce vulnerability to the hazard:** ❖ Create and maintain defensible space around structures and infrastructure and provide water on site ❖ Use fire-retardant building materials ❖ Use fire-resistant plantings in buffer areas of high wildfire threat. • **Build local capacity to respond to or be prepared for the hazard:** ❖ Support Firewise USA community initiatives. ❖ Create /establish stored water supplies to be utilized for fire fighting.	• **Manipulate the hazard:** ❖ Clear potential fuels on property such as dry underbrush and diseased trees ❖ Implement best management practices on public lands • **Reduce exposure to the hazard:** ❖ Create and maintain defensible space around structures and infrastructure ❖ Locate outside of hazard area ❖ Enhance building code to include use of fire resistant materials in high hazard area. • **Reduce vulnerability to the hazard:** ❖ Create and maintain defensible space around structures and infrastructure ❖ Use fire-retardant building materials ❖ Use fire-resistant plantings in buffer areas of high wildfire threat. ❖ Consider higher regulatory standards (such as Class A roofing) ❖ Establish biomass reclamation initiatives ❖ Reintroduce fire (controlled or prescribed burns) to fire-prone ecosystems ❖ Manage fuel load through thinning and brush removal • **Build local capacity to respond to or be prepared for the hazard:** ❖ More public outreach and education efforts, including an active Firewise USA program ❖ Possible weapons of mass destruction funds available to enhance fire capability in high-risk areas ❖ Identify fire response and alternative evacuation routes ❖ Seek alternative water supplies ❖ Become a Firewise USA community ❖ Use academia to study impacts/solutions to wildfire risk ❖ Establish/maintain mutual aid agreements between fire service agencies ❖ Develop, adopt, and implement integrated plans for mitigating wildfire impacts in wildland-urban interface areas ❖ Consider the probable impacts of climate change on the risk associated with the wildfire hazard in future land use decisions ❖ Establish a management program to track forest and rangeland health

19.2 ADAPTIVE CAPACITY

Adaptive capacity is defined as "the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences" (IPCC, 2014b). This term is typically used while discussing climate change adaptation; however, it is similar to the alternatives presented in the tables for building local capacity. In addition to hazard-specific capacity building, the following list provides general alternatives that planning partners considered to build capacity for adapting to both current and future risks (Cal EMA, et al., 2012a and 2012b):

- Incorporate climate change adaptation into relevant local and regional plans and projects.
- Establish a climate change adaptation and hazard mitigation public outreach and education program.
- Build collaborative relationships between regional entities and neighboring communities to promote complementary adaptation and mitigation strategy development and regional approaches.
- Establish an ongoing monitoring program to track local and regional climate impacts and adaptation strategy effectiveness.
- Increase participation of low-income, immigrant, non-English-speaking, racially and ethnically diverse, and special-needs residents in planning and implementation.
- Ask local employers and business associations to participate in local efforts to address climate change and natural hazard risk reduction.
- Conduct a communitywide assessment and develop a program to address health, socioeconomic, and equity vulnerabilities.
- Focus planning and intervention programs on neighborhoods that currently experience social or environmental injustice or bear a disproportionate burden of potential public health impacts.
- Use performance metrics and data to evaluate and monitor the impacts of climate change and natural hazard risk reduction strategies on public health and social equity.
- Develop coordinated plans for mitigating future flood, landslide, and related impacts through concurrent adoption of updated general plan safety elements and local hazard mitigation plans.
- Implement general plan safety elements through zoning and subdivision practices that restrict development in floodplains, landslide, and other natural hazard areas.
- Identify and protect locations where native species may shift or lose habitat due to climate change impacts (sea level rise, loss of wetlands, warmer temperatures, drought).
- Collaborate with agencies managing public lands to identify, develop, or maintain corridors and linkages between undeveloped areas.
- Promote economic diversity.
- Incorporate consideration of climate change impacts as part of infrastructure planning and operations.
- Conduct a climate impact assessment on community infrastructure.
- Identify gaps in legal and regulatory capabilities and develop ordinances or guidelines to address those gaps.
- Identify and pursue new sources of funding for mitigation and adaptation activities.
- Hire new staff or provide training to current staff to ensure an adequate level of administrative and technical capability to pursue mitigation and adaptation activities.

20. AREA-WIDE ACTION PLAN

20.1 RECOMMENDED MITIGATION ACTIONS

The Steering Committee reviewed the catalogs of hazard mitigation alternatives and selected area-wide actions to be included in a hazard mitigation action plan. The selection of area-wide actions was based on the risk assessment of identified hazards of concern and the defined hazard mitigation goals and objectives. Table 20-1 lists the recommended hazard mitigation actions that make up the action plan. The timeframe indicated in the table is defined as follows:

- Short Term = to be completed in 1 to 5 years
- Long Term = to be completed in greater than 5 years
- Ongoing = currently being funded and implemented under existing programs.

20.2 BENEFIT-COST REVIEW

The action plan must be prioritized according to a benefit/cost analysis of the proposed actions (44 CFR, Section 201.6(c)(3)(iii)). The benefits of proposed actions were weighed against estimated costs as part of the action 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 Pre-Disaster Mitigation (PDM) grant 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. Therefore, a review of the apparent benefits versus the apparent cost of each action was performed. Parameters were established for assigning subjective ratings (high, medium, and low) to the costs and benefits of these actions.

Cost ratings were defined as follows:

- **High**—Existing funding will not cover the cost of the action; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).
- **Medium**—The action could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the action would have to be spread over multiple years.
- **Low**—The action could be funded under the existing budget. The action is part of or can be part of an ongoing existing program.

Benefit ratings were defined as follows:

- **High—**Action will provide an immediate reduction of risk exposure for life and property.
- **Medium—**Action will have a long-term impact on the reduction of risk exposure for life and property, or action will provide an immediate reduction in the risk exposure for property.
- **Low—**Long-term benefits of the action are difficult to quantify in the short term.

Using this approach, actions with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly.

Table 20-1. Action Plan

Hazards Addressed	Funding Options	Timeframe	Objectives Met	In Previous Plan? (# from previous plan)
CW-1—To the extent possible based on available resources, provide coordination and technical assistance in the application for grant funding that includes assistance in cost vs. benefit analysis for grant eligible projects **Responsible Agency:** County OES				
All	Existing County programs; grant funding	Short-term, ongoing	4, 8	Yes (CW-1)
CW-2—Encourage the development and implementation of a county-wide hazard mitigation public-information strategy that meets the needs of all planning partners. **Responsible Agency:** County OES with participation of all planning partners				
All	Cost sharing from the Partnership, General Fund Allocations, Cost sharing with Stakeholders	Short-term, depends on funding	5, 8, 9	Yes (CW-2)
CW-3—Coordinate updates to land use and building regulations as they pertain to reducing the impacts of natural hazards, to seek a regulatory cohesiveness within the planning area. This can be accomplished via a commitment from all planning partners to involve each other in their adoption processes, by seeking input and comment during the course of regulatory updates or general planning. **Responsible Agency:** Governing body of each eligible planning partner.				
All	General funds	Short-term, ongoing	1, 5, 7, 8	Yes (CW-3)
CW-4—Sponsor and maintain a natural hazards informational website to include the following types of information: • **Hazard-specific information such as GIS layers, private property mitigation alternatives, important facts on risk and vulnerability** • **Pre- and post-disaster information such as notices of grant funding availability** • **CRS creditable information** • **Links to Planning Partners' pages, FEMA, Red Cross, NOAA, USGS and the National Weather Service.** • **Information such as progress reports, mitigation success stories, update strategies, Steering Committee meetings.** **Responsible Agency:** County OES				
All	County general fund through existing programs, grant funding	Short-term, ongoing	5,8	Yes (CW-4)
CW-5—The Steering Committee will remain as a functioning body over time to monitor progress of the plan, provide technical assistance to planning partners and oversee the update of the plan according to schedule. This body will continue to operate under the ground rules established at its inception. **Responsible Agency:** County OES				
All	Funded through existing, ongoing programs	Short-term	All	Yes (CW-5)
CW-6—Amend or enhance this hazard mitigation plan as needed to comply with state or federal mandates as compliance guidelines become available. **Responsible Agency:** County OES with participation of all planning partners				
All	Ongoing programs, grant funding depending on the mandate	Long-term Ongoing	All	Yes (CW-6)
CW-7—All planning partners that fully participated in this planning effort will formally adopt this plan once pre-adoption approval has been granted by CalEMA and FEMA, and will adhere to the plan maintenance protocol identified in Chapter 21. **Responsible Agency:** All planning partners				
All	To be funded under existing programs for all planning partners	Short-term	All	Yes (CW-7)

For many of the strategies identified in this action plan, financial assistance may be available through the HMGP or PDM programs, both of which require detailed benefit/cost analyses. These analyses will be performed on projects at the time of application using the FEMA benefit-cost model. For actions not seeking financial assistance from grant programs that require detailed analysis, "benefits" can be defined according to parameters that meet the goals and objectives of this plan.

20.3 ACTION PLAN PRIORITIZATION

Table 20-2 lists the priority of each area-wide action. A qualitative benefit-cost review was performed for each of these actions. The priorities are defined as follows:

- **Implementation Priority**
  - **High Priority**—An action that meets multiple objectives, has benefits that exceed costs, and has a secured source of funding. Action can be completed in the short term (1 to 5 years).
  - **Medium Priority**—An action that meets multiple objectives, has benefits that exceed costs, and is eligible for funding though no funding has yet been secured for it. Action can be completed in the short term (1 to 5 years), once funding is secured. Medium-priority actions become high-priority actions once funding is secured.
  - **Low Priority**—An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions are generally "wish-list" actions. They may be eligible for grant funding from programs that have not yet been identified.
- **Grant Pursuit Priority**
  - **High Priority**—An action that meets identified grant eligibility requirements, has high benefits, and is listed as high or medium implementation priority; local funding options are unavailable or available local funds could be used instead for actions that are not eligible for grant funding.
  - **Medium Priority**—An action that meets identified grant eligibility requirements, has medium or low benefits, and is listed as medium or low implementation priority; local funding options are unavailable.
  - **Low Priority**—An action that has not been identified as meeting any grant eligibility requirements.

Table 20-2. Prioritization of Area-Wide Mitigation Actions

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Action Grant Eligible?	Can Action be Funded under Existing Programs/ Budgets?	Implementation Priority	Grant Pursuit Priority
CW-1	2	Medium	Low	Yes	Yes	Yes	High	Medium
CW-2	3	Low	Low	Yes	Yes	Yes	High	Medium
CW-3	4	Low	Low	Yes	No	Yes	High	Low
CW-4	2	Medium	Medium	Yes	Yes	No	Medium	Medium
CW-5	10	Low	Low	Yes	No	Yes	High	Low
CW-6	12	Low	Low	Yes	No	Yes	High	Low
CW-7	12	Medium	Low	Yes	No	Yes	High	Low

20.4 CLASSIFICATION OF MITIGATION ACTIONS

Each recommended action was classified based on the hazard it addresses and the type of mitigation it involves. Table 20-3 shows these classifications.

Table 20-3. Analysis of Mitigation Actions

Hazard	Actions That Address the Hazard, by Mitigation Type[a]							
	Prevention	Property Protection	Public Education and Awareness	Natural Resource Protection	Emergency Services	Structural Projects	Climate Resiliency	Community Capacity Building
Dam Failure	CW-3, 6		CW-2, 4					CW-1, 3, 5, 7
Drought	CW-3, 6		CW-2, 4					CW-1, 3, 5, 7
Earthquake	CW-3, 6		CW-2, 4					CW-1, 3, 5, 7
Flooding	CW-3, 6		CW-2, 4					CW-1, 3, 5, 7
Landslide	CW-3, 6		CW-2, 4					CW-1, 3, 5, 7
Severe Weather	CW-3, 6		CW-2, 4					CW-1, 3, 5, 7
Tsunami	CW-3, 6		CW-2, 4					CW-1, 3, 5, 7
Wildland Fire	CW-3, 6		CW-2, 4					CW-1, 3, 5, 7
Non-Natural Hazards	CW-3, 6		CW-2, 4					CW-1, 3, 5, 7

a. See Section 20.4 for description of mitigation types

Mitigation types used for this categorization are as follows:

- **Prevention**—Government, administrative or regulatory actions that influence the way land and buildings are developed to reduce hazard losses. Includes planning and zoning, floodplain laws, capital improvement programs, open space preservation, and stormwater management regulations.
- **Property Protection**—Modification of buildings or structures to protect them from a hazard or removal of structures from a hazard area. Includes acquisition, elevation, relocation, structural retrofit, storm shutters, and shatter-resistant glass.
- **Public Education and Awareness**—Actions to inform residents and elected officials about hazards and ways to mitigate them. Includes outreach projects, real estate disclosure, hazard information centers, and school-age and adult education.
- **Natural Resource Protection**—Actions that minimize hazard loss and preserve or restore the functions of natural systems. Includes sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, wetland restoration and preservation, and green infrastructure.
- **Emergency Services**—Actions that protect people and property during and immediately after a hazard event. Includes warning systems, emergency response services, and the protection of essential facilities.
- **Structural Projects**—Actions that involve the construction of structures to reduce the impact of a hazard. Includes dams, setback levees, floodwalls, retaining walls, and safe rooms.
- **Climate Resiliency**—Actions that incorporate methods to mitigate and/or adapt to the impacts of climate change. Includes aquifer storage and recovery activities, incorporating future conditions projections in project design or planning, or actions that specifically address jurisdiction-specific climate change risks, such as sea level rise or urban heat island effect.
- **Community Capacity Building**—Actions that increase or enhance local capabilities to adjust to potential damage, to take advantage of opportunities, or to respond to consequences. Includes staff training, memorandums of understanding, development of plans and studies, and monitoring programs.

20.5 ACTION PLAN IMPLEMENTATION

The area-wide action plan here and jurisdiction-specific action plans in Volume 2 present a range of action items for reducing loss from hazard events. The planning partners have prioritized actions and can begin to implement the highest-priority actions over the next five years. The effectiveness of the hazard mitigation plan depends on its effective implementation and incorporation of the outlined action items into all partners' existing plans, policies, and programs. Some action items do not need to be implemented through regulation but can be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation.

The Del Norte County Office of Emergency Services will assume lead responsibility for facilitating hazard mitigation plan implementation. Plan implementation will be a shared responsibility among all planning partnership members and agencies identified as lead agencies in the area-wide and jurisdiction-specific action plans.

20.6 INTEGRATION INTO OTHER PLANNING MECHANISMS

Integrating relevant information from this hazard mitigation plan into other plans and programs where opportunities arise will be the ongoing responsibility of the governing bodies for all planning partners covered by this plan. By adopting general plans and zoning ordinances, the planning partners have planned for the impact of natural hazards, and these documents are integral parts of this hazard mitigation plan. The hazard mitigation planning process provided the partners with an opportunity to review and expand on policies contained within these documents, based on the best science and technology available at the time this plan was prepared. The partners should use their general plans and the hazard mitigation plan as complementary documents to achieve the ultimate goal of reducing risk exposure to citizens of the planning area. A comprehensive update to a general plan may trigger an update to the hazard mitigation plan.

All municipal planning partners have committed to creating a linkage between the hazard mitigation plan and their individual general plans or similar plans identified in the core capability assessment. Each municipal jurisdiction-specific action plan includes a high-priority mitigation action to create such a linkage. Additionally, Crescent City and Del Norte County are committed to being in full compliance with California Assembly Bill 2140 and Senate Bill 379, which promote the integration of local hazard mitigation plans and general plans and mandate that these plans address climate change.

Other planning processes and programs to be coordinated with the recommendations of the hazard mitigation plan may include the following:

- Emergency response plans
- Capital improvement programs
- Municipal codes
- Community design guidelines
- Water-efficient landscape design guidelines
- Stormwater management programs
- Water system vulnerability assessments.
- Climate action/adaptation plans
- Debris Management plans
- Post disaster action/Recovery plans

All planning partners have identified opportunities and strategies for integration in their annexes in Volume 2 of this plan.

21. PLAN ADOPTION AND MAINTENANCE

21.1 PLAN ADOPTION

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) and Section 201.7(c)(5)). For multi-jurisdictional plans, each jurisdiction requesting approval must document that is has been formally adopted. 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 planning partners will formally adopt the plan. DMA 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 of this volume.

21.2 PLAN MAINTENANCE STRATEGY

Plan maintenance is the formal process for achieving the following:

- Ensuring that the hazard mitigation plan remains an active and relevant document and that the planning partnership maintains its eligibility for applicable funding sources
- Monitoring and evaluating the plan annually and producing an updated plan every five years
- Integrating public participation throughout the plan maintenance and implementation process
- Incorporating the mitigation strategies outlined in this plan into existing planning mechanisms and programs, such as any relevant comprehensive land-use planning process, capital improvement planning process, and building code enforcement and implementation.

To achieve these ends, a hazard mitigation plan must present a plan maintenance process that includes the following (44 CFR Section 201.6(c)(4) and Section 201.7(c)(4)):

- A method and schedule for monitoring, evaluating and updating the mitigation plan within a 5-year cycle
- An approach for how the community will continue public participation in the plan maintenance process.
- A process by which local governments will incorporate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate

Table 21-1 summarizes the plan maintenance strategy. The sections below further describe each element (except "integration into other planning mechanisms," which is discussed in Section 20.6).

21.2.1 Plan Monitoring

Del Norte County will be the lead agency responsible for monitoring the plan, and each partner will have monitor plan implementation by tracking the status of all recommended mitigation actions in its action plan. Staff or departments with primary responsibility are identified in each jurisdictional annex (see Volume 2) and summarized in Table 21-1.

Table 21-1. Plan Maintenance Matrix

Approach	Timeline	Lead Responsibility[a]
Integration into Other Planning Mechanisms		
Create a linkage between the hazard mitigation plan and individual jurisdictions' general plans or similar plans identified in the core capability assessments	Continuous over the 5-year performance period of the plan	Del Norte County, City of Crescent City, Elk Valley Rancheria, Big Rock Community Services District, Crescent City Harbor District, Crescent Fire Protection District, Gasquet Community Services District, Klamath Community Services District, Smith River Community Services District, Smith River Fire Protection District. See Points of Contact for each jurisdiction listed in each chapter of Volume 2.
Plan Monitoring[b]		
Track the implementation of actions over the performance period of the plan	Continuous over the 5-year performance period of the plan	Del Norte County will be the lead agency responsible for the plan, all planning partners will monitor themselves and report to Del Norte OES. This will be monitored by the Del Norte County Emergency Manager. All monitoring contacts will be as designated as the primary point of contacts in their jurisdictional annexes
Plan Evaluation		
Review the status of previous actions; assess changes in risk; evaluate success of integration	Upon initiation of hazard mitigation plan update, comprehensive general plan update, or major disaster	Del Norte County, City of Crescent City, Elk Valley Rancheria, Big Rock Community Services District, Crescent City Harbor District, Crescent Fire Protection District, Gasquet Community Services District, Klamath Community Services District, Smith River Community Services District, Smith River Fire Protection District
Grant Monitoring and Coordination		
As grant opportunities present themselves, the planning partners will consider options to pursue grants to fund actions identified in this plan	As grants become available	The Del Norte County Emergency Manager, OES will provide notification to planning partners and will strive to convene grant funding coordination meetings as needed when funding is available.
Plan Update		
The planning partnership will reconvene, at a minimum, every 5 years to guide a comprehensive update of the plan.	Every 5 years or upon comprehensive update to General Plan or major disaster; funding and organizing for plan update will begin in FY 2021/2022	The governing body for all planning partners covered by this plan. Del Norte County OES, Emergency Manager, will strive to initiate the plan update within 1 year prior to plan expiration. However, please note that extenuating circumstances could impact this schedule.
Continuing Public Participation		
Del Norte OES will keep the website maintained, bring the plan to the Board of Supervisors meeting for review once a year (these meetings are also televised and on public notices in community newspaper), and receive comments through the website. The website and comments will be maintained over the course of the plan.	Continuous over the 5-year performance period of the plan	Del Norte OES will be the lead agency responsible. Other jurisdictional point of contacts identified in volume 2 annexes will help support. This will be monitored by the Del Norte County Emergency Manager.

a. Responsible lead party may designate an alternate. Jurisdictional points of contact identified in Volume 2 annexes have support responsibility.
b. For the monitoring task, agencies identified as lead agencies in each jurisdictions' action plan will report status as requested to the agency charged with lead responsibility for plan monitoring

21.2.2 Plan Evaluation

The plan will be evaluated by how successfully the implementation of identified actions has helped to achieve the goals and objectives identified in this plan. This will be assessed by a review of the changes in risk that occur over the performance period and by the degree to which mitigation goals and objectives are incorporated into existing plans, policies and programs. Plan evaluation will be a shared responsibility among all planning partnership members and agencies identified as lead agencies in the area-wide and jurisdiction-specific action plans.

21.2.3 Grant Monitoring and Coordination

Del Norte County OES will identify grant funding opportunities and send notifications to participating partner jurisdictions. Once these opportunities are identified, planning partners interested in pursuing a grant opportunity will convene in a short meeting to review the hazard mitigation plan and pursue a strategy to capture that grant funding. Del Norte County OES will assume lead responsibility for planning and facilitating grant opportunity meetings. Review of the hazard mitigation plan at these meetings can include the following:

- Discussion of any hazard events that occurred during the prior year and their impact on the planning area
- Impact of potential grant opportunities on the implementation of mitigation actions
- Re-evaluation of the action plans to determine if the timeline for identified actions need to be amended (such as changing a long-term action to a short-term action because of funding availability)
- Recommendations for new actions
- Impact of any other planning programs or initiatives that involve hazard mitigation.

If multiple planning partners decide to pursue the same grant funding opportunity, partnerships can be formed to utilize the hazard mitigation plan in the grant application.

21.2.4 Plan Update

Federal regulations require that local hazard mitigation plans be reviewed, revised if appropriate, and resubmitted for approval in order to remain eligible for benefits awarded under the Disaster Mitigation Act (44 CFR Section 201.6.d(3) and Section 201.7(d)(3)). This plan's format allows the planning partnership to review and update sections when new data become available. New data can be easily incorporated, resulting in a plan that will remain current and relevant. The planning partnership intends to update the plan on a five-year cycle from the date of plan approval. This cycle may be accelerated to less than 5 years based on the following triggers:

- A presidential disaster declaration that impacts the planning area
- A hazard event that causes loss of life
- A 20-year plan update of a participating jurisdiction's general plan

It will not be the intent of the update process to develop a complete new hazard mitigation plan. Based on needs identified by the planning team, the update will, at a minimum, include the following elements:

- The update process will be convened through a new steering committee.
- The hazard risk assessment will be reviewed and, if necessary, updated using best available information and technologies.
- Action plans will be reviewed and revised to account for any actions completed, dropped, or changed and to account for changes in the risk assessment or planning partnership policies identified under other planning mechanisms (such as the general plan).
- The draft update will be sent to appropriate agencies and organizations for comment.
- The public will be given an opportunity to comment on the update prior to adoption.
- Partners' governing bodies will adopt their respective portions of the updated plan.

Because plan updates can require a year or more to complete, the Del Norte County OES will initiate efforts to update the plan before it expires. Del Norte County OES will consider applying for funding to update the plan in the Fiscal Year 2021/2022 grant cycle or will identify an alternate source of funding for the plan update in order to begin the update process in the spring of 2022.

21.2.5 Continuing Public Participation

The public outreach strategy used during development of the current update will provide a framework for public engagement through the plan maintenance process. It can be adapted for ongoing public outreach as determined to be feasible by the planning partnership. A steering committee similar to the one involved in developing this hazard mitigation plan update will be put in place to provide stakeholder input on plan maintenance activities.

The public will continue to be apprised of hazard mitigation activities through the website and reports on successful hazard mitigation actions provided to the media. Del Norte OES will keep the website maintained, including monitoring the email address where members of the public can submit comments to the steering committee. This site will house the final plan and will be a one-stop shop for information regarding the plan, the partnership and plan implementation. Copies of the plan also will be distributed to the Del Norte County Library System.

Once a year, Del Norte OES will bring the plan to a Board of Supervisors meeting for review. These meetings are also televised and on public notices in community newspaper.

Upon initiation of the next plan update process, a new public involvement strategy will be initiated, with guidance from the new steering committee. This strategy will be based on the needs and capabilities of the planning partnership at the time of the update. At a minimum, it will include the use of local media outlets.

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LIST OF ACRONYMS

AB—Assembly Bill

ADA—American with Disabilities Act

ASDSO— Association of State Dam Safety Officials

BIA—Bureau of Indian Affairs

BLM—Bureau of Land Management

Cal EMA—California Emergency Management Agency

Cal OES—California Governor's Office of Emergency Services

Cal Fire—California Department of Forestry and Fire Protection

CCR—California Code of Regulations

CDBG-DR—Community Development Block Grant Disaster Recovery

CEQA—California Environmental Quality Act

CFA—California Fire Alliance

CFR—Code of Federal Regulations

CRS—Community Rating System

CWA—Clean Water Act

DFIRM—Digital Flood Insurance Rate Maps

DMA —Disaster Mitigation Act

DWR—Department of Water Resources (California)

EAP—Emergency Action Plan

EMA—Emergency Management Agency (California state)

EPA—U.S. Environmental Protection Agency

ESA—Endangered Species Act

EWP—Emergency Watershed Protection

FEMA—Federal Emergency Management Agency

FERC—Federal Energy Regulatory Commission

FHSZ—Fire hazard severity zones

FRAP—Fire and Resources Assessment Program

GBS—General Building Stock

GIS—Geographic Information System

Hazus—Hazards, United States

HMGP—Hazard Mitigation Grant Program

IBC—International Building Code

IPCC—Intergovernmental Panel on Climate Change

Mw—Moment Magnitude Scale

mph—Miles per hour

NASA—National Aeronautics and Space Administration

NEHRP—National Earthquake Hazards Reduction Program

NFIP—National Flood Insurance Program

NIMS—National Incident Management System

NOAA—National Oceanic and Atmospheric Administration

NPS—National Park Service

NRCS—Natural Resources Conservation Service

NWS—National Weather Service

OES—Office of Emergency Services (Del Norte County)

PDM—Pre-Disaster Mitigation Grant Program

PGA—Peak Ground Acceleration

SEMS—Standardized Emergency Management Systems

UGA—Urban growth area

USDA—U.S. Department of Agriculture

USGCRP—U.S. Global Change Research Program

USGS—U.S. Geological Survey

Del Norte County Operational Area Hazard Mitigation Plan

Appendix A. Public Involvement Materials

STEERING COMMITTEE MEETING SUMMARIES

MEETING SUMMARY

Date/Time of Meeting:	Thursday – July 20, 2017; 10:00am to 12:00pm
Location:	Crescent FPD, 255 W Washington Blvd, Crescent City CA, 95531
Subject:	Steering Committee No. 1
Project Name:	Del Norte County Multi-Jurisdiction Hazard Mitigation Plan
In Attendance: **(See Attachment):**	Steve Wakefield, Vanessa Johnson, Geoff Antill, Randy Crawford, Chris Vaughan, Craig Bradford, Lane Tavasci, Charlie Helms, Taylor Carsley, Randy Hooper, Heidi Kunstal, Kymmie Scott Phoned in: (None) **Planning Team:** Cindy Henderson, Rob Flaner, Stephen Veith
Summary Prepared by:	Stephen Veith
Quorum – Yes or No	Yes

Item	Action

Meeting Started at 10:07am

Welcome and Introductions, Review Agenda

- Rob Flaner opened the meeting and facilitated group introductions.
- Distributed handouts included: Agenda; Scope of Work for the HMP; Draft Steering Committee Charter; Risk Assessment Update.
- The agenda was reviewed and no modifications were made.

Project Overview

Mr. Flaner covered the basics of the planning process, such as a timeline of 8-10 months, a planned 6 more meetings, the scope of work and how to use this plan for funding grants. Mentions were made of the familiarity with the last Del Norte plan, and some of the struggles getting planning partner jurisdictions involved, and the importance of getting Letters of Intent early on in the process. One of the main goals of this plan is to update the action items from last time, which are easy to report on and help make this plan dynamic, instead of “sitting on a shelf”.

Item	Action
The Steering Committee Role Stephen Veith introduced the committee to the draft charter for the plan, which outlines the ground rules and procedures for future steering committee meetings and the plan process. It was agreed upon to have 11 steering committee members with a quorum of 6 to confirm decisions. Randy Hooper was chosen as Chairperson of the Steering Committee and Kymmie Scott would be Vice-Chair, as well as the media spokesperson and media outreach liaison. Alternates were also designated and given full voting authority.	
Additional groups that were not present but thought to be included were discussed, such as the Tribal Jurisdictions, other CSD's, school districts and the Farm Bureau. To facilitate the planning partner process, "Expectation Packets" would be made available at the next meeting that would feature an overview of the planning process, partner expectations, sample Letters of Intent (LOI) and an overview of the FEMA HAZUS Risk Assessment software.	Contact other districts, jurisdictions and entities for planning process inclusion.
Plan Review Mr. Flaner presented the previous plan and what will need to be looked at for the next meeting. The main goal of the next meeting will be to overlook the hazards of concern, vision/mission statement, goals and objectives. This plan will need to include provisions of California SBC 379, which will necessitate including climate change as an individual hazard or parts of relevant hazards. The previous plan did not cover non-natural hazards (such as terrorist attacks, riots, etc.), as this is a natural hazard mitigation plan. However, FEMA has said that non-natural hazards may be included if the jurisdictions desire, but be aware that funding grants for non-natural hazard mitigation will likely not be awarded.	Review Chapters 5 and 8 introductions and come prepared to discuss at SC Meeting #2. Chapters will be sent out by Stephen Veith.
Public Involvement Strategy Rob Flaner and Stephen Veith discussed with the committee possible avenues of public involvement for this plan. Social media plays an increasingly powerful tool to use for public engagement, and it was decided to use the Del Norte County Facebook page as a primary social media outlet.	Get public website (will be on Del Norte County website) set up to be "one stop shop

Item	Action
Other applications such as Nextdoor were considered as secondary tools. In addition to this, a public survey will be created to send out via the website, facebook, email and at public events in the county. Other parts of public outreach would be to make sure city councils and FPD boards are kept in the loop of this planning process by generating "briefing packets" for quick review of the material. **Action Items and Next Steps** Stephen Veith updated the committee of the risk assessment update, which is in the beginning phases, but most of the data has been requested and received from sources such as Del Norte County and Crescent City GIS. Other sources of GIS data are welcome during the course of the risk assessment. A brief overview of HAZUS, FEMA's risk assessment software, was given to the committee. Future action items at the next steering committee meeting were discussed, such as thinking about hazards of concern, vision statements, goals and objectives. **Meeting Adjourned at 11:32am**	

MEETING SUMMARY

Attachment: Sign-in Sheet

NAME	REPRESENTING	EMAIL
STEVE WAKEFIELD	CRESCENT FIRE PROTECTION DIST	CITYCHIEFS1@GMAIL.COM
Vanessa Johnson	Crescent Fire Protection Dist.	vjohnson@ccfr.crescentcity.org
GEOFF ANTILL	SMITH RIVER FIRE P.D.	GANTILL@CHARTER.NET
" "	(RANDY CRAWFORD) FORTDICK FPD	"
Cindy Henderson	Del Norte OES	chenderson@dnco.org
Chris Vaughan	Smith River CSD	General.manager@SRWater.net
Craig Bradford	Big Rock CSD	craigsbradford@gmail.com
Lane Tavasci	C.C. HARBOR DISTRICT	Lane@ccharbor.com
Charlie Helms	Harbor District	charlie@ccharbor.com
Taylor Carsley	Del Norte County CDD	tcarsley@co.del-norte.ca.us
Randy Hooper	Del Norte Co.	rhooper@co.del-norte.ca.us
HEIDI KUNSTAL	DEL NORTE Co.	hkunstal@co.del-norte.ca.us
Kymmie Scott	City	kscott@crescentcity.org

MEETING SUMMARY

Date/Time of Meeting:	Thursday – August 17, 2017; 1:00pm to 3:00pm
Location:	Crescent FPD, 255 W Washington Blvd, Crescent City CA, 95531
Subject:	Steering Committee Meeting No. 2
Project Name:	Del Norte County Multi-Jurisdiction Hazard Mitigation Plan
In Attendance: **(See Attachment):**	Vanessa Johnson, Geoff Antill, Chris Vaughan, Craig Bradford, Charlie Helms, Taylor Carsley, Heidi Kunstal, Kymmie Scott, Margaret Caldwell, Crista Stewart, Heidi Valadao, Rob Jacob Phoned in: (None) **Planning Team:** Cindy Henderson, Rob Flaner, Stephen Veith
Summary Prepared by:	Stephen Veith
Quorum – Yes or No	Yes

Item	Action

Meeting Started at 1:04pm

Welcome and Introductions, Review Agenda

- Heidi Kunstal opened the meeting and facilitated group introductions.
- Distributed handouts included: Agenda; Meeting #1 Minutes; Revised Steering Committee Charter, Chapter 5 - Hazards of Concern, Chapter 8 - Vision/Mission/Goals; Risk Assessment Update, Planning Partner Expectations Packet.
- The agenda was reviewed and no modifications were made.

Planning Process

- The previous meeting minutes were confirmed.
- The revised Charter was confirmed with the addition of the new partners at the meeting.

Plan Review

Mr. Veith covered the previous plan's hazards of concern, noting that in the seven years since the last plan passed, provisions for climate change are now required by the state. Drought was added as a primary hazard to plan,

Item	Action
as well as climate change. Sea level rise will be added underneath the climate change chapter.	
The steering committee discussed adding non-natural hazards to the plan. Rob Flaner mentioned that non-natural hazards are optional, and will not be eligible for FEMA grant funding, however other sources of funding might be available from the Department of Homeland Security. Two non-natural hazards were added to the plan, Communications failure brought about by construction accidents or theft, and hazardous material spills along crucial highways. Geoff Antill mentioned that hazardous material spills can be especially hazardous due to long response times. Craig Bradford talked about making sure each district has response plans in place for just such an occurrence.	Review response plans for natural and non-natural hazards already in place.
For specific scenarios, 100 and 500 year flood will be acceptable, there will be no need for 10 and 50 year flood scenarios. The Del Norte DFIRM boundaries are updated and easy to see, as long as preliminary coastal studies are also taken into account. No new dam inundation scenarios were known since the last plan, as well as wildfire scenarios. The CalFIRE FRAP data is still the most recent severity data. For landslide, Cindy Henderson mentioned that CalTrans would have the most current information regarding landslides in critical corridors. Sea level rise data from NOAA (1-6 feet) and the Pacific Institute (55 inches) was downloaded.	Contact CalTrans for information about landslides in crucial transportation corridors.
Mr. Veith reviewed the previous plan’s vision statement. After a brief discussion, the previous vision statement was left unchanged and confirmed unanimously.	
Mr. Veith then reviewed the previous plan’s goals and objectives supporting those goals. Goals 2 and 3 were flipped to reflect an increased importance of the environment in Del Norte County. To reflect the new hazards of concern, the term “non-natural hazards” was added to goals 1 and 3. Mr. Flaner mentioned that it is much easier to point to California SB379 if there’s a separate climate change goal. The motion to add a new climate change goal emphatically passed. Other language including “adaptive capacities” was added to the goals and objectives where appropriate.	

Item	Action
Public Involvement Strategy Stephen Veith discussed with the committee possible avenues of public involvement for this plan. The steering committee discussed the option of just one public meeting, preferably tied to a bigger event to maximize participation. Other ideas include using planning partner email lists to the community to broaden reach.	Get list of preferred events for public meeting partners.
Action Items and Next Steps Stephen Veith and Rob Flaner introduced the Planning Partner expectation packets, which include the obligations of planning partners and example Letter of Intents (LOI's). The jurisdictional annex process will include three phases, Phase 1 - Jurisdictional Profiles, Phase 2 – Capability Assessments, Phase 3 – Action Planning. LOI's for all eligible planning partners will be due 30 days from the next steering committee meeting.	Create and send Letters of Intent to Stephen Veith by October 20th.
Cindy Henderson, Heidi Kunstal and Rob Flaner discussed if joint powers agreements will also be covered under the Del Norte LOI. It was deemed that they would be covered.	
Future action items at the next steering committee meeting were discussed, such as public survey drafts, critical facilities definitions and confirming hazards of concern.	
Meeting Adjourned at 2:37pm	

MEETING SUMMARY

Attachment: Sign-in Sheet

Stephen Veith Tt
Rob Flaner on Phone

Del Norte County Multi-Jurisdiction HMP Meeting Sign In

Thursday, August 17th, 2017

Name	Title	Organization	Email
Charlie Helms	CEO/Harbormaster	Crescent City Harbor District	charlie@ccharbor.com
GEOFF ANTILL	PROT. ADMIN.	SMITH RIVER FPD	GANTILL@CHARTER.NET
Vanessa Johnson	Crescent Fire Protection Dist. Admin Assistant	Crescent Fire Protection District	vjohnson@ccfr.crescentcity.org
Cindy Henderson	Emerg Services Mgr	Del Norte OES	chenderson@dnco.org
HEIDI KUNSTAL	Del Norte County Comm. Dev. Dept.	Del Norte County	hkunstal@co.del-norte.ca.us
MARGARET CALDWELL	President	Klamath Community Service Dist	Klamathcsd@gmail.com
Chris Vaughan	General Manager	Smith River CSD	General.Manager@SRWater.net
Craig Bradford	President, Board of Directors/Trustees	Big Rock CSD	craigsbradford@gmail.com
Taylor Carsley	Del Norte County - CDD Planning Division	Planner	tcarsley@co.del-norte.ca.us
Crista Stewart	Elk Valley Rancheria	Director of Grants	cstewart@elk-valley.com

Heidi Valadao.	EVR COUNCIL & Disaster com. chair	Elk Valley Rancheria	HVALADAO@Elk-valley.com
ROB JACOB	ENVIRO SERVICES COORDINATOR	ELK VALLEY RANCHERIA	RJACOB@ELK-VALLEY.COM

MEETING SUMMARY

Date/Time of Meeting:	Thursday – September 21st, 2017; 1:00pm to 3:00pm
Location:	Crescent FPD, 255 W Washington Blvd, Crescent City CA, 95531
Subject:	Steering Committee Meeting No. 3
Project Name:	Del Norte County Multi-Jurisdiction Hazard Mitigation Plan
In Attendance: **(See Attachment):**	Geoff Antill, Chris Vaughan, Craig Bradford, Charlie Helms, Heidi Kunstal, Kymmie Scott, Margaret Caldwell, Rob Jacob, Sam Rutledge, Eileen Rutledge, Randy Hooper, James Weiland, Elaine Fullgren Phoned in: (None) **Planning Team:** Stephen Veith, Laura Johnston
Summary Prepared by:	Stephen Veith
Quorum – Yes or No	Yes

Item	Action

Meeting Started at 1:04pm

Welcome and Introductions, Review Agenda

- Randy Hooper opened the meeting and facilitated group introductions.
- Distributed handouts included: Agenda; Meeting #2 Minutes, 2010 HMP Critical Facilities Listing, Revised Chapter 5 - Hazards of Concern, Revised Chapter 8 - Vision/Mission/Goals, Section 10 – Critical Facility Definition, Risk Assessment Update, Sample HMP Survey and Press Release
- The agenda was reviewed and no changes were made.

Planning Process

- The previous meeting minutes were confirmed after making recommendation to finish the description at the end of the paragraph on the 2nd page concerning sea level rise.

Plan Review

Mr. Veith opened the discussion of the previous meeting, concerning the addition of probabilistic earthquake scenarios. Geoff Antill talked about how probabilistic scenarios can counterbalance the other scenario results, where only looking at catastrophic results leads to trying to mitigate the

Item	Action
statistically improbable event. Geoff added that if there's a true risk to life and safety, then the problem should be addressed.	
There was much discussion about the hazard results impacting building codes and funding opportunities. Laura Johnston answered a question about FEMA funding approval of certain projects depending on the hazard ranking coming out of risk rankings, which is based in part on damage estimates from the Hazus model. Rating a hazard higher in the plan will not necessarily get more funding from FEMA.	
Kymmie Scott and Heidi Kunstal talked about life safety issues with earthquake hazards – pointing out that the state does take in money with building permits for earthquake safety.	
The steering committee voted unanimously to include a 100-year probabilistic earthquake scenario in the plan.	Include 100-year probabilistic earthquake scenario in the plan
The steering committee then voted to include Gasquet Community Services District representatives in the steering committee.	
In reviewing the other confirmed hazards of concern, it was brought up why to include drought as a hazard in the Del Norte County HMP? Mr. Veith explained that it was included in a previous discussion to show that the drought hazard was taken in consideration and can be shown in the plan to have little to no impact to Del Norte County.	
In reviewing the confirmed goals and objectives, it was brought up by Sam and Eileen Rutledge why would goals 2 and 3 be flipped when it was originally property then environment? Geoff Antill explained that all the revised charters in fire district generally include environment before property.	
It was also mentioned that objective 10 can be removed from the plan update, as there are no more repetitive loss properties in Del Norte County.	

Item	Action

Stephen then brought up critical facilities and the definition used in the last plan. The steering committee reviewed the previous critical facilities definition and added hardware stores to the definition, as they are a key element of the general public when recovering after a disaster.

Geoff Antill brought up hazardous material definitions and what that specifically entails. Heidi Kunstal mentioned she has a list of hazardous material facilities in Del Norte County that she could review and submit to be updated in the plan, and weed out the more innocuous Tier II facilities.

Review critical facilities in handout, come prepared to add or edit critical facilities at next meeting.

Kymmie Scott and Laura Johnston talked about how the definition of critical facilities is completely up to the steering committee. Stephen Veith mentioned that any category of facilities added should have a database, either addresses or GIS coordinates ready available for inclusion into the Hazus model.

<u>Public Involvement Strategy</u>

Stephen Veith introduced a sample public survey template, so the steering committee could look over and edit as necessary. A summary of the edits are:

- Update relevant hazards, change references to Del Norte
- Update power sources so that there’s only electricity
- List door to door as a method of communication
- Question 4 edit – “Identify and Practice Tsunami Event Route”
- Question 5 edit – “Up to ten days”
- Question 9 edit – Change Nixle to Del Norte Community Alert
- Question 10 – add non-natural hazards for consistency
- Question 11 – Don’t use acronyms, explain the process more

Kymmie Scott wanted to add a question about asking the person how knowledgeable they are about hazards? This would allow Del Norte to gauge how much information they need to provide to the public and measure interest. Use a 5 point scale. Laura Johnston mentioned that this survey would be kept open throughout the planning process through the prioritization of mitigation actions, can use the interim reports during the planning process to incorporate responses.

Prepare website for public survey links.

Item	Action
Craig Bradford brought up possible future public outreach and booths, such as a Nov 11th Veteran's Day public booth or the Taste of the Holidays by the Rotary Club on November 4th.	Look into public booth spaces at upcoming events
<u>Action Items & Next Steps</u> Stephen Veith gave an update on the next steps, which includes reviewing the critical facilities handouts and making edits. Next meeting is also the steering committee cutoff date for submitting Letters of Intent to the planning team. The next meeting will be on October 19th from 1:00 to 3:00pm.	Submit Letter of Intent if not already done.

Meeting Adjourned at 2:34pm

Attachment: Sign-in Sheet

Del Norte County Multi-Jurisdiction HMP Meeting Sign In

Thursday, September 21st, 2017

Name	Title	Organization	Email
Stephen Veith	GIS Analyst	Tetra Tech	stephen.veith@tetratech.com
Charlie Helms	Harbormaster	Crescent City Harbor District	charlie@ccharbor.com
Geoff Antill	Proj. Administrator	Smith River Fire Protection	GANTILL@CHARTER.NET
Sam Rutledge	Board Of	Gasquet CSD	SAMCPA@HOTMAIL.COM
Eileen Rutledge	Sec/Treas	GCSD	EAR@charter.net
Craig Bradford	President / Board of Directors/Trustees Big	Big Rock CSD	craigsbradford@gmail.com
Margaret Caldwell	President/Board	Klamath CSD	klamathcsd@gmail.com
Rob Jacob	Environmental Coordinator	Elk-Valley Rancheria	RJACOB@ELK-VALLEY.COM
Chris Vaughan	General Manager	Smith River CSD	General.Manager@SRWater.net
Randy Hooper	Ast Director CDD	Del Norte Co.	rhooper@dnco.org

Kymmie Scott	Admin Analyst / City Clerk / PIO	City of Crescent City	kscott@crescentcity.org
Heidi Kunstal	Director – Community Dev. Dept. DNC	Del Norte Co.	hkunstal@co.del-norte.ca.us
James Weiland	BC	CCFCR	jweiland215@hotmail
Elaine Fallgren	SR Fire Board Chair / Alternate	Smith River Fire	SmithRiverFire9121@ ~~[illegible]~~ gmail.com

MEETING SUMMARY

Date/Time of Meeting:	Thursday – October 19th, 2017; 1:00pm to 3:00pm
Location:	Crescent FPD, 255 W Washington Blvd, Crescent City CA, 95531
Subject:	Steering Committee Meeting No. 4
Project Name:	Del Norte County Multi-Jurisdiction Hazard Mitigation Plan
In Attendance: **(See Attachment):**	Geoff Antill, Craig Bradford, Margaret Caldwell, Taylor Carsley, Cindy Henderson, Randy Hooper, Rob Jacob, Heidi Kunstal, Eileen Rutledge, Sam Rutledge, Kymmie Scott, Lane Tavasci, Chris Vaughan, Stephen Wakefield Phoned in: (None) **Planning Team:** Stephen Veith, Rob Flaner
Summary Prepared by:	Stephen Veith
Quorum – Yes or No	Yes

Item	Action
Meeting Started at 1:04pm	
<u>Welcome and Introductions, Review Agenda</u> • Kymmie Scott opened the meeting and facilitated group introductions. • Distributed handouts included: Agenda; Meeting #3 Minutes, 2010 HMP Critical Facilities Listing, Section 10 – Revised Critical Facility Definition, Section 7 – Plan Maintenance, Risk Assessment Update, Draft HMP Survey, SWOO Introduction, Phase 1 Annex Planning Instructions and Tsunami Inundation Boundaries (Crescent City) • The agenda was reviewed and no changes were made.	
<u>Planning Process</u> • The previous meeting minutes were confirmed after review by the steering committee.	
<u>Planning Partner Update</u> Stephen Veith talked about the Phase 1 update and instructions for completing the annex template. Individualized and updated templates would be sent out over the next week.	Fill out Phase 1 Annex Planning Templates and return to TetraTech

Item	Action
Lane Tavasci brought up a question about critical infrastructure inside a district that's owned by another and where should that fall under. If this occurs, a district should only list infrastructure that they own (for instance, if the city has electrical lines running through the Harbor District, that would fall under the city).	
Kymmie Scott and Geoff Antill asked about what happens if assets are overvalued. Rob Flaner explained that this is more a tool to help the district prioritize assets in mitigation actions.	Think about valuation of assets for Phase 1.
Rob Flaner also explained how the benefit cost analysis works during the Phase 1 analysis and how FEMA responds to our risk rankings. The State of California is looking for more robust action planning that ties into these risk rankings.	
<u>Plan Review</u>	
Mr. Veith opened the plan review section by discussing the tsunami scenario going to be used for the plan. The current combined tsunami model from USC generated in 2009 is still the standard used in California tsunami evacuation planning. The steering committee voted to confirm the scenario.	
Mr. Veith also talked about the sea-level rise scenario going to be used in the plan. Mr. Veith explained the standard sea level rise dataset used in planning is the NOAA SLR data, of which they have 6 scenarios, ranging from 1 to 6 feet. The steering committee discussed the scenarios and voted to use the NOAA data as long as two scenarios show the near and long-term effects.	
Mr. Veith talked about the critical facility updates and thanked Geoff and Kymmie for making edits to the original list. The critical facility database should be updated and complete in one to two months.	
The revised critical facility definition was looked over and was unanimously confirmed by the steering committee.	
There was much discussion about annual reporting and the plan maintenance strategy. Geoff Antill pointed out that it's pretty hard to get everyone together, even once a year to make changes. If annual reporting	

Item	Action
is going to happen, it will need to be simple and more of a tool for internal meetings. It was discussed that instead of annual updates and reviews of the plan, it would be better to use the HMP as a trigger for grant funding and to notify partner jurisdictions when grant funding becomes available. Cindy Henderson laid out an internal review process to look at grant funding, Del Norte OES can send out notices for grant opportunities and ask all of the partners who want to go in for a grant. Districts going after the same grant can form partnerships. Stephen will tweak chapter 7 to present at the next meeting.	Revise chapter 7 – plan maintenance strategy and think about internal review process moving forward.
Sam Rutledge had a question about CRS ratings and if any jurisdiction participates. Del Norte County and Crescent City currently do not participate in the CRS program, although it only applies to flooding, not tsunami or wildfire.	
<u>Public Involvement Strategy</u>	
The steering committee reviewed the revised public survey and had additional changes: • Question 10 – Add Prepare Del Norte, and separate email & text messaging • Question 2 – Put Severe Weather above None • Question 7 & 8 – Add Big Flat area • Question 4 – Add amateur radios • Question 13 – Reduce question to less wordy, remove email box but replace with links to current emergency services like Del Norte Community Alert, preparedelnorte.com	
Stephen asked Cindy Henderson about the website, and it is being worked on. Dan McCorkle has the space available. The website will link to the public survey and have other resources about the HMP process.	Prepare website for public survey links.
The steering committee voted to approve the public survey with the revisions made and to distribute.	
The steering committee discussed other public outreach events that could be attended. The Veteran's Day parade has space for a booth outside Veteran's Hall. Mr. Veith will plan to attend that day to distribute flyers, and out surveys and engage the public. Other opportunities would be the First	Look into public booth spaces at upcoming events

Item	Action
Friday in January, the tree lighting ceremony, etc. Stephen Wakefield talked about how we can piggyback our surveys and engagement with any public event, such as folding it in with an emergency preparedness drill day	

<u>Action Items & Next Steps</u>

Stephen Veith gave an update on the next steps, which includes a SWOO workshop and further annex templates. The SWOO session is done on a countywide scale and then jurisdictions can look at that to help in their annex planning. The next meeting will be on November 16th from 1:00 to 3:00pm.

Meeting Adjourned at 2:40pm

Del Norte County Multi-Jurisdiction HMP Meeting Sign In

Thursday, October 19th, 2017

Signature	Name	Title	Organization	Email
	Geoff Antill	Project Administrator	Smith River Fire Protection District	gantill@charter.net
	Craig Bradford	President / Board of Directors & Trustees	Big Rock CSD	craigsbradford@gmail.com
Margaret Caldwell	Margaret Caldwell	President / Board	Klamath CSD	klamathcsd@gmail.com
	Taylor Carsley	Planner	Del Norte County CDD	tcarsley@co.del-norte.ca.us
	Elaine Fallgren	SR Fire Board Chair	Smith River Fire Protection District	smithriverfire9121@gmail.com
LUNE TAVASCI ALT	Charlie Helms	Harbormaster	Crescent City Harbor District	charlie@ccharbor.com
	Cindy Henderson	Emergency Services Manager	Del Norte County OES	chenderson@dnco.org
	Randy Hooper	Assistant Director CDD	Del Norte County CDD	rhooper@dnco.org
	Rob Jacob	Environmental Coordinator	Elk Valley Rancheria	rjacob@elk-valley.com
	Vanessa Johnson	Administrative Assistant	Crescent Fire Protection District	vjohnson@ccfr.crescentcity.org

Heidi Kunstal	Heidi Kunstal	Director – CDD	DN Co. Community Development	hkunstal@co.del-norte.ca.us
Eileen Rutledge	Eileen Rutledge	Secretary / Treasurer	Gasquet CSD	ear@charter.net
[illegible]	Sam Rutledge	Board Director	Gasquet CSD	samcpa@hotmail.com
[illegible]	Kymmie Scott	Admin Analyst / City Clerk / PIO	City of Crescent City	kscott@crescentcity.org
	Crista Stewart	Director of Grants	Elk Valley Rancheria	cstewart@elk-valley.com
	Lane Tavasci	Deputy Harbormaster	Crescent City Harbor District	lane@ccharbor.com
	Heidi Valadao	EVR Council & Disaster.com Chair	Elk Valley Rancheria	hvaladao@elk-valley.com
[illegible]	Chris Vaughan	General Manager	Smith River CSD	general.manager@srwater.net
	Stephen Veith	GIS Analyst	Tetra Tech, EM Inc.	stephen.veith@tetratech.com
	James Weiland	Battalion Chief	Crescent Fire Protection District	jweiland215@hotmail.com
[illegible]	STEPHEN WAKEFIELD	FIRE CHIEF	CRESCENT FIRE PROTECTION DIST	CITYCHIEF51@GMAIL.COM

MEETING SUMMARY

Date/Time of Meeting:	Thursday – November 16th, 2017; 1:00pm to 3:00pm
Location:	Crescent FPD, 255 W Washington Blvd, Crescent City CA, 95531
Subject:	Steering Committee Meeting No. 5
Project Name:	Del Norte County Multi-Jurisdiction Hazard Mitigation Plan
In Attendance: **(See Attachment):**	Geoff Antill, Craig Bradford, Margaret Caldwell, Randy Hooper, Rob Jacob, Heidi Kunstal, Eileen Rutledge, Sam Rutledge, Kymmie Scott, Lane Tavasci, Heidi Valadao, Chris Vaughan, Stephen Wakefield Phoned in: (None) **Planning Team:** Stephen Veith, Rob Flaner
Summary Prepared by:	Stephen Veith
Quorum – Yes or No	Yes

Item	Action
Meeting Started at 1:04pm	
<u>Welcome and Introductions, Review Agenda</u>	
• Randy Hooper opened the meeting and facilitated group introductions.	
• Distributed handouts included: Agenda; Meeting #4 Summary, Phase 2 Annex Planning Instructions, Revised Plan Maintenance Strategy Chapter 7.3 and 7.4, Current Del Norte SurveyMonkey results and comments	
• The agenda was reviewed and no changes were made. The steering committee would like to receive the meeting summaries before the day of the meeting, so more time can be spent preparing questions.	Distribute & review Meeting Summaries before the meeting
<u>Planning Process</u>	
• The previous meeting minutes were confirmed after review by the steering committee.	
<u>Planning Partner Update</u>	
Stephen Veith talked about the Phase 2 update and instructions for completing the annex template. Individualized and updated templates will be sent out along with the previous Phase 1 responses. This will be in	

Item	Action
preparation of the Phase 3 Jurisdictional Annex Planning Workshop. There were no questions regarding the Phase 2 templates.	Review Phase 1 & 2 Annex Planning Templates and return to TetraTech by Phase 3 Workshop
<u>Plan Review</u>	
Stephen Veith talked about the current plan updates and asked the steering committee to approve two changes to the plan. The first one was that an older earthquake scenario was too far away from Del Norte County and not showing any significant impact, so it was to be replaced with the Big Lagoon – Bald Mountain earthquake scenario from the USGS. Kymmie Scott asked about if we're including any offshore faults into this plan, and Stephen answered that the Big Lagoon and Cascadia faults are both offshore.	
The second change was to change the critical facilities definition to include Elk Valley Rancheria facilities so that this plan will meet with current FEMA Tribal Planning requirements. Both changes were unanimously approved.	
Stephen Veith then brought up a review of the plan maintenance strategy that had been changed in the last meeting. The steering committee reviewed the plan, and Heidi Kunstal asked to change the terminology of one of the triggers to the update cycle. Instead of "comprehensive update", it should be changed to "20-year plan update" to avoid confusion.	
<u>Public Involvement Strategy</u>	
Stephen Veith gave an update on the public outreach strategy. The public outreach at the Veteran's Day Parade on Saturday, November 11th was a success. Stephen engaged with over 100 members of the public about the project, and 5 people filled out surveys at the booth.	
Other candidates for public outreach events such as the First Fridays will not likely happen. The steering committee does like the idea of creating a community preparedness event centered on the survey, risk assessment and useful tips for before, during and after natural disasters.	Think about other public outreach events to either piggyback off of or create.
Geoff Antill commented on the high number of responses that said they had CPR-Training in the county.	

Item	Action

Action Items & Next Steps

With time to spare, Stephen Veith started the Strengths / Weaknesses / Obstacles / Opportunities (SWOO) planning session for the remainder of the meeting. The SWOO session included looking at each hazard in the plan and discussing what advantages and disadvantages Del Norte County and its jurisdictions have when dealing with certain types of hazards, such as Tsunami, Earthquakes, Non-natural hazards (transportation / roadway spills), Floods and Dam Failure. The next meeting will be on January 18th from 1:00 to 3:00pm.

Meeting Adjourned at 2:32pm

Attachment: Sign-in Sheet

Del Norte County Multi-Jurisdiction HMP Meeting Sign In

Thursday, November 16th, 2017

Signature	Name	Title	Organization	Email
[illegible]	Geoff Antill	Project Administrator	Smith River Fire Protection District	gantill@charter.net
[illegible]	Craig Bradford	President / Board of Directors & Trustees	Big Rock CSD	craigsbradford@gmail.com
M Caldwell	Margaret Caldwell	President / Board	Klamath CSD	klamathcsd@gmail.com
	Taylor Carsley	Planner	Del Norte County CDD	tcarsley@co.del-norte.ca.us
	Elaine Fallgren	SR Fire Board Chair	Smith River Fire Protection District	smithriverfire9121@gmail.com
	Charlie Helms	Harbormaster	Crescent City Harbor District	charlie@ccharbor.com
	Cindy Henderson	Emergency Services Manager	Del Norte County OES	chenderson@dnco.org
[illegible]	Randy Hooper	Assistant Director CDD	Del Norte County CDD	rhooper@dnco.org
[illegible]	Rob Jacob	Environmental Coordinator	Elk Valley Rancheria	rjacob@elk-valley.com
	Vanessa Johnson	Administrative Assistant	Crescent Fire Protection District	vjohnson@ccfr.crescentcity.org

HK	Heidi Kunstal	Director – CDD	DN Co. Community Development	hkunstal@co.del-norte.ca.us
ER	Eileen Rutledge	Secretary / Treasurer	Gasquet CSD	rear1944nut@gmail.com ear@~~charter.net~~
SR	Sam Rutledge	Board Director	Gasquet CSD	samcpa@hotmail.com
	Kymmie Scott	Admin Analyst / City Clerk / PIO	City of Crescent City	kscott@crescentcity.org
	Crista Stewart	Director of Grants	Elk Valley Rancheria	cstewart@elk-valley.com
Lane Tavasci	Lane Tavasci	Deputy Harbormaster	Crescent City Harbor District	lane@ccharbor.com
Heidi Valadao	Heidi Valadao	EVR Council & Disaster.com Chair	Elk Valley Rancheria	hvaladao@elk-valley.com
	Chris Vaughan	General Manager	Smith River CSD	general.manager@srwater.net
	Stephen Veith	GIS Analyst	Tetra Tech, EM Inc.	stephen.veith@tetratech.com
SM Wakefield	Stephen Wakefield	Fire Chief	Crescent Fire Protection District	citychief51@gmail.com@hotmail.com
	James Weiland	Battalion Chief	Crescent Fire Protection District	jweiland215@hotmail.com

MEETING SUMMARY

Date/Time of Meeting:	Thursday – January 18th, 2018; 1:00pm to 3:00pm
Location:	Crescent FPD, 255 W Washington Blvd, Crescent City CA, 95531
Subject:	Steering Committee Meeting No. 6
Project Name:	Del Norte County Multi-Jurisdiction Hazard Mitigation Plan
In Attendance: **(See Attachment):**	Geoff Antill, Craig Bradford, Margaret Caldwell, Randy Hooper, Rob Jacob, Vanessa Johnson, Caitlin Smith, Heidi Kunstal, Eileen Rutledge, Sam Rutledge, Lane Tavasci, Eric Taylor, Chris Vaughan, Stephen Wakefield, Mike Morgan Phoned in: Kristen Gelino **Planning Team:** Stephen Veith, Rob Flaner, Cindy Henderson
Summary Prepared by:	Stephen Veith
Quorum – Yes or No	Yes

Item	Action
Meeting Started at 1:07pm	

Welcome and Introductions, Review Agenda

- Randy Hooper opened the meeting and facilitated group introductions.
- Distributed handouts included: Agenda; Meeting #5 Summary, Project Timeline, Risk Assessment Update, Public Survey Update Summary, Matching Grant Funds Sign-In Sheet
- The agenda was reviewed and no changes were made.
- No public comments

Planning Process

- The previous meeting minutes were confirmed after review by the steering committee.
- Stephen Veith went over the current project timeline and planning milestones ahead for the committee. The next objectives for the planning process is do initiate Phase 3 Action Planning and develop the review draft.
- Cindy Henderson talked about how time spent having meetings about the annex and HMP planning should be recorded in the distributed sign-

Item	Action
in sheets and turned in every month, so matching grant funds can be received.	Fill out HMP Grant Matching Sign In sheets when having meetings about the HMP and Annexes
Planning Partner Update	
Stephen Veith talked about the Phase 3 update and instructions for completing the annex template. Individualized and updated templates were sent out for Phase 1 and 2 and should be looked over and returned to the planning team by the next steering committee meeting, February 15th.	
Kristen Gelino of Tetra Tech called in during the meeting and wanted to know if anybody had questions about the Phase 1 or 2 annex templates. She can be reached at Kristen.gelino@tetratech.com for any additional annex template help.	If you have questions about the annex templates (Phase 1/2/3), let the planning team know
Rob Flaner talked about the upcoming Phase 3 action plan development. He mentioned that FEMA is starting to get very picky about this, so it's important to include other helpful input when developing action plans, such as from public works personnel.	
Plan Review	
Stephen Veith put the risk assessment matrix up on the screens and talked about the analysis results for every hazard. These included results for tsunami, earthquake, flood, wildfire, dam inundation, landslide, and sea level rise.	Review risk assessment results for accuracy and congruency
Margaret Caldwell asked about the source of the population and building data and where it came from. Stephen answered that the building data is from 2017 Del Norte County Assessor's Data and the population info is from 2017 California Department of Finance estimates distributed based on 2010 Census divisions and residential building locations. Geoff Antill asked about the flood results for Smith River, more specifically the difference between the 100 year and 500 year results, which showed 6 more buildings in the Smith River planning unit flood zone, but accounted for $25 million more exposure. Stephen said he would look into why the amount was so much.	
When discussing the earthquake results, Geoff Antill brought up the point that when presenting the impacts in the plan, other secondary impacts	

Item	Action
should be considered (for instance, that the ground shaking from Cascadia is only one aspect of the earthquake, landslide and tsunami impacts are also likely).	
Rob Flaner talked about the next step for this plan, once a draft is complete, is the public comment period. This could be either 14 or 30 days depending on whether the steering committee wants to apply for either a categorically exempt status or mitigated negative declaration to comply with the California Environmental Quality Act (CEQA). Either process has its benefits and drawbacks, and Randy Hooper mentioned that this would probably need to be run through council before deciding on a final plan. Rob Flaner would provide examples for the steering committee to review.	Distribute guidelines and examples of other California plans that complied with CEQA to steering committee
<u>Public Involvement Strategy</u>	
Stephen Veith gave an update on the public outreach strategy and survey results. Before this steering committee, Stephen went to a Rotary Club meeting and gave a presentation about the Hazard Mitigation Planning Process. Approximately 18 people filled out surveys on the spot which Stephen will enter the results manually into the online survey.	
Stephen talked about the website update, and while the survey link does appear on the Del Norte homepage, a dedicated page still does not exist. A dedicated webpage will be a necessity before the public comment period.	Stephen will ask Dan McCorkle about the webpage after this steering committee meeting.
<u>Action Items & Next Steps</u>	
Craig Bradford announced that Big Rock CSD has a website that will have the entire FEMA approved plan for review and inclusion into this plan.	
The next meeting will be on February 15th from 1:00 to 3:00pm in the same location and it is mandatory that every planning partner have at least one representative.	
Meeting Adjourned at 2:15pm	

Attachment: Sign-in Sheet

Del Norte County Multi-Jurisdiction HMP Meeting Sign In

Thursday, January 18th, 2018

Signature	Name	Title	Organization	Email
	Geoff Antill	Project Administrator	Smith River Fire Protection District	gantill@charter.net
	Craig Bradford	President / Board of Directors & Trustees	Big Rock CSD	craigsbradford@gmail.com
M Caldwell	Margaret Caldwell	President / Board	Klamath CSD	klamathcsd@gmail.com
	Taylor Carsley	Planner	Del Norte County CDD	tcarsley@co.del-norte.ca.us
	Elaine Fallgren	SR Fire Board Chair	Smith River Fire Protection District	smithriverfire9121@gmail.com
	Charlie Helms	Harbormaster	Crescent City Harbor District	charlie@ccharbor.com
	Cindy Henderson	Emergency Services Manager	Del Norte County OES	chenderson@dnco.org
	Randy Hooper	Assistant Director CDD	Del Norte County CDD	rhooper@dnco.org
	Rob Jacob	Environmental Coordinator	Elk Valley Rancheria	rjacob@elk-valley.com
Vanessa Johnson	Vanessa Johnson	Administrative Assistant	Crescent Fire Protection District	vjohnson@ccfr.crescentcity.org
Caitlin M. Smith	Caitlin Smith	Emergency Manager	Elk Valley Rancheria	csmith@Elk-Valley.com

	Heidi Kunstal	Director – CDD	DN Co. Community Development	hkunstal@co.del-norte.ca.us
	Eileen Rutledge	Secretary / Treasurer	Gasquet CSD	ear@charter.net
	Sam Rutledge	Board Director	Gasquet CSD	samcpa@hotmail.com
	Jay Sarina	County Admin Officer	Del Norte County OES	jsarina@co.del-norte.ca.us
	Kymmie Scott	Admin Analyst / City Clerk / PIO	City of Crescent City	kscott@crescentcity.org
	Crista Stewart	Director of Grants	Elk Valley Rancheria	cstewart@elk-valley.com
	Lane Tavasci	Deputy Harbormaster	Crescent City Harbor District	lane@ccharbor.com
	Eric Taylor	Planner	City of Crescent City	etaylor@crescentcity.org
	Heidi Valadao	EVR Council & Disaster.com Chair	Elk Valley Rancheria	hvaladao@elk-valley.com
	Chris Vaughan	General Manager	Smith River CSD	general.manager@srwater.net
	Stephen Veith	GIS Analyst	Tetra Tech, EM Inc.	stephen.veith@tetratech.com
	Stephen Wakefield	Fire Chief	Crescent Fire Protection District	citychief51@gmail.com@hotmail.com
	Mike Morgan	Gasquet CSD GM	Gasquet CSD	mjmorgan[illegible]@Gmail.com

MEETING SUMMARY

Date/Time of Meeting:	Thursday – February 15th, 2018; 1:00pm to 3:00pm
Location:	Crescent FPD, 255 W Washington Blvd, Crescent City CA, 95531
Subject:	Steering Committee Meeting No. 7
Project Name:	Del Norte County Multi-Jurisdiction Hazard Mitigation Plan
In Attendance: **(See Attachment):**	Craig Bradford, Margaret Caldwell, Elaine Fallgren, Charlie Helms, Randy Hooper, Rob Jacob, Vanessa Duncan, Heidi Kunstal, Mike Morgan, Eileen Rutledge, Sam Rutledge, Jay Sarina, Lane Tavasci, Eric Taylor, Chris Vaughan, James Weiland Phoned in: (None) **Planning Team:** Stephen Veith, Rob Flaner
Summary Prepared by:	Stephen Veith
Quorum – Yes or No	Yes

Item	Action
Meeting Started at 1:13pm	

<u>Welcome and Introductions, Review Agenda</u>

- Randy Hooper opened the meeting.
- Distributed handouts included: Agenda; Meeting #6 Summary, Phase 3 Toolkit Instructions/Handout
- The agenda was reviewed and no changes were made.
- No public comments

<u>Planning Process</u>

- The previous meeting minutes were unanimously confirmed after review by the steering committee.

<u>Jurisdictional Annex Process</u>

Rob Flaner from the Tetra Tech, Inc Planning Team started the Phase 3 presentation that covered the final portion of the Jurisdictional Annex planning process.

Item	Action
Rob congratulated everyone for earnestly working on the Phase 1 and 2 templates and getting them turned into Tetra Tech. The toolkit for completing your Phase 3 annexes will be ready by close of business February 23rd. This toolkit contains everything you need to complete the Phase 3 process. The toolkit will have the combined Phase 1/2 revisions. Please review these and let us know if the changes are acceptable. The end goal of Phase 3 is to have a clearly defined action plan matrix that FEMA will approve. To get to this end state, jurisdictions will need to keep a couple things in mind when filling out their templates. Some of these questions include, “Has there been any events since 2010 where I had to activate my EOC?”, and “Do I have any actions from the last plan that are completed or no longer relevant?” Examples of generating these actions starts with a general problem statement like, “What worries me the most in my jurisdiction?”; they might be things that are not captured in the Hazus modeling process, such as trees falling on water tanks. Rob then explained the risk ranking exercise included in the toolkit, which has been done for each jurisdiction. These risk rankings are based off of primary causes, not secondary causes (such as a landslide itself, not if it then knocks out power lines). These risk rankings are important for action planning, and are calculated through probability, exposure and impacts where available. If a jurisdiction had previous plan actions, they should review them to cut out any “dead wood”. These can be actions that are no longer feasible, or if you have no idea where it came from. Actions that contain phrases such as “consider” or “where appropriate” should be removed from the action plan, or replaced with more direct language. FEMA requires that each jurisdiction generate an action for each hazard that has a “high” risk ranking. These should also be new actions, not just old actions carried over from the last plan. Keep in mind these actions should be measurable and trackable. They should be concise, yet have enough detail to show how that action is mitigating a specific problem.	

Item	Action
Cities and counties should also look for other resources and partners when generating these actions, as multi-jurisdictional projects show initiative and cooperation needed to make a mitigation project successful.	
Rob also talked about your capability assessment (completed in Phase 2) should inform your action planning. Perhaps an action could be to develop a capability the jurisdiction did not have before. As always, make sure to tie actions back to the goals and objectives the steering committee decided on at the start of the planning process.	
Craig Bradford talked about putting together a workshop for grant funding opportunities to show other jurisdictions in the county how to acquire grants for these mitigation projects. Feasibility is a key component of receiving grants.	
Rob Flaner talked about how each of these actions will also be looked at in a benefit/cost capacity. These actions can range from low to high priority, but might have a different ranking in the feasibility of a project. If you can use your leverage for projects that are already scheduled, but grants would free up other money to be used in a CIP, so much the better.	If you have questions about the annex templates (Phase 1/2/3), let the planning team know
<u>Action Items & Next Steps</u>	
These phase 3 templates will have a deadline of March 30th. Please review and complete them by then. Remember to fill out the HMP Grant Matching sheets when working on your annexes.	Fill out HMP Grant Matching Sign In sheets when having meetings about the HMP and Annexes
The next meeting will be on April 19th from 1:00 to 3:00pm in the same location.	

Meeting Adjourned at 3:19pm

MEETING SUMMARY

Attachment: Sign-in Sheet

Del Norte County Multi-Jurisdiction HMP Meeting Sign In

Thursday, February 18th, 2018

Signature	Name	Title	Organization	Email
	Geoff Antill	Project Administrator	Smith River Fire Protection District	gantill@charter.net
	Craig Bradford	President / Board of Directors & Trustees	Big Rock CSD	craigsbradford@gmail.com
Margaret Caldwell	Margaret Caldwell	President / Board	Klamath CSD	klamathcsd@gmail.com
	Taylor Carsley	Planner	Del Norte County CDD	tcarsley@co.del-norte.ca.us
Elaine Fallgren	Elaine Fallgren	SR Fire Board Chair	Smith River Fire Protection District	smithriverfire9121@gmail.com
	Charlie Helms	Harbormaster	Crescent City Harbor District	charlie@ccharbor.com
	Cindy Henderson	Emergency Services Manager	Del Norte County OES	chenderson@dnco.org
	Randy Hooper	Assistant Director CDD	Del Norte County CDD	rhooper@dnco.org
Rob Jacob	Rob Jacob	Environmental Coordinator	Elk Valley Rancheria	rjacob@elk-valley.com
Vanessa Duncan	Vanessa ~~Johnson~~ DUNCAN	Administrative Assistant	Crescent Fire Protection District	vjohnson@ccfr.crescentcity.org
Heidi Kunstal	Heidi Kunstal	Director – CDD	DN Co. Community Development	hkunstal@co.del-norte.ca.us

	Mike Morgan	General Manager	Gasquet CSD	mjmorgan2@gmail.com
Eileen Rutledge	Eileen Rutledge	Secretary / Treasurer	Gasquet CSD	ear1944rut@charter.net
	Sam Rutledge	Board Director	Gasquet CSD	samcpa@hotmail.com
	Jay Sarina	County Admin Officer	Del Norte County OES	jsarina@co.del-norte.ca.us
	Caitlin Smith	Emergency Manager	Elk Valley Rancheria	csmith@elk-valley.com
	Crista Stewart	Director of Grants	Elk Valley Rancheria	cstewart@elk-valley.com
	Lane Tavasci	Deputy Harbormaster	Crescent City Harbor District	lane@ccharbor.com
	Eric Taylor	Planner	City of Crescent City	etaylor@crescentcity.org
	Heidi Valadao	EVR Council & Disaster.com Chair	Elk Valley Rancheria	hvaladao@elk-valley.com
	Chris Vaughan	General Manager	Smith River CSD	general.manager@srwater.net
	Stephen Veith	GIS Analyst	Tetra Tech, EM Inc.	stephen.veith@tetratech.com
	James Weiland	Battalion Chief	Crescent Fire Protection District	Jweiland215@hotmail.com

MEETING SUMMARY

Date/Time of Meeting:	Thursday – April 19th, 2018; 1:00pm to 3:00pm
Location:	Crescent FPD, 255 W Washington Blvd, Crescent City CA, 95531
Subject:	Steering Committee Meeting No. 8
Project Name:	Del Norte County Multi-Jurisdiction Hazard Mitigation Plan
In Attendance: **(See Attachment):**	Geoff Antill, Craig Bradford, Margaret Caldwell, Bill Gillespie, Randy Hooper, Rob Jacob, Vanessa Duncan, Heidi Kunstal, Valerie Machado, Mike Morgan, Eileen Rutledge, Sam Rutledge, Caitlin Smith, Lane Tavasci, Eric Taylor, Chris Vaughan Phoned in: (None) **Planning Team:** Stephen Veith, Cindy Henderson
Summary Prepared by:	Stephen Veith
Quorum – Yes or No	Yes

Item	Action

Meeting Started at 1:03pm

Welcome and Introductions, Review Agenda

- Randy Hooper opened the meeting.
- Distributed handouts included: Agenda; Meeting #7 Summary, Revised Plan Maintenance Strategy, Draft HMP Volume 1 Internal Review Instructions
- The agenda was reviewed and no changes were made.
- No public comments

Planning Process

- The previous meeting minutes were unanimously confirmed after review by the steering committee.

Plan Review

Stephen Veith started talking about a couple loose ends to tie up before moving on to a completed Volume 1 Draft. The first of which was addressing additional items in the plan maintenance strategy, such as public involvement. In the previous discussion about the Plan Maintenance

Item	Action
strategy, there was no public involvement component, however there needs to be one to have a complete plan. Heidi Kunstal suggested that every year an update could occur during the Del Norte Board of Supervisors meeting, to review the plan, go over any hazards that occurred in the past year and solicit public comments. Rob Jacob also floated the idea of tying in public engagement with the Hazard Mitigation Plan into Del Norte Tsunami Anniversary events; Cindy Henderson mentioned that the Hazard Mitigation Plan could also be a part of well-attended annual events like the Community Health Fair.	
Lane Tavasci asked about the public website for the plan. The public website is live and accessible at http://www.co.del-norte.ca.us/hmp. This website will be the main repository for plan information, FAQ's, documents and feedback. A couple other odds and ends were asked to the Del Norte and Crescent City planners, such as if hazard information is accessible to the public and complies with Real Estate Disclosure laws. Randy Hooper noted that while there's isn't a dedicated website, that information is provided to those who ask for it at the County.	Visit the plan website and submit any comments to Stephen. Past meeting minutes are also available on the website.
Jurisdictional Annex Process Geoff Antill asked about updating their Phase 3 to include action items they didn't think of. Stephen responded that the Phase 3's can still be edited and added to, but that any changes before the public review draft will need to be submitted soon, ideally by next Monday, April 23rd. Stephen said that the Phase 3 process is wrapping up, and that most everyone's Phase 3 has been submitted and thanked everyone for all the hard work that they've put into this process.	
Public Involvement Strategy Stephen Veith reiterated that the website for the planning project is live and available. All of the steering committee members are encouraged to link to this website through their own jurisdictions.	Link to the HMP website on each planning partner's own website.

Item	Action
There have been 287 responses to the Hazard Mitigation Survey so far. Stephen thanked Elk Valley Rancheria and Klamath CSD for distributing paper copies of the survey to their members for input.	Review Volume 1 of the HMP and submit comments to Stephen / Planning Team by April 30th
The steering committee decided to go forward with a categorical exemption to the CEQA requirements of the plan, rather than an Initial Study-Mitigated/ Negative Declaration. This will entail having a 14-day public comment period. Many of planning partners liked the language of the Statutorily Exempt Article 18, Section 15262. Stephen will send Eric Taylor an additional list of other CEQA exemptions to look over.	
With the departure of Kymmie Scott from the Steering Committee, Jay Sarina has volunteered to take over the Public Information Officer duties on this project. The Steering Committee also welcomed Bill Gillespie, Interim Fire Chief, to the steering committee, representing Crescent Fire Protection District.	
As part of the public comment period, there will need to be meetings with the opportunity for public input. The steering committee decided to start the public comment period on May 8th, 2018 and present the HMP project first at the Crescent City Council meeting on Monday, May 7th at 5:00pm and the next at the Del Norte County Board of Supervisors meeting on Tuesday, May 8th at 10:00am in the Flynn Administrative Center at 981 H Street, Crescent City. Randy Hooper has volunteered to give the presentations. Stephen will send out a prepared PowerPoint presentation and press releases.	Review public presentations and press releases.
<u>Action Items & Next Steps</u>	
Valerie Machado talked about the in-kind match process for this Hazard Mitigation Plan and noted that the project requires at least $44,000 of match which is not being met at the moment. Planning partners are encouraged to fill out timesheets for when they worked on this project retroactively, as well as submit letters from a jurisdiction's payroll department if the person who worked on the project is paid at a higher rate than the standard volunteer rate of $23 an hour. These timesheets should also be signed at the bottom. Please send any timesheets to Stephen, Valerie, Cindy, Jay or another member of the planning team.	Make sure all time spent working on this project (meetings, Phase 1/2/3 annexes, etc.) are recorded and submitted.

Item	Action
Any planning partner who has not submitted their completed Jurisdictional Annex phases should please do so as soon as possible to be incorporated into the public review draft. The Volume 1 internal review draft comments should be submitted to Stephen or another member of the planning team by end of day on April 30th. Remember to fill out the HMP Grant Matching sheets when working on your annexes. The next and likely final meeting will be on May 31st from 1:00 to 3:00pm in the same location.	

Meeting Adjourned at 2:05pm

Attachment: Sign-in Sheet

Del Norte County Multi-Jurisdiction HMP Meeting Sign In

Thursday, April 19th, 2018

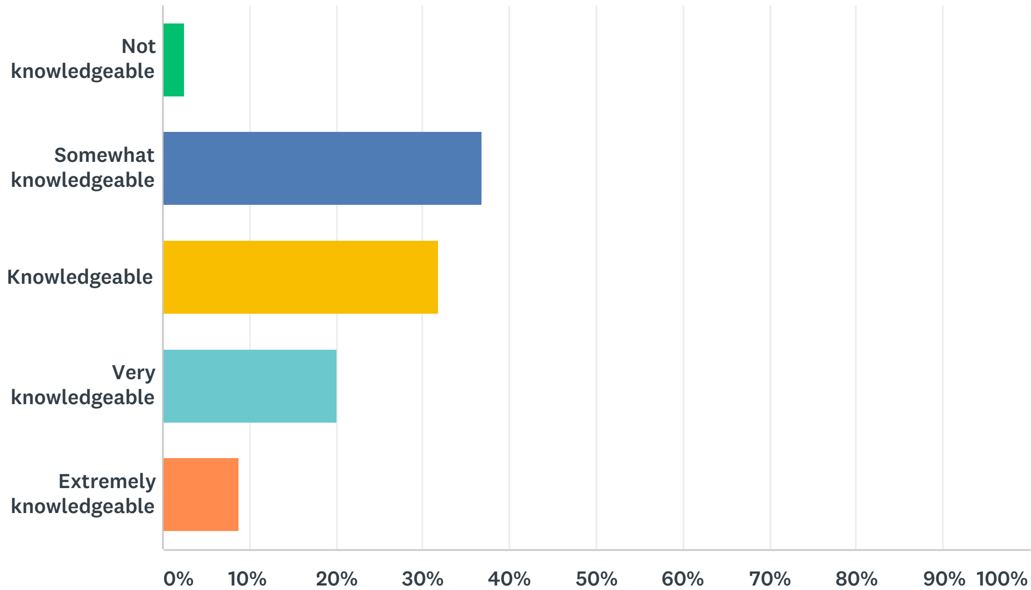
Signature	Name	Title	Organization	Email
[signature]	Geoff Antill	Project Administrator	Smith River Fire Protection District	gantill@charter.net
[signature]	Craig Bradford	President / Board of Directors & Trustees	Big Rock CSD	craigsbradford@gmail.com
Margaret Caldwell	Margaret Caldwell	President / Board	Klamath CSD	klamathcsd@gmail.com
	Taylor Carsley	Planner	Del Norte County CDD	tcarsley@co.del-norte.ca.us
	Elaine Fallgren	SR Fire Board Chair	Smith River Fire Protection District	smithriverfire9121@gmail.com
See back	Bill Gillespie	Interim Fire Chief	Crescent Fire Protection District	bgillespie@crescentcity.org
	Charlie Helms	Harbormaster	Crescent City Harbor District	charlie@ccharbor.com
[signature]	Cindy Henderson	Emergency Services Manager	Del Norte County OES	chenderson@dnco.org
[signature]	Randy Hooper	Assistant Director CDD	Del Norte County CDD	rhooper@dnco.org
[signature]	Rob Jacob	Environmental Coordinator	Elk Valley Rancheria	rjacob@elk-valley.com
Vanessa Duncan	Vanessa Duncan	Administrative Assistant	Crescent Fire Protection District	vduncan@crescentcity.org

	Heidi Kunstal	Director – CDD	DN Co. Community Development	hkunstal@co.del-norte.ca.us
	Mike Morgan	General Manager	Gasquet CSD	mjmorgan2@gmail.com
	Eileen Rutledge	Secretary / Treasurer	Gasquet CSD	ear1944rut@charter.net
	Sam Rutledge	Board Director	Gasquet CSD	samcpa@hotmail.com
	Jay Sarina	County Admin Officer	Del Norte County OES	jsarina@co.del-norte.ca.us
	Caitlin Smith	Emergency Manager	Elk Valley Rancheria	csmith@elk-valley.com
	Crista Stewart	Director of Grants	Elk Valley Rancheria	cstewart@elk-valley.com
	Lane Tavasci	Deputy Harbormaster	Crescent City Harbor District	lane@ccharbor.com
	Eric Taylor	Planner	City of Crescent City	etaylor@crescentcity.org
	Heidi Valadao	EVR Council & Disaster.com Chair	Elk Valley Rancheria	hvaladao@elk-valley.com
	Chris Vaughan	General Manager	Smith River CSD	general.manager@srwater.net
	Stephen Veith	GIS Analyst	Tetra Tech, EM Inc.	stephen.veith@tetratech.com
	Valerie Machado	Admin Analyst	DN co	vmachado@co.del-norte.ca.us
	Bill Gillespie	Interim Fire Chief	Crescent City Fire & Rescue	bgillespie@crescentcity.org

SURVEY RESULTS

Q1 How knowledgeable would you rate yourself on natural hazards?

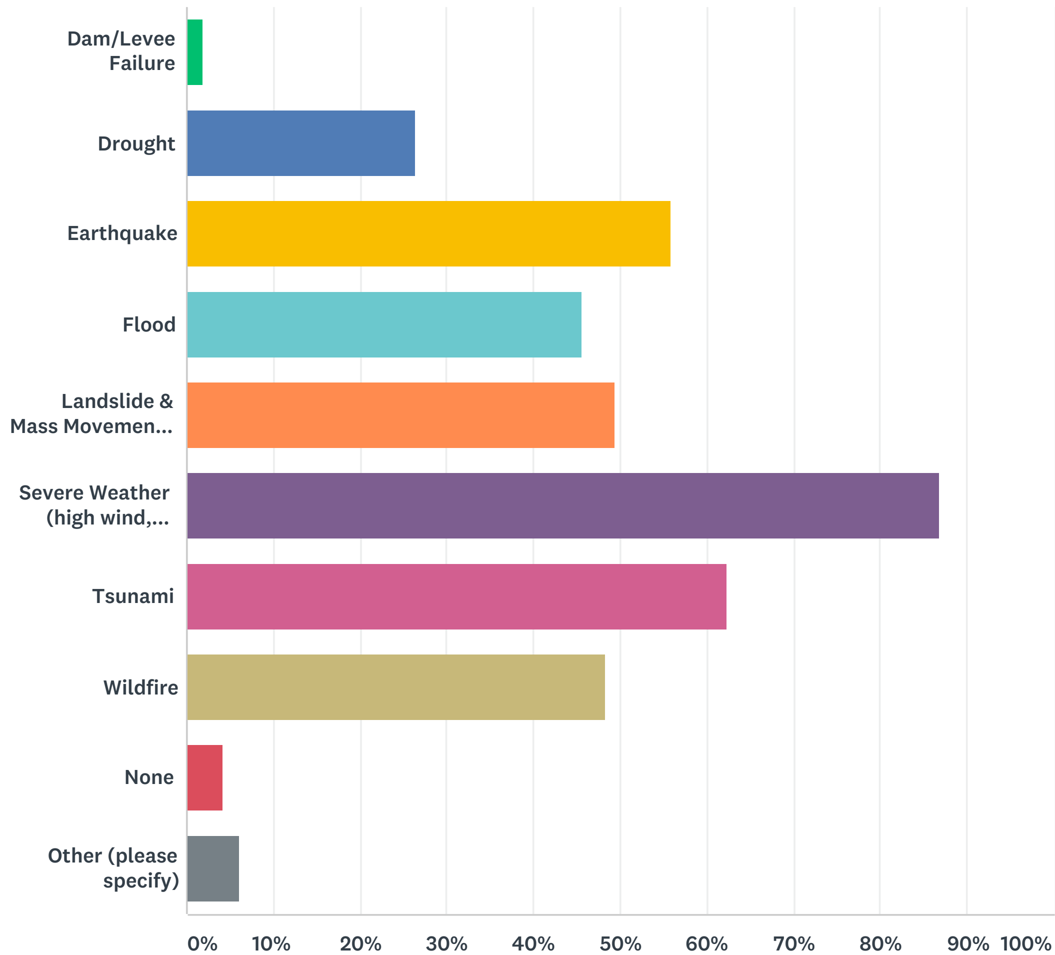
Answered: 283 Skipped: 7



ANSWER CHOICES	RESPONSES	
Not knowledgeable	2.47%	7
Somewhat knowledgeable	36.75%	104
Knowledgeable	31.80%	90
Very knowledgeable	20.14%	57
Extremely knowledgeable	8.83%	25
TOTAL		283

Q2 Which of the following natural hazard events have you experienced in the Del Norte County? (Check all that apply)

Answered: 281   Skipped: 9

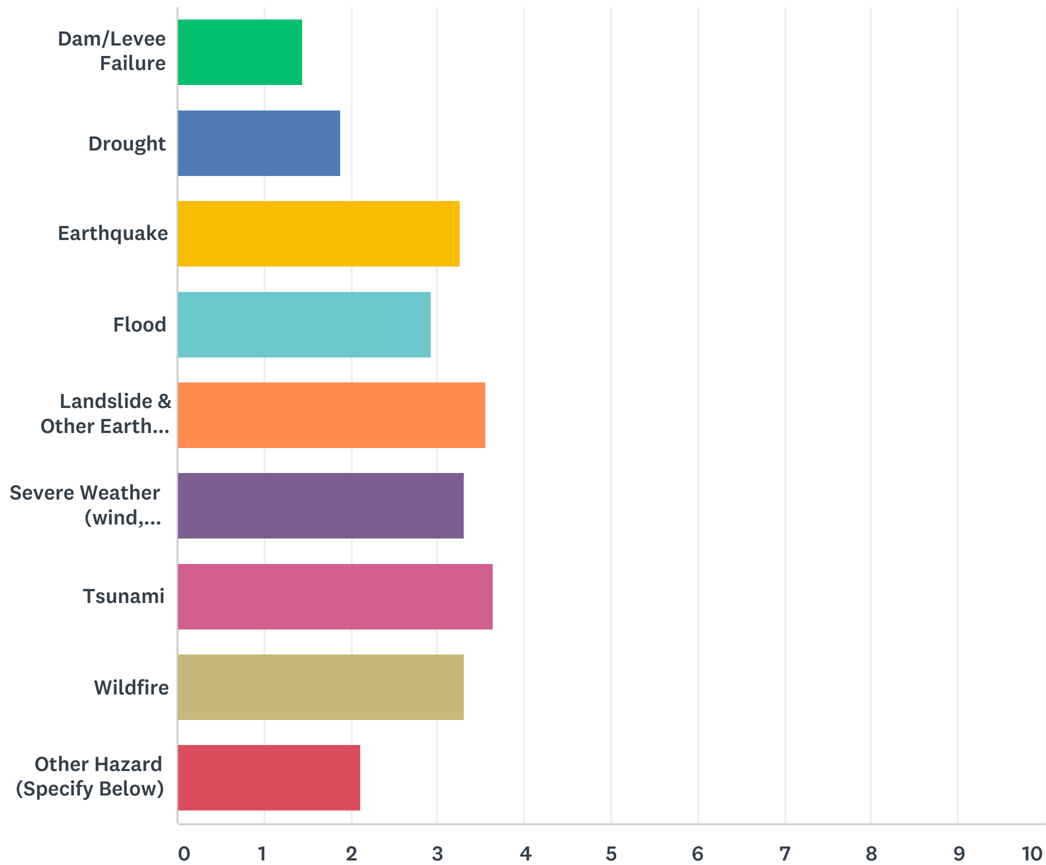


ANSWER CHOICES	RESPONSES	
Dam/Levee Failure	1.78%	5
Drought	26.33%	74
Earthquake	55.87%	157
Flood	45.55%	128
Landslide & Mass Movements (sinkholes, geologic hazards)	49.47%	139
Severe Weather (high wind, heavy rain, lightning, etc.)	86.83%	244
Tsunami	62.28%	175
Wildfire	48.40%	136
None	4.27%	12
Other (please specify)	6.05%	17

Total Respondents: 281	

Q3 How concerned are you about the following natural hazards in Del Norte County? (Please check one for each hazard)

Answered: 278 Skipped: 12

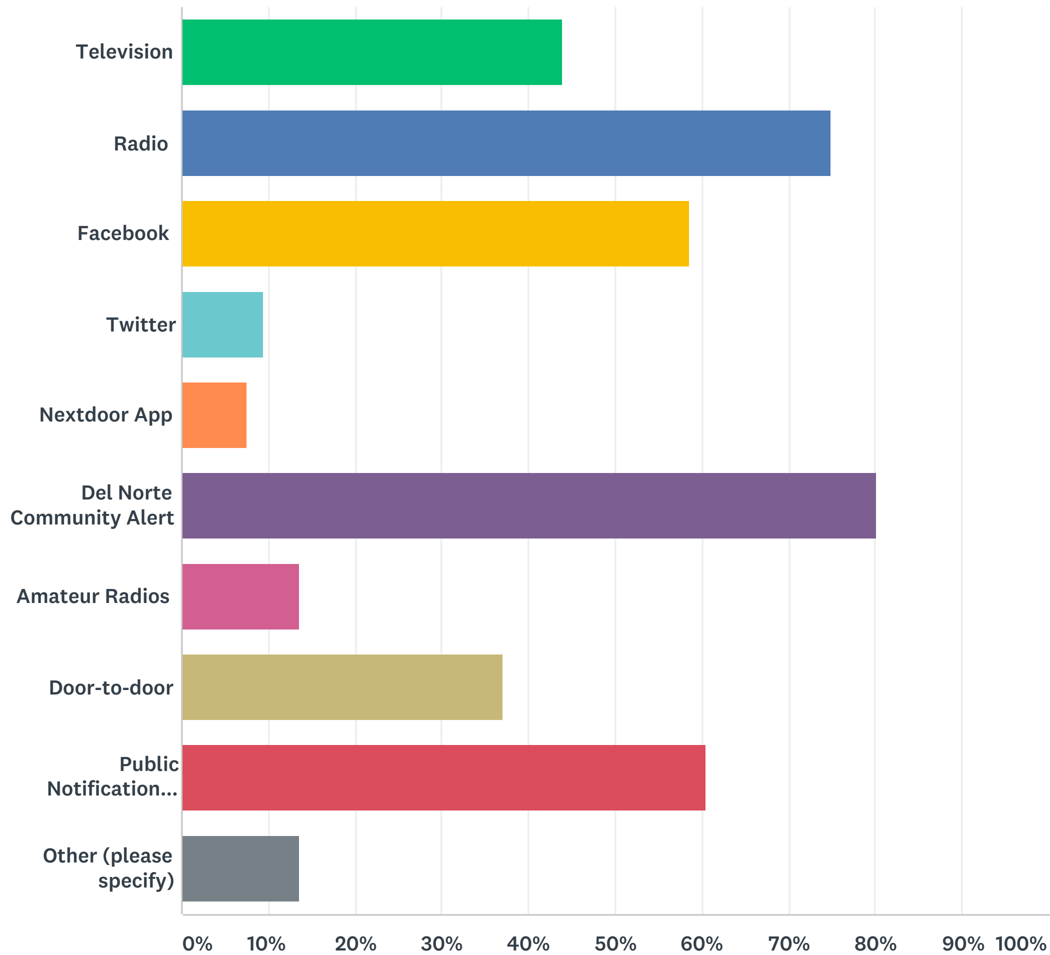


	NOT CONCERNED	SOMEWHAT CONCERNED	CONCERNED	VERY CONCERNED	EXTREMELY CONCERNED	TOTAL	WEIGHTED AVERAGE
Dam/Levee Failure	72.80% 190	14.56% 38	9.20% 24	1.53% 4	1.92% 5	261	1.45
Drought	42.48% 113	36.09% 96	13.91% 37	4.89% 13	2.63% 7	266	1.89
Earthquake	6.69% 18	20.45% 55	30.86% 83	24.54% 66	17.47% 47	269	3.26
Flood	10.33% 28	25.83% 70	32.10% 87	23.62% 64	8.12% 22	271	2.93
Landslide & Other Earth Movements (sinkholes,geologic hazard)	4.36% 12	16.00% 44	24.36% 67	30.55% 84	24.73% 68	275	3.55
Severe Weather (wind, lightning, fog, heavy rains, solar flare, etc.)	7.75% 21	16.61% 45	27.68% 75	33.95% 92	14.02% 38	271	3.30
Tsunami	5.07% 14	13.41% 37	23.19% 64	30.43% 84	27.90% 77	276	3.63

Wildfire	6.77% 18	16.92% 45	30.45% 81	30.83% 82	15.04% 40	266	3.30
Other Hazard (Specify Below)	54.22% 45	13.25% 11	13.25% 11	6.02% 5	13.25% 11	83	2.11

Q4 How would you expect to be notified in case of an immediate threat caused by a local hazard.Select all that apply.

Answered: 278 Skipped: 12

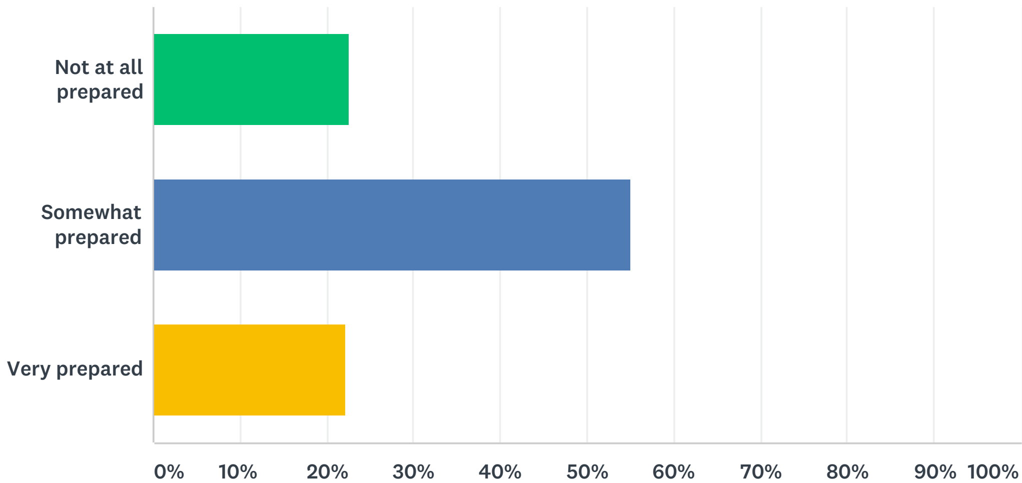


ANSWER CHOICES	RESPONSES	
Television	43.88%	122
Radio	74.82%	208
Facebook	58.63%	163
Twitter	9.35%	26
Nextdoor App	7.55%	21
Del Norte Community Alert	80.22%	223
Amateur Radios	13.67%	38
Door-to-door	37.05%	103
Public Notification System	60.43%	168
Other (please specify)	13.67%	38

Total Respondents: 278	

Q5 How prepared is your household to get along without electricity for up to ten days? (Select one)

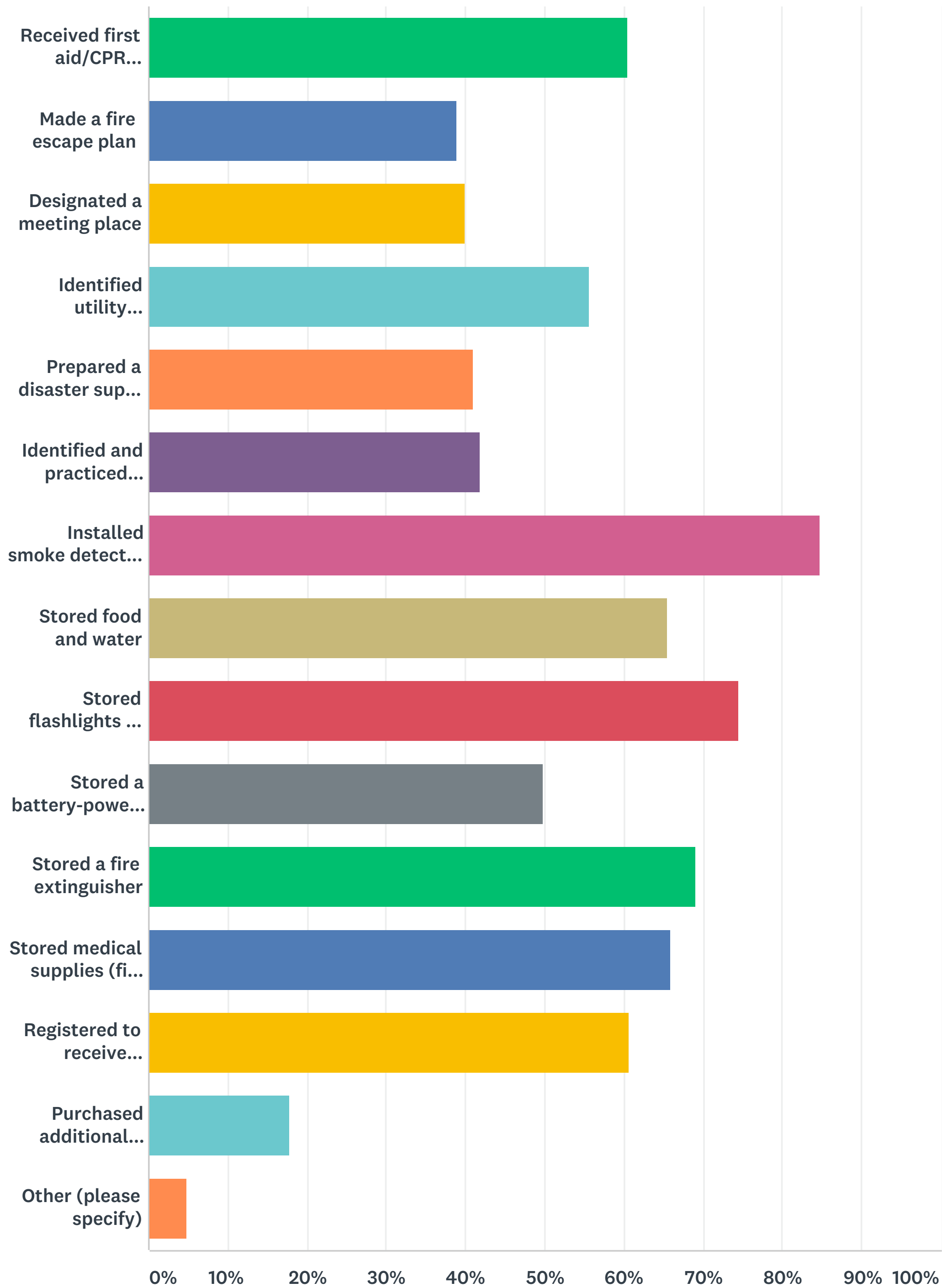
Answered: 274 Skipped: 16



ANSWER CHOICES	RESPONSES	
Not at all prepared	22.63%	62
Somewhat prepared	55.11%	151
Very prepared	22.26%	61
TOTAL		274

Q6 Which of the following steps has your household taken to prepare for a local hazard event? (Check all that apply)

Answered: 275 Skipped: 15

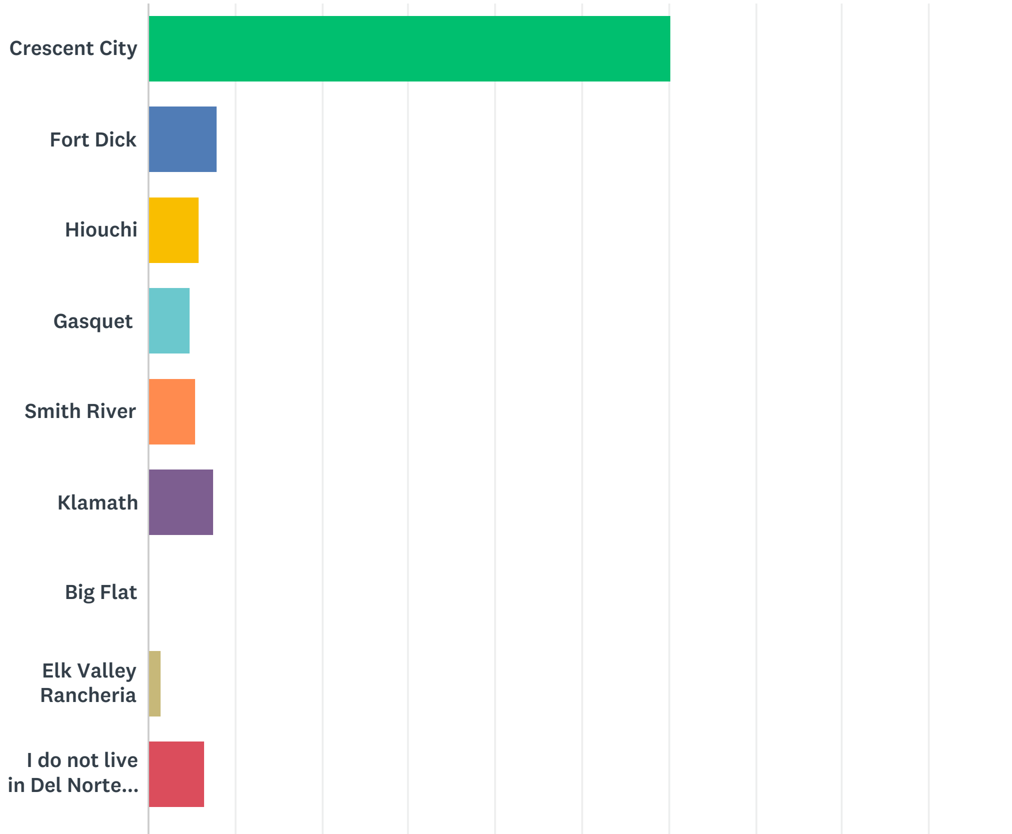


ANSWER CHOICES	RESPONSES	
Received first aid/CPR training	60.36%	166
Made a fire escape plan	38.91%	107

Designated a meeting place	40.00%	110
Identified utility shutoffs	55.64%	153
Prepared a disaster supply kit	41.09%	113
Identified and practiced tsunami evacuation route	41.82%	115
Installed smoke detectors on each level of the house	84.73%	233
Stored food and water	65.45%	180
Stored flashlights and batteries	74.55%	205
Stored a battery-powered radio	49.82%	137
Stored a fire extinguisher	69.09%	190
Stored medical supplies (first aid kit, medications)	65.82%	181
Registered to receive emergency alerts	60.73%	167
Purchased additional Insurance	17.82%	49
Other (please specify)	4.73%	13
Total Respondents: 275		

Q7 Where do you live?

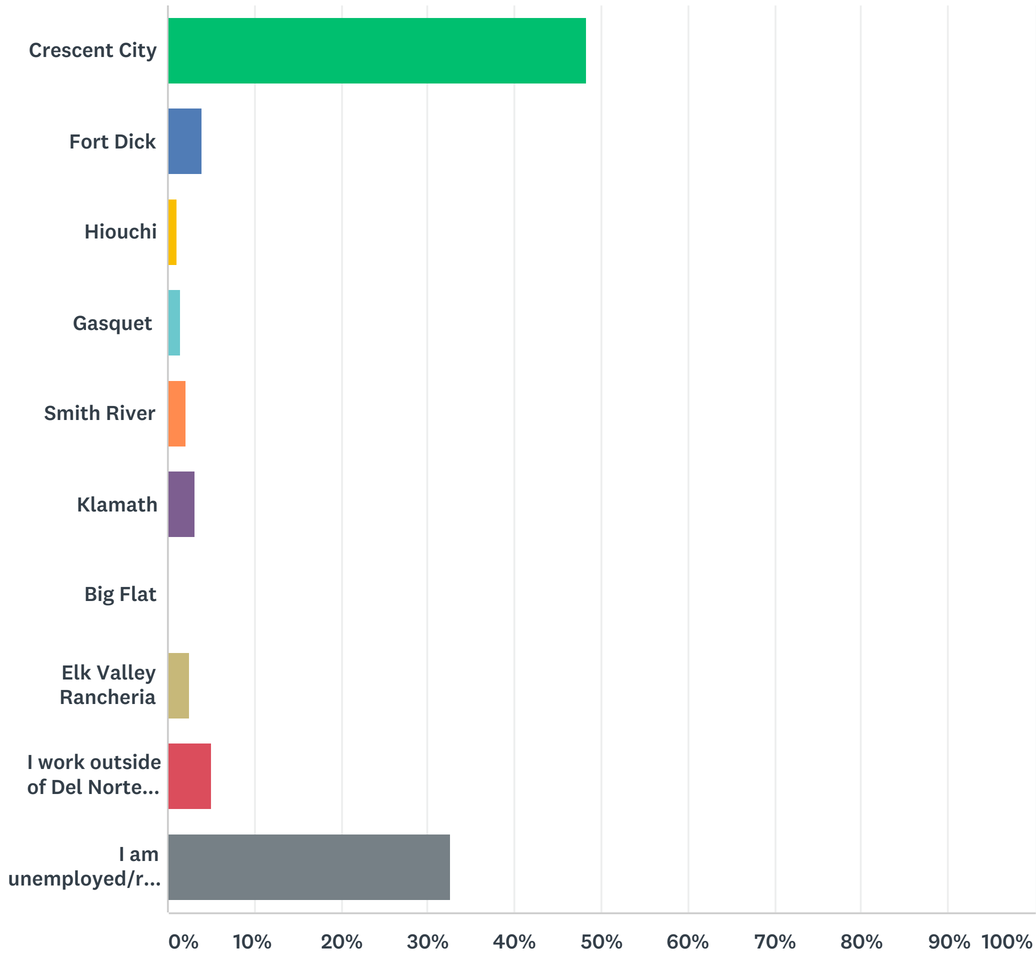
Answered: 290 Skipped: 0



ANSWER CHOICES	RESPONSES	
Crescent City	60.34%	175
Fort Dick	7.93%	23
Hiouchi	5.86%	17
Gasquet	4.83%	14
Smith River	5.52%	16
Klamath	7.59%	22
Big Flat	0.00%	0
Elk Valley Rancheria	1.38%	4
I do not live in Del Norte County	6.55%	19
N/A	0.00%	0

Q8 Where do you work?

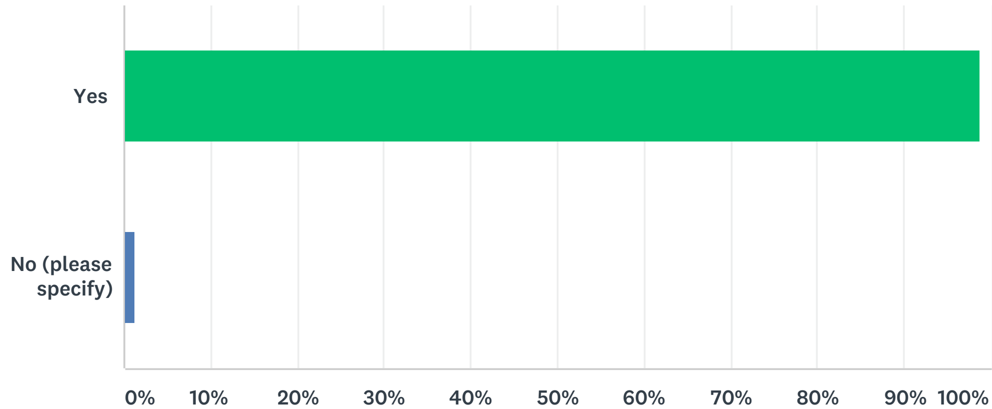
Answered: 282 Skipped: 8



ANSWER CHOICES	RESPONSES	
Crescent City	48.23%	136
Fort Dick	3.90%	11
Hiouchi	1.06%	3
Gasquet	1.42%	4
Smith River	2.13%	6
Klamath	3.19%	9
Big Flat	0.00%	0
Elk Valley Rancheria	2.48%	7
I work outside of Del Norte County	4.96%	14
I am unemployed/retired	32.62%	92
TOTAL		282

Q9 Is English the primary language spoken in your home?

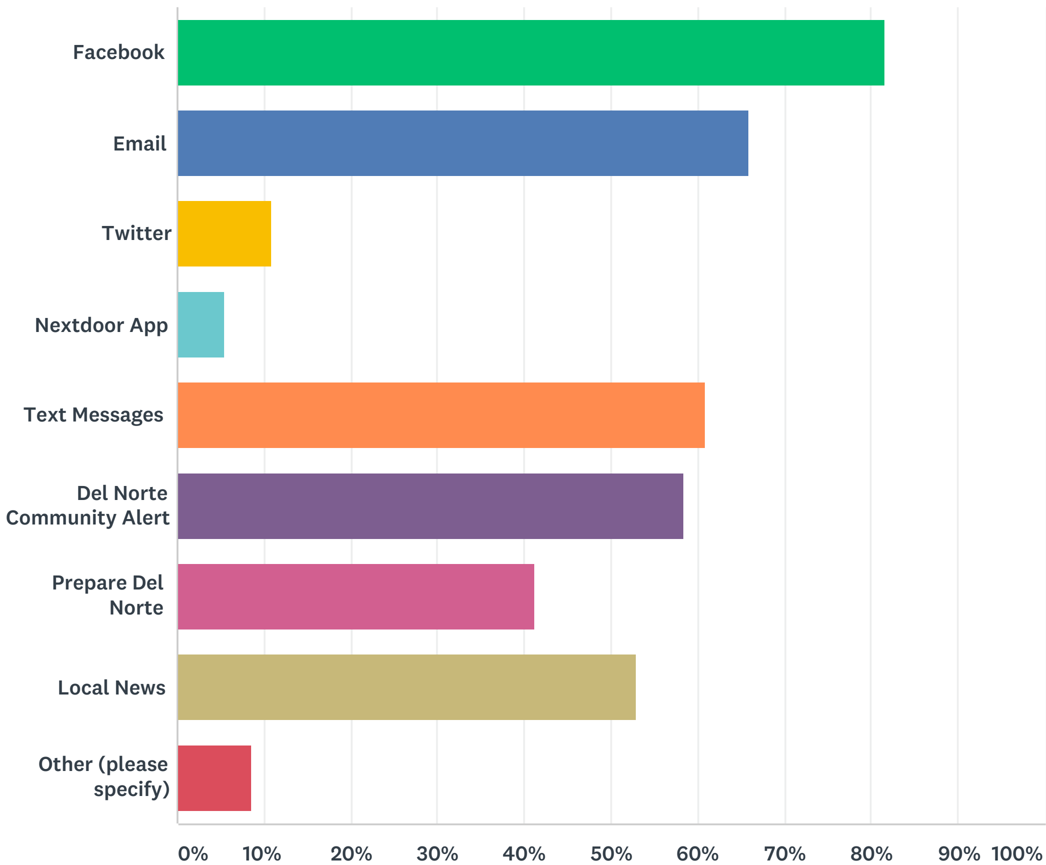
Answered: 259 Skipped: 31



ANSWER CHOICES	RESPONSES	
Yes	98.84%	256
No (please specify)	1.16%	3
TOTAL		259

Q10 Which of the following digital media outlets do you use and/or subscribe to receive news and information about Del Norte County? Select all that apply.

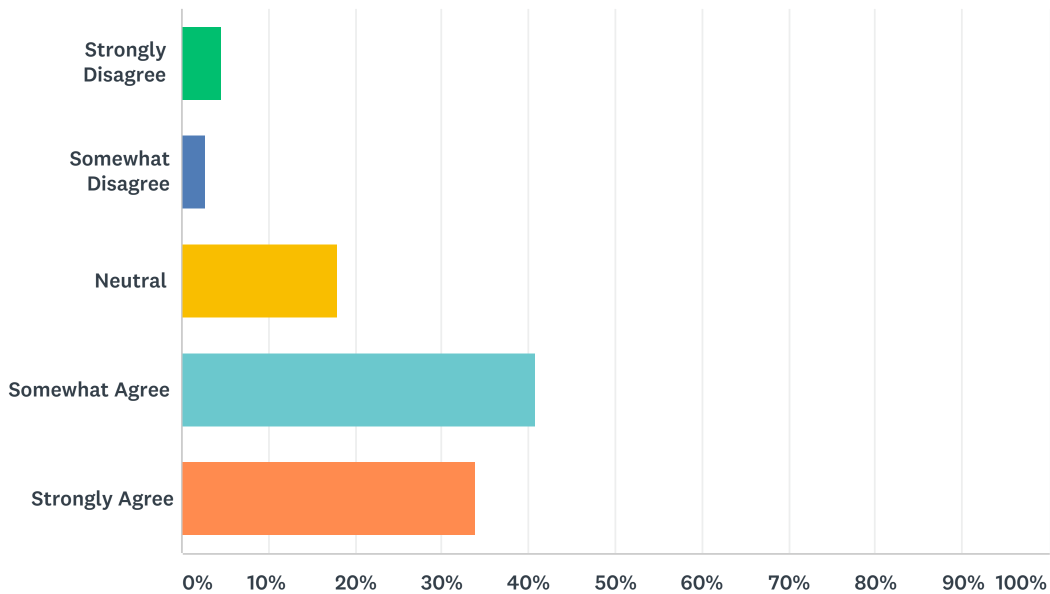
Answered: 255 Skipped: 35



ANSWER CHOICES	RESPONSES	
Facebook	81.57%	208
Email	65.88%	168
Twitter	10.98%	28
Nextdoor App	5.49%	14
Text Messages	60.78%	155
Del Norte Community Alert	58.43%	149
Prepare Del Norte	41.18%	105
Local News	52.94%	135
Other (please specify)	8.63%	22
Total Respondents: 255		

Q11 Please indicate how you feel about the following statement:It is the responsibility of government (local, state and federal) to provide education and programs that promote citizen actions that will reduce exposure to the risks associated with natural hazards.

Answered: 257 Skipped: 33



ANSWER CHOICES	RESPONSES	
Strongly Disagree	4.67%	12
Somewhat Disagree	2.72%	7
Neutral	17.90%	46
Somewhat Agree	40.86%	105
Strongly Agree	33.85%	87
TOTAL		257

Q12 Please provide any additional comments you would like to share with the Local Hazard Mitigation Plan Steering Committee. We use these comments when drafting the plan to create a better hazard mitigation document that reflects and benefits the citizens of Del Norte County.

Answered: 55 Skipped: 235

Appendix B. Summary of Federal and State Agencies, Programs and Regulations

B. SUMMARY OF FEDERAL AND STATE AGENCIES, PROGRAMS AND REGULATIONS

Existing laws, ordinances, plans and programs at the federal and state level can support or impact hazard mitigation actions identified in this plan. Hazard mitigation plans are required to include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information as part of the planning process (44 CFR, Section 201.6(b)(3)). The following federal and state programs have been identified as programs that may interface with the actions identified in this plan. Each program enhances capabilities to implement mitigation actions or has a nexus with a mitigation action in this plan. Information presented in this section can be used to review local capabilities to implement the actions found in the jurisdictional annexes of Volume 2. Each planning partner has individually reviewed existing local plans, studies, reports, and technical information in its jurisdictional annex, presented in Volume 2.

FEDERAL

Americans with Disabilities Act

The Americans with Disabilities Act (ADA) seeks to prevent discrimination against people with disabilities in employment, transportation, public accommodation, communications, and government activities. Title II of the ADA deals with compliance with the Act in emergency management and disaster-related programs, services, and activities. It applies to state and local governments as well as third parties, including religious entities and private nonprofit organizations.

The ADA has implications for sheltering requirements and public notifications. During an emergency alert, officials must use a combination of warning methods to ensure that all residents have all necessary information. Those with hearing impairments may not hear radio, television, sirens, or other audible alerts, while those with visual impairments may not see flashing lights or other visual alerts. Two technical documents for shelter operators address physical accessibility needs of people with disabilities, as well as medical needs and service animals.

The ADA intersects with disaster preparedness programs in regards to transportation, social services, temporary housing, and rebuilding. Persons with disabilities may require additional assistance in evacuation and transit (e.g., vehicles with wheelchair lifts or paratransit buses). Evacuation and other response plans should address the unique needs of residents. Local governments may be interested in implementing a special-needs registry to identify the home addresses, contact information, and needs for residents who may require more assistance.

FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Bureau of Indian Affairs

The U.S. Bureau of Indian Affairs' (BIA's) Fire and Aviation Management National Interagency Fire Center provides wildfire protection, fire use and hazardous fuels management, and emergency rehabilitation on Indian forest and rangelands held in trust by the United States, based on fire management plans approved by the appropriate Indian Tribe.

Bureau of Land Management

The U.S. Bureau of Land Management (BLM) funds and coordinates wildfire management programs and structural fire management and prevention on BLM lands. BLM works closely with the Forest Service and state and local governments to coordinate fire safety activities. The Interagency Fire Coordination Center in Boise, Idaho serves as the center for this effort.

Civil Rights Act of 1964

The Civil Rights Act of 1964 prohibits discrimination based on race, color, religion, sex or nation origin and requires equal access to public places and employment. The Act is relevant to emergency management and hazard mitigation in that it prohibits local governments from favoring the needs of one population group over another. Local government and emergency response must ensure the continued safety and well-being of all residents equally, to the extent possible. FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Clean Water Act

The federal Clean Water Act (CWA) employs regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's surface waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."

Evolution of CWA programs over the last decade has included a shift from a program-by-program, source-by-source, and pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach, equal emphasis is placed on protecting healthy waters and restoring impaired ones. Numerous issues are addressed, not just those subject to CWA regulatory authority. Involvement of stakeholder groups in the development and implementation of strategies for achieving and maintaining water quality and other environmental goals is a hallmark of this approach.

The CWA is important to hazard mitigation in several ways. There are often permitting requirements for any construction within 200 feet of water of the United States, which may have implications for mitigation projects identified by a local jurisdiction. Additionally, CWA requirements apply to wetlands, which serve important functions related to preserving and protecting the natural and beneficial functions of floodplains and are linked with a community's floodplain management program. Finally, the National Pollutant Discharge Elimination System is part of the CWA and addresses local stormwater management programs. Stormwater management plays a critical role in hazard mitigation by addressing urban drainage or localized flooding issues within jurisdictions.

FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Community Development Block Grant Disaster Resilience Program

In response to disasters, Congress may appropriate additional funding for the U.S. Department of Housing and Urban Development Community Development Block Grant programs to be distributed as Disaster Recovery grants (CDBG-DR). These grants can be used to rebuild affected areas and provide seed money to start the recovery process. CDBG-DR assistance may fund a broad range of recovery activities, helping communities and neighborhoods that otherwise might not recover due to limited resources. CDBG-DR grants often supplement disaster programs of FEMA, the Small Business Administration, and the U.S. Army Corps of Engineers. Housing and Urban Development generally awards noncompetitive, nonrecurring CDBG-DR grants by a formula that considers disaster recovery needs unmet by other federal disaster assistance programs. To be eligible for CDBG-DR funds, projects must meet the following criteria:

- Address a disaster-related impact (direct or indirect) in a presidentially declared county for the covered disaster
- Be a CDBG-eligible activity (according to regulations and waivers)
- Meet a national objective.

Incorporating preparedness and mitigation into these actions is encouraged, as the goal is to rebuild in ways that are safer and stronger. CDBG-DR funding is a potential alternative source of funding for actions identified in this plan.

Community Rating System

The CRS is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions meeting the following three goals of the CRS:

- Reduce flood losses.
- Facilitate accurate insurance rating.
- Promote awareness of flood insurance.

For participating communities, flood insurance premium rates are discounted in increments of 5 percent. For example, a Class 1 community would receive a 45 percent premium discount, and a Class 9 community would receive a 5 percent discount. (Class 10 communities are those that do not participate in the CRS; they receive no discount.) The discount partially depends on location of the property. Properties outside the special flood hazard area receive smaller discounts: a 10-percent discount if the community is at Class 1 to 6 and a 5-percent discount if the community is at Class 7 to 9. The CRS classes for local communities are based on 18 creditable activities in the following categories:

- Public information
- Mapping and regulations
- Flood damage reduction
- Flood preparedness.

CRS activities can help to save lives and reduce property damage. Communities participating in the CRS represent a significant portion of the nation's flood risk; over 66 percent of the NFIP's policy base is located in these communities. Communities receiving premium discounts through the CRS range from small to large and represent a broad mixture of flood risks, including both coastal and riverine flood risks.

Disaster Mitigation Act

The DMA is the current federal legislation addressing hazard mitigation planning. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Assistance grant funds are available to communities. This plan is designed to meet the requirements of DMA, improving eligibility for future hazard mitigation funds.

Emergency Relief for Federally Owned Roads Program

The U.S. Forest Service's Emergency Relief for Federally Owned Roads Program was established to assist federal agencies with repair or reconstruction of tribal transportation facilities, federal lands transportation facilities, and other federally owned roads that are open to public travel and have suffered serious damage by a natural disaster over a wide area or by a catastrophic failure. The program funds both emergency and permanent repairs (Office of Federal Lands Highway, 2016). Eligible activities under this program meet some of the goals and objectives for this plan and the program is a possible funding source for actions identified in this plan.

Emergency Watershed Program

The USDA Natural Resources Conservation Service (NRCS) administers the Emergency Watershed Protection (EWP) Program, which responds to emergencies created by natural disasters. Eligibility for assistance is not dependent on a national emergency declaration. The program is designed to help people and conserve natural resources by relieving imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. EWP is an emergency recovery program. Financial and technical assistance are available for the following activities (Natural Resources Conservation Service, 2016):

- Remove debris from stream channels, road culverts, and bridges
- Reshape and protect eroded banks
- Correct damaged drainage facilities
- Establish cover on critically eroding lands
- Repair levees and structures
- Repair conservation practices.

This federal program could be a possible funding source for actions identified in this plan.

Endangered Species Act

The federal Endangered Species Act (ESA) was enacted in 1973 to conserve species facing depletion or extinction and the ecosystems that support them. The act sets forth a process for determining which species are threatened and endangered and requires the conservation of the critical habitat in which those species live. The ESA provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species and contains exceptions and exemptions. It is the enabling legislation for the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Criminal and civil penalties are provided for violations of the ESA and the Convention.

Federal agencies must seek to conserve endangered and threatened species and use their authorities in furtherance of the ESA's purposes. The ESA defines three fundamental terms:

- Endangered means that a species of fish, animal or plant is "in danger of extinction throughout all or a significant portion of its range." (For salmon and other vertebrate species, this may include subspecies and distinct population segments.)
- Threatened means that a species "is likely to become endangered within the foreseeable future." Regulations may be less restrictive for threatened species than for endangered species.
- Critical habitat means "specific geographical areas that are…essential for the conservation and management of a listed species, whether occupied by the species or not."

Five sections of the ESA are of critical importance to understanding it:

- Section 4: Listing of a Species—The National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries) is responsible for listing marine species; the U.S. Fish and Wildlife Service is responsible for listing terrestrial and freshwater aquatic species. The agencies may initiate reviews for listings, or citizens may petition for them. A listing must be made "solely on the basis of the best scientific and commercial data available." After a listing has been proposed, agencies receive comment and conduct further scientific reviews for 12 to 18 months, after which they must decide if the listing is warranted. Economic impacts cannot be considered in this decision, but it may include an evaluation of the adequacy of local and state protections. Critical habitat for the species may be designated at the time of listing.
- Section 7: Consultation—Federal agencies must ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed or proposed species or adversely modify its critical habitat. This includes private and public actions that require a federal permit. Once a final listing is made, non-federal actions are subject to the same review, termed a "consultation." If the listing agency finds that an action will "take" a species, it must propose mitigations or "reasonable and prudent" alternatives to the action; if the proponent rejects these, the action cannot proceed.
- Section 9: Prohibition of Take—It is unlawful to "take" an endangered species, including killing or injuring it or modifying its habitat in a way that interferes with essential behavioral patterns, including breeding, feeding or sheltering.
- Section 10: Permitted Take—Through voluntary agreements with the federal government that provide protections to an endangered species, a non-federal applicant may commit a take that would otherwise be prohibited as long as it is incidental to an otherwise lawful activity (such as developing land or building a road). These agreements often take the form of a "Habitat Conservation Plan."
- Section 11: Citizen Lawsuits—Civil actions initiated by any citizen can require the listing agency to enforce the ESA's prohibition of taking or to meet the requirements of the consultation process.

FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) cooperates with a large number of federal and state agencies to ensure and promote dam safety. More than 3,000 dams are part of regulated hydroelectric projects in the FERC program. Two-thirds of these are more than 50 years old. As dams age, concern about their safety and integrity grows, so oversight and regular inspection are important. FERC inspects hydroelectric projects on an unscheduled basis to investigate the following:

- Potential dam safety problems
- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with the terms and conditions of a license.

Every five years, an independent engineer approved by the FERC must inspect and evaluate projects with dams higher than 32.8 feet (10 meters), or with a total storage capacity of more than 2,000 acre-feet.

FERC monitors seismic research and applies it in performing structural analyses of hydroelectric projects. FERC also evaluates the effects of potential and actual large floods on the safety of dams. During and following floods, FERC visits dams and licensed projects, determines the extent of damage, if any, and directs any necessary studies or remedial measures the licensee must undertake. The FERC publication Engineering Guidelines for the Evaluation of Hydropower Projects guides the FERC engineering staff and licensees in evaluating dam safety. The publication is frequently revised to reflect current information and methodologies.

FERC requires licensees to prepare emergency action plans and conducts training sessions on how to develop and test these plans. The plans outline an early warning system if there is an actual or potential sudden release of water from a dam due to failure. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that everyone knows what to do in emergency situations.

National Environmental Policy Act

The National Environmental Policy Act requires federal agencies to consider the environmental impacts of proposed actions and reasonable alternatives to those actions, alongside technical and economic considerations. The National Environmental Policy Act established the Council on Environmental Quality, whose regulations (40 CFR Parts 1500-1508) set standards for compliance. Consideration and decision-making regarding environmental impacts must be documented in an environmental impact statement or environmental assessment. Environmental impact assessment requires the evaluation of reasonable alternatives to a proposed action, solicitation of input from organizations and individuals that could be affected, and an unbiased presentation of direct, indirect, and cumulative environmental impacts. FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Federal Wildfire Management Policy and Healthy Forests Restoration Act

Federal Wildfire Management Policy and Healthy Forests Restoration Act (2003). These documents call for a single comprehensive federal fire policy for the Interior and Agriculture Departments (the agencies using federal fire management resources). They mandate community-based collaboration to reduce risks from wildfire.

National Dam Safety Act

Potential for catastrophic flooding due to dam failures led to passage of the National Dam Inspection Act in 1972, creation of the National Dam Safety Program in 1996, and reauthorization of the program through the Dam Safety Act in 2006. National Dam Safety Program, administered by FEMA requires a periodic engineering analysis of the majority of dams in the country; exceptions include the following:

- Dams under jurisdiction of the Bureau of Reclamation, Tennessee Valley Authority, or International Boundary and Water Commission
- Dams constructed pursuant to licenses issued under the Federal Power Act
- Dams that the Secretary of the Army determines do not pose any threat to human life or property.

The goal of this FEMA-monitored effort is to identify and mitigate the risk of dam failure so as to protect lives and property of the public. The National Dam Safety Program is a partnership among the states, federal agencies, and other stakeholders that encourages individual and community responsibility for dam safety. Under FEMA's leadership, state assistance funds have allowed all participating states to improve their programs through increased inspections, emergency action planning, and purchases of needed equipment. FEMA has also expanded existing and initiated new training programs. Grant assistance from FEMA provides support for improvement of dam safety programs that regulate most of the dams in the United States.

National Fire Plan (2001)

The 2001 National Fire Plan was developed based on the National Fire Policy. A major aspect of the National Fire Plan is joint risk reduction planning and implementation carried out by federal, state and local agencies and communities. The National Fire Plan presented a comprehensive strategy in five key initiatives:

- Firefighting—Be adequately prepared to fight fires each fire season.
- Rehabilitation and Restoration—Restore landscapes and rebuild communities damaged by wildfires.
- Hazardous Fuel Reduction—Invest in projects to reduce fire risk.
- Community Assistance—Work directly with communities to ensure adequate protection.
- Accountability—Be accountable and establish adequate oversight, coordination, program development, and monitoring for performance.

National Flood Insurance Program

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. For most participating communities, FEMA has prepared a detailed Flood Insurance Study. The study presents water surface elevations for floods of various magnitudes, including the 1-percent-annual-chance flood and the 0.2-percent-annual-chance flood. Base flood elevations and the boundaries of the flood hazard areas are shown on Flood Insurance Rate Maps, which are the principle tool for identifying the extent and location of the flood hazard. Flood Insurance Rate Maps are the most detailed and consistent data source available, and for many communities they represent the minimum area of oversight under the local floodplain management program. In recent years, Flood Insurance Rate Maps have been digitized as Digital Flood Insurance Rate Maps, which are more accessible to residents, local governments and stakeholders.

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 1-percent-annual-chance flood.
- New floodplain development must not aggravate existing flood problems or increase damage to other properties.
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

National Flood Insurance Program

The National Flood Insurance Program (NFIP) provides federally backed flood insurance in exchange for communities enacting floodplain regulations. Participation and good standing under NFIP are prerequisites to grant funding eligibility under the Robert T. Stafford Act. Del Norte County and Crescent City participate in the NFIP and have adopted and enforced floodplain management regulations that meet or exceed the requirements of the NFIP. At the time of the preparation of this plan, both jurisdictions were in good standing with NFIP requirements. Full compliance and good standing under the NFIP are application prerequisites for all FEMA grant programs for which participating jurisdictions are eligible under this plan.

National Incident Management System

The National Incident Management System (NIMS) is a systematic approach for government, nongovernmental organizations, and the private sector to work together to manage incidents involving hazards. The NIMS provides a flexible but standardized set of incident management practices. Incidents typically begin and end locally, and they are managed at the lowest possible geographical, organizational, and jurisdictional level. In some cases, success depends on the involvement of multiple jurisdictions, levels of government, functional agencies, and emergency responder disciplines. These cases necessitate coordination across a spectrum of organizations. Communities using NIMS follow a comprehensive national approach that improves the effectiveness of emergency management and response personnel across the full spectrum of potential hazards (including natural hazards, technological hazards, and human-caused hazards) regardless of size or complexity.

Although participation is voluntary, federal departments and agencies are required to make adoption of NIMS by local and state jurisdictions a condition to receive federal preparedness grants and awards. The content of this plan is considered to be a viable support tool for any phase of emergency management. The NIMS program is considered as a response function, and information in this hazard mitigation plan can support the implementation and update of all NIMS-compliant plans within the planning area.

National Park Service, Redwood National Park

The National Park Service (NPS) provides wildland and structure fire protection, and conducts wildfire management within the NPS units. These activities are guided by the National Park Service Fire Management Plan.

Presidential Executive Order 11988, Floodplain Management

Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. It requires federal agencies to provide leadership and take action to reduce the risk of flood loss, minimize the impact of floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values of floodplains. The requirements apply to the following activities (FEMA, 2015a):

- Acquiring, managing, and disposing of federal lands and facilities
- Providing federally undertaken, financed, or assisted construction and improvements
- Conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing.

Presidential Executive Order 11990, Protection of Wetlands

Executive Order 11990 requires federal agencies to provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. The requirements apply to the following activities (National Archives, 2016):

- Acquiring, managing, and disposing of federal lands and facilities
- Providing federally undertaken, financed, or assisted construction and improvements
- Conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing.

All actions identified in this plan will seek full compliance with all applicable presidential executive orders.

U.S. Army Corps of Engineers Dam Safety Program

The U.S. Army Corps of Engineers operates and maintains approximately 700 dams nationwide. It is also responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. The Corps has inventoried dams; surveyed each state and federal agency's capabilities, practices and regulations regarding design, construction, operation and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety. The Corps maintains the National Inventory of Dams, which contains information about a dam's location, size, purpose, type, last inspection and regulatory status (U.S. Army Corps of Engineers, 2017).

U.S. Army Corps of Engineers Flood Hazard Management

The U.S. Army Corps of Engineers has several civil works authorities and programs related to flood risk and flood hazard management:

- The Floodplain Management Services program offers 100-percent federally funded technical services such as development and interpretation of site-specific data related to the extent, duration and frequency of flooding. Special studies may be conducted to help a community understand and respond to flood risk. These may include flood hazard evaluation, flood warning and preparedness, or flood modeling.
- For more extensive studies, the Corps of Engineers offers a cost-shared program called Planning Assistance to States and Tribes. Studies under this program generally range from $25,000 to $100,000 with the local jurisdiction providing 50 percent of the cost.
- The Corps of Engineers has several cost-shared programs (typically 65 percent federal and 35 percent non-federal) aimed at developing, evaluating and implementing structural and non-structural capital projects to address flood risks at specific locations or within a specific watershed:
  - The Continuing Authorities Program for smaller-scale projects includes Section 205 for Flood Control, with a $7 million federal limit and Section 14 for Emergency Streambank Protection with a $1.5 million federal limit. These can be implemented without specific authorization from Congress.
  - Larger scale studies, referred to as General Investigations, and projects for flood risk management, for ecosystem restoration or to address other water resource issues, can be pursued through a specific authorization from Congress and are cost-shared, typically at 65 percent federal and 35 percent non-federal.
  - Watershed management planning studies can be specifically authorized and are cost-shared at 50 percent federal and 50 percent non-federal.
- The Corps of Engineers provides emergency response assistance during and following natural disasters. Public Law 84-99 enables the Corps to assist state and local authorities in flood fight activities and cost share in the repair of flood protective structures. Assistance is provided in the flowing categories:
  - Preparedness—The Flood Control and Coastal Emergency Act establishes an emergency fund for preparedness for emergency response to natural disasters; for flood fighting and rescue operations; for rehabilitation of flood control and hurricane protection structures. Funding for Corps of Engineers emergency response under this authority is provided by Congress through the annual Energy and Water Development Appropriation Act. Disaster preparedness activities include coordination, planning, training and conduct of response exercises with local, state and federal agencies.
  - Response Activities—Public Law 84-99 allows the Corps of Engineers to supplement state and local entities in flood fighting urban and other non-agricultural areas under certain conditions (Engineering Regulation 500-1-1 provides specific details). All flood fight efforts require a project cooperation agreement signed by the public sponsor and the sponsor must remove all flood fight material after the flood has receded. Public Law 84-99 also authorizes emergency water support and drought assistance in certain situations and allows for “advance measures” assistance to prevent or reduce flood damage conditions of imminent threat of unusual flooding.
  - Rehabilitation—Under Public Law 84-99, an eligible flood protection system can be rehabilitated if damaged by a flood event. The flood system would be restored to its pre-disaster status at no cost to the federal system owner, and at 20-percent cost to the eligible non-federal system owner. All systems considered eligible for Public Law 84-99 rehabilitation assistance have to be in the Rehabilitation and Inspection Program prior to the flood event. Acceptable operation and maintenance by the public levee sponsor are verified by levee inspections conducted by the Corps on a regular basis. The Corps

has the responsibility to coordinate levee repair issues with interested federal, state, and local agencies following natural disaster events where flood control works are damaged.

All of these authorities and programs are available to the planning partners to support any intersecting mitigation actions.

U.S. Fire Administration

There are federal agencies that provide technical support to fire agencies/organizations. For example, the U.S. Fire Administration, which is a part of FEMA, provides leadership, advocacy, coordination, and support for fire agencies and organizations.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service fire management strategy employs prescribed fire to maintain early successional fire-adapted grasslands and other ecological communities throughout the National Wildlife Refuge System.

U.S. Forest Service Six Rivers National Forest

The U.S. Forest Service role in wildfire management is primarily focused on National Forest lands. However, Forest Service personnel will respond to wildland and structural fires on adjacent lands through mutual aid agreements when crews and equipment are available. Forest Service fire stations are not staffed outside of fire season.

STATE

AB 32: The California Global Warming Solutions Act

This bill identifies the following potential adverse impacts of global warming:

> "… the exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems."

AB 32 establishes a state goal of reducing greenhouse gas emissions to 1990 levels by 2020 (a reduction of approximately 25 percent from forecast emission levels), with further reductions to follow. The law requires the state Air Resources Board to do the following:

- Establish a program to track and report greenhouse gas emissions.
- Approve a scoping plan for achieving the maximum technologically feasible and cost-effective reductions from sources of greenhouse gas emissions.
- Adopt early reduction measures to begin moving forward.
- Adopt, implement and enforce regulations—including market mechanisms such as "cap and-trade" programs—to ensure that the required reductions occur.

The Air Resources Board has adopted a statewide greenhouse gas emissions limit and an emissions inventory, along with requirements to measure, track, and report greenhouse gas emissions by the industries it determined to be significant sources of greenhouse gas emissions.

AB 70: Flood Liability

This bill provides that a city or county may be required to contribute a fair and reasonable share to compensate for property damage caused by a flood to the extent that it has increased the state's exposure to liability for property damage by unreasonably approving new development in a previously undeveloped area that is protected by a state flood control project, unless the city or county meets specified requirements.

AB 162: Flood Planning

This California State Assembly Bill passed in 2007 requires cities and counties to address flood-related matters in the land use, conservation, and safety and housing elements of their general plans. The land use element must identify and annually review the areas covered by the general plan that are subject to flooding as identified in floodplain mapping by either FEMA or the state Department of Water Resources (DWR). During the next revision of the housing element on or after January 1, 2009, the conservation element of the general plan must identify rivers, creeks, streams, flood corridors, riparian habitat, and land that may accommodate floodwater for the purpose of groundwater recharge and stormwater management. The safety element must identify information regarding flood hazards, including:

- Flood hazard zones
- Maps published by FEMA, DWR, the U.S. Army Corps of Engineers, the Central Valley Flood Protection Board, and the Governor's Office of Emergency Services (Cal OES)
- Historical data on flooding
- Existing and planned development in flood hazard zones.

The general plan must establish goals, policies and objectives to protect from unreasonable flooding risks, including:

- Avoiding or minimizing the risks of flooding new development
- Evaluating whether new development should be located in flood hazard zones
- Identifying construction methods to minimize damage.

AB 162 establishes goals, policies and objectives to protect from unreasonable flooding risks. It establishes procedures for the determination of available land suitable for urban development, which may exclude lands where FEMA or DWR has concluded that the flood management infrastructure is not adequate to avoid the risk of flooding.

AB 2140: General Plans—Safety Element

This bill provides that the state may allow for more than 75 percent of public assistance funding under the California Disaster Assistance Act only if the local agency is in a jurisdiction that has adopted a local hazard mitigation plan as part of the safety element of its general plan. The local hazard mitigation plan needs to include elements specified in this legislation. In addition, this bill requires Cal OES to give preference for federal mitigation funding to cities and counties that have adopted local hazard mitigation plans. The intent of the bill is to encourage cities and counties to create and adopt hazard mitigation plans.

AB 2800: Climate Change—Infrastructure Planning

This California State Assembly bill passed in 2016 and until July 1, 2020, requires state agencies to take into account the current and future impacts of climate change when planning, designing, building, operating, maintaining, and investing in state infrastructure. The bill, by July 1, 2017, and until July 1, 2020, requires an agency to establish a Climate-Safe Infrastructure Working Group to examine how to integrate scientific data concerning projected climate change impacts into state infrastructure engineering.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was enacted in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. The Alquist-Priolo Earthquake Fault Zoning Act's main purpose is to prevent construction of buildings used for human occupancy on the surface trace of active faults. Before a new project is permitted, cities and counties require a geologic investigation to demonstrate that proposed buildings will not be constructed on active faults. The act addresses only the hazard of surface fault rupture and is not directed toward other earthquake hazards, such as liquefaction or seismically induced landslides. The law requires the State of California Geologist to establish regulatory zones around the surface traces of active faults and to issue appropriate maps. The maps are distributed to all affected cities, counties, and state agencies for their use in planning and controlling new or renewed construction. Local agencies must regulate most development projects within the zones. Projects include all land divisions and most structures for human occupancy. All seismic hazard mitigation actions identified in this plan will seek full compliance with the Alquist-Priolo Earthquake Fault Zoning Act.

California Coastal Management Program

The California Coastal Management Program under the California Coastal Act requires each city or county lying wholly or partly within the coastal zone to prepare a local coastal plan. The specific contents of such plans are not specified by state law, but they must be certified by the Coastal Commission as consistent with policies of the Coastal Act (Public Resources Code, Division 20). The Coastal Act has provisions relating to geologic hazards, but does not mention tsunamis specifically. Section 30253(1) of the Coastal Act states that new development shall minimize risks to life and property in areas of high geologic, flood, and fire hazard. Development should be prevented or limited in high hazard areas whenever possible. However, where development cannot be prevented or limited, land use density, building value, and occupancy should be kept at a minimum. Any mitigation project identified in this plan that intersects the mapped coastal zone will be consistent with the recommendations of the local coastal plan.

California Department of Forestry and Fire Protection

CAL FIRE has responsibility for wildfires in areas of the county that are not under the jurisdiction of the Forest Service or a local fire organization, including lands designated as State Responsibility Areas. CAL FIRE also has fire protection responsibilities by contract and mutual aid agreements. For example, CAL FIRE provides year-round fire protection under Amador Plan agreements with certain local government agencies (Public Resources Code §4144). Through these agreements, CAL FIRE provides local structural and wildfire protection or dispatch services to a community and maintains a staffing level that otherwise would be available only during the fire season. The local entity pays the additional cost of the service.

California Department of Parks and Recreation (State Parks)

State Parks manages portions of the California coastline including coastal wetlands, estuaries, beaches, and dune systems. The State Parks Resources Management Division has limited wildfire protection resources available to suppress fires on State Park lands. State Parks does not operate a fire station in Del Norte County and relies on CAL FIRE as the primary wildfire protection resource for the lands under its management. State Parks cooperates with CAL FIRE and Redwood National Park on prescribed burns, and can provide limited mutual aid.

California Department Water Resources

In California, the DWR is the coordinating agency for floodplain management. The DWR works with FEMA and local governments by providing grants and technical assistance, evaluating community floodplain management programs, reviewing local floodplain ordinances, participating in statewide flood hazard mitigation planning, and facilitating annual statewide workshops. Compliance is monitored by FEMA regional staff and by the DWR.

California Division of Safety of Dams

California's Division of Safety of Dams (a division of the DWR) monitors the dam safety program at the state level and maintains a working list of dams in the state. When a new dam is proposed, Division engineers and geologists inspect the site and the subsurface. Upon submittal of an application, the Division reviews the plans and specifications prepared by the owner to ensure that the dam is designed to meet minimum requirements and that the design is appropriate for the known geologic conditions. After approval of the application, the Division inspects all aspects of the construction to ensure that the work is done in accordance with the approved plans and specifications. After construction, the Division inspects each dam to ensure that it is performing as intended and is not developing problems. The Division periodically reviews the stability of dams and their major appurtenances in light of improved design approaches and requirements, as well as new findings regarding earthquake hazards and hydrologic estimates in California. Over 1,200 dams are inspected by Division engineers on a yearly schedule to ensure performance and maintenance of dams (California Division of Safety of Dams, 2017).

California Environmental Quality Act

The California Environmental Quality Act (CEQA) was passed in 1970, shortly after the federal government enacted the National Environmental Policy Act, to institute a statewide policy of environmental protection. CEQA requires state and local agencies in California to follow a protocol of analysis and public disclosure of the potential environmental impacts of development projects. CEQA makes environmental protection a mandatory part of every California state and local agency's decision-making process.

CEQA establishes a statewide environmental policy and mandates actions all state and local agencies must take to advance the policy. Jurisdictions conduct analysis of the project to determine if there are potentially significant environmental impacts, identify mitigation measures, and possible project alternatives by preparing environmental reports for projects that requires CEQA review. This environmental review is required before an agency takes action on any policy, program, or project. Any project action identified in this plan will seek full CEQA compliance upon implementation.

California Fire Alliance

The California Fire Alliance (CFA) was established in response to directives from the National Fire Plan that was developed in 2001. The CFA pursues four strategies to deal with the National Fire Plan's community assistance initiative:

- Work with communities at risk from wildfires to develop community-based planning leadership and facilitate the development of community fire loss mitigation plans, which transcend jurisdiction and ownership boundaries.
- Assist communities in development of fire loss mitigation planning, education and projects to reduce the threat of wildfire losses on public and private lands.
- Develop an information and education outreach plan to increase awareness of wildfire protection program opportunities available to communities at risk.
- Work collaboratively to develop, modify and maintain a comprehensive list of communities at risk.

California Fire Plan

The State Board of Forestry and CAL FIRE have prepared a comprehensive update of the California Fire Plan for wildfire protection. The planning process included defining a level of service measurement; considering assets at risk; incorporating the cooperative interdependent relationships of wildfire protection providers; providing for public stakeholder involvement; and creating a fiscal framework for policy analysis. The California Fire Plan's overall goal is to reduce costs and losses from wildfire in the state by protecting assets at risk through pre-fire management and by reducing the spread of fire through more successful initial response.

California Fire Safe Council

In 1993, the statewide Fire Safe Council, consisting of private and public membership, was formed to educate and encourage Californians to plan and prepare for wildfires by reducing the risk of fire to property, communities, and natural/structural resources. In 2002, this group created a nonprofit organization and board of directors, called the California Fire Safe Council. The Council works with the California Fire Alliance to facilitate the distribution of National Fire Plan grants for wildfire risk reduction and education (www.grants.firesafecouncil.org). The Council also provides assistance to local Fire Safe Councils through its website (www.firesafecouncil.org), the distribution of educational materials, and technical assistance, primarily through regional representatives. More than 130 local Fire Safe Councils have formed in California to plan, coordinate, and implement fire prevention activities.

California Fire Service and Rescue Emergency Mutual Aid Plan

The Governor's Office of Emergency Services Fire and Rescue Branch administers the California Fire Service and Rescue Emergency Mutual Aid Plan. The agency provides guidance and procedures for agencies developing emergency operations plans, as well as training and technical support, primarily to overall emergency service organizations and urban search and rescue teams.

California General Planning Law

California state law requires that every county and city prepare and adopt a comprehensive long-range plan to serve as a guide for community development. The general plan expresses the community's goals, visions, and policies relative to future land uses, both public and private. The general plan is mandated and prescribed by state law (Cal. Gov. Code §65300 et seq.), and forms the basis for most local government land use decision-making.

The plan must consist of an integrated and internally consistent set of goals, policies, and implementation measures. In addition, the plan must focus on issues of the greatest concern to the community and be written in a clear and concise manner. City and county actions, such as those relating to land use allocations, annexations, zoning, subdivision and design review, redevelopment, and capital improvements, must be consistent with the plan.

California Multi-Hazard Mitigation Plan

Under the DMA, California must adopt a federally approved state multi-hazard mitigation plan to be eligible for certain disaster assistance and mitigation funding. The intent of the State of California Multi-Hazard Mitigation Plan is to reduce or prevent injury and damage from hazards in the state through the following:

- Documenting statewide hazard mitigation planning in California
- Describing strategies and priorities for future mitigation activities
- Facilitating the integration of local and tribal hazard mitigation planning activities into statewide efforts
- Meeting state and federal statutory and regulatory requirements.

The plan is an annex to the State Emergency Plan, and it identifies past and present mitigation activities, current policies and programs, and mitigation strategies for the future. It also establishes hazard mitigation goals and objectives. The plan will be reviewed and updated annually to reflect changing conditions and new information, especially information on local planning activities.

Under 44 CFR Section 201.6, local hazard mitigation plans must be consistent with their state's hazard mitigation plan. In updating this plan, the Steering Committee reviewed the California State Hazard Mitigation Plan to identify key relevant state plan elements (see Section 3.7).

California Residential Mitigation Program

The California Residential Mitigation Program was established in 2011 to help Californians strengthen their homes against damage from earthquakes. The program is a joint powers authority created by Cal OES and the California Earthquake Authority, which is a not-for-profit, publicly managed, privately funded provider of home earthquake insurance to California homeowners and renters.

Earthquake Brace + Bolt was developed to help homeowners lessen the potential for damage to their houses during an earthquake. A residential seismic retrofit strengthens an existing older house, making it more resistant to earthquake activity such as ground shaking and soil failure. The seismic retrofitting involves bolting the house to its foundation and adding bracing around the perimeter of the crawl space. Most homeowners hire a contractor to do the retrofit work, and owners of houses in ZIP Codes with house characteristics suitable for this type of retrofit are eligible for up to $3,000 toward the cost. A typical retrofit by a contractor may cost between $3,000 and $7,000, depending on the location and size of the house, contractor fees, and the amount of materials and work involved. If the homeowner is an experienced do-it-yourselfer, a retrofit can cost less than $3,000.

California State Building Code

California Code of Regulations Title 24 (CCR Title 24), also known as the California Building Standards Code, is a compilation of building standards from three sources:

- Building standards that have been adopted by state agencies without change from building standards contained in national model codes
- Building standards that have been adopted and adapted from the national model code standards to meet California conditions
- Building standards authorized by the California legislature that constitute extensive additions not covered by the model codes adopted to address particular California concerns.

The state Building Standards Commission is authorized by California Building Standards Law (Health and Safety Code Sections 18901 through 18949.6) to administer the processes related to the adoption, approval, publication, and implementation of California's building codes. These building codes serve as the basis for the design and construction of buildings in California. The national model code standards adopted into Title 24 apply to all occupancies in California, except for modifications adopted by state agencies and local governing bodies. Since 1989, the Building Standards Commission has published new editions of Title 24 every three years.

On January 1, 2014, California Building Code Accessibility Standards found in Chapter 11B incorporated the 2010 Americans with Disabilities Act (ADA) Standards as the model accessibility code for California. The purpose was to ensure consistency with federal guidelines. As a result of this incorporation, the California standards will fully implement and include 2010 ADA Standards within the California Building Code while maintaining enhanced levels of accessibility already provided by existing California accessibility regulations. All planning partners that have building code and permit authority have adopted building codes that are in full compliance with the California State Building Code.

Disadvantaged and Low-income Communities Investments

Senate Bill (SB) 535 directs state and local agencies to make investments that benefit California's disadvantaged communities. It also directs the California Environmental Protection Agency to identify disadvantaged communities for the purposes of these investments based on geographic, socio-economic, public health, and environmental hazard criteria. Assembly Bill (AB) 1550 increased the percent of funds for projects located in disadvantaged communities from 10 to 25 percent and added a focus on investments in low-income communities and households. This program is a potential alternative source of funding for actions identified in this plan.

Governor's Executive Order S-13-08

Governor's Executive Order S-13-08 enhances the state's management of climate impacts from sea level rise, increased temperatures, shifting precipitation and extreme weather events. There are four key actions in the executive order:

- Initiate California's first statewide climate change adaptation strategy to assess expected climate change impacts, identify where California is most vulnerable, and recommend adaptation policies. This effort will improve coordination within state government so that better planning can more effectively address climate impacts on human health, the environment, the state's water supply and the economy.
- Request that the National Academy of Science establish an expert panel to report on sea level rise impacts in California, to inform state planning and development efforts.
- Issue interim guidance to state agencies for how to plan for sea level rise in designated coastal and floodplain areas for new projects.
- Initiate a report on critical infrastructure projects vulnerable to sea level rise.

Office of the State Fire Marshal

The Office of the State Fire Marshal is a division of CAL FIRE that has a wide variety of fire safety and training responsibilities and provides technical support to fire agencies/organizations.

Senate Bill 97: Guidelines for Greenhouse Gas Emissions

Senate Bill 97, enacted in 2007, amends CEQA to clearly establish that greenhouse gas emissions and the effects of greenhouse gas emissions are appropriate subjects for CEQA analysis. It directs the Governor's Office of Planning and Research to develop draft CEQA guidelines for the mitigation of greenhouse gas emissions or their effects by July 1, 2009 and directs the California Natural Resources Agency to certify and adopt the CEQA Guidelines by January 1, 2010.

Senate Bill 379: General Plans: Safety Element—Climate Adaptation

Senate Bill 379 builds upon the flood planning inclusions into the safety and housing elements and the hazard mitigation planning safety element inclusions in general plans outlined in AB 162 and AB 2140, respectively. SB 379 focuses on a new requirement that cities and counties include climate adaptation and resiliency strategies in the safety element of their general plans beginning January 1, 2017. In addition, this bill requires general plans to include a set of goals, policies and objectives, and specified implementation measures based on the conclusions drawn from climate adaptation research and recommendations.

Senate Bill 1000: General Plan Amendments—Safety and Environmental Justice Elements

In 2016, Senate Bill 1000 amended California's Planning and Zoning Law in two ways:

- The original law established requirements for initial revisions of general plan safety elements to address flooding, fire, and climate adaptation and resilience. It also required subsequent review and revision as necessary based on new information. Senate Bill 1000 specifies that the subsequent reviews and revision based on new information are required to address only flooding and fires (not climate adaptation and resilience).
- Senate Bill 1000 adds a requirement that, upon adoption or revision of any two other general plan elements on or after January 1, 2018, an environmental justice element be adopted for the general plan or environmental justice goals, policies and objectives be incorporated into other elements of the plan.

Senate Bill 1241: General Plans: Safety Element—Fire Hazard Impacts

In 2012, Senate Bill 1241 passed requiring that the safety elements of all future general plans address fire risk in state responsibility areas and very high fire hazard severity zones. The bill requires cities and counties to make findings regarding available fire protection and suppression services before approving a tentative map or parcel map.

Standardized Emergency Management System

CCR Title 19 establishes the Standardized Emergency Management System (SEMS) to standardize the response to emergencies involving multiple jurisdictions. SEMS is intended to be flexible and adaptable to the needs of all emergency responders in California. It requires emergency response agencies to use basic principles and components of emergency management. Local governments must use SEMS by December 1, 1996, to be eligible for state funding of response-related personnel costs under CCR Title 19 (Sections 2920, 2925 and 2930). The roles and responsibilities of Individual agencies contained in existing laws or the state emergency plan are not superseded by these regulations. This hazard mitigation plan is considered to be a support document for all phases of emergency management, including those associated with SEMS.

Western Governors Association Ten-Year Comprehensive Strategy

The Western Governors Association Ten-Year Comprehensive Strategy: A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment (August 2001),

Del Norte County Operational Area Hazard Mitigation Plan

Appendix C. Risk Assessment Results

C. Risk Assessment Results

DAM FAILURE

Exposure in the Dam Failure Inundation Zone

Planning Unit	Estimated Exposure in the Dam Failure Inundation Zone[c]						
	Population Exposed[a]	% of Population Exposed	Buildings Exposed[b]	Structure Value Exposed[b]	Contents Value Exposed[b]	Total Value Exposed (Structure + Contents)[b]	% of Total Value Exposed
Crescent City Limits	0	0.00%	0	$0	$0	$0	0.00%
Crescent City UGA	0	0.00%	0	$0	$0	$0	0.00%
Elk Valley Rancheria	0	0.00%	0	$0	$0	$0	0.00%
Gasquet	0	0.00%	0	$0	$0	$0	0.00%
Hiouchi	0	0.00%	0	$0	$0	$0	0.00%
Klamath	1,152	86.49%	416	$426,580,480	$348,861,586	$775,442,067	91.46%
Smith River	0	0.00%	0	$0	$0	$0	0.00%
Unincorporated County	0	0.00%	0	$0	$0	$0	0.00%
Total	**1,152**	**4.15%**	**416**	**$426,580,480**	**$348,861,586**	**$775,442,067**	**5.04%**

a. Percent of residential buildings exposed multiplied by the estimated population (2010 Census population multiplied by the countywide percent change in population (-2.96%) between the American Community Survey 2006-2010 and 2012-2016 5-Year Estimates).
b. Values based on Del Norte County tax parcel data received August 2017.
c. Combined dam inundation areas (Copco No. 1, Iron Gate, and Trinity dams) data acquired from the California Department of Conservation.

Structures in the Dam Failure Inundation Zone by Land Use Type

Planning Unit	Number of Structures within Dam Failure Inundation Zone[a]							
	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Crescent City Limits	0	0	0	0	0	0	0	0
Crescent City UGA	0	0	0	0	0	0	0	0
Elk Valley Rancheria	0	0	0	0	0	0	0	0
Gasquet	0	0	0	0	0	0	0	0
Hiouchi	0	0	0	0	0	0	0	0
Klamath	365	42	0	0	2	7	0	416
Smith River	0	0	0	0	0	0	0	0
Unincorporated County	0	0	0	0	0	0	0	0
Total	**365**	**42**	**0**	**0**	**2**	**7**	**0**	**416**

a. Values based on Del Norte County tax parcel data received August 2017.

Critical Facilities and Infrastructure in the Dam Failure Inundation Zone									
	Number of Facilities in the Dam Failure Inundation Zone								
Planning Unit	Crescent City Limits	Crescent City UGA	Elk Valley Rancheria	Gasquet	Hiouchi	Klamath	Smith River	Unincorporated County	Total
Bridges	0	0	0	0	0	16	0	1	**17**
Communication	0	0	0	0	0	0	0	0	**0**
Fuel Storage	0	0	0	0	0	0	0	0	**0**
Government Function	0	0	0	0	0	1	0	0	**1**
Hazardous Materials	0	0	0	0	0	0	0	0	**0**
Medical & Health	0	0	0	0	0	0	0	0	**0**
Other Critical Function	0	0	0	0	0	3	0	0	**3**
Power	0	0	0	0	0	0	0	0	**0**
Protective Function	0	0	0	0	0	1	0	0	**1**
Schools	0	0	0	0	0	1	0	0	**1**
Societal Function	0	0	0	0	0	2	0	0	**2**
Wastewater	0	0	0	0	0	1	0	0	**1**
Water Supply	0	0	0	0	0	2	0	0	**2**
Total	0	0	0	0	0	27	0	1	28

EARTHQUAKE

Exposure in the Earthquake Hazard Area					
	Estimated Exposure to the Earthquake Hazard[c]				
Planning Unit	Population Exposed[a]	% of Population Exposed	Buildings Exposed[b]	Total Value Exposed (Structure + Contents)[b]	% of Total Value Exposed
Crescent City Limits	7,417	100%	1,266	$5,575,854,297	100%
Crescent City UGA	11,819	100%	4,218	$5,246,930,338	100%
Elk Valley Rancheria	98	100%	32	$90,720,737	100%
Gasquet	700	100%	305	$518,564,637	100%
Hiouchi	739	100%	319	$361,077,007	100%
Klamath	1,332	100%	479	$847,803,630	100%
Smith River	1,918	100%	751	$1,429,583,586	100%
Unincorporated County	3,740	100%	1,406	$1,326,370,532	100%
Total	27,763	100%	8,776	$15,396,904,764	100%

a. Estimated population calculated as the 2010 Census population multiplied by the countywide percent change in population (-2.96%) between the American Community Survey 2006-2010 and 2012-2016 5-Year Estimates.
b. Values based on Del Norte County tax parcel data received August 2017.
c. The entire planning area is exposed to the earthquake hazard, so the exposure estimates are equal to the planning area totals, and are the same for all modeled earthquake scenarios.

Critical Facilities and Infrastructure in the Earthquake Hazard Area									
	Number of Facilities in the Earthquake Hazard Area[a]								
Planning Unit	Crescent City Limits	Crescent City UGA	Elk Valley Rancheria	Gasquet	Hiouchi	Klamath	Smith River	Unincorporated County	Total
Bridges	0	3	0	17	9	17	11	15	**72**
Communication	2	1	0	1	2	1	3	0	**10**
Fuel Storage	3	0	0	0	1	0	2	0	**6**
Government Function	16	4	1	1	2	1	7	1	**33**
Hazardous Materials	1	0	0	0	0	0	16	0	**17**
Medical & Health	2	2	0	0	0	0	1	0	**5**
Other Critical Function	1	1	6	1	1	3	4	0	**17**
Power	2	3	0	1	3	0	2	1	**12**
Protective Function	6	0	0	1	1	1	2	2	**13**
Schools	4	3	1	1	0	1	2	2	**14**
Societal Function	8	7	0	1	2	2	8	2	**30**
Wastewater	1	0	0	0	0	1	4	0	**6**
Water Supply	1	3	0	0	2	2	12	5	**25**
Total	**47**	**27**	**8**	**24**	**23**	**29**	**74**	**28**	**260**

a. The entire planning area is exposed to the earthquake hazard, so the numbers of exposed critical facilities and infrastructure are the same as the total planning area critical facility and infrastructure counts, and are the same for all modeled earthquake scenarios.

Potential Damage in the Earthquake Hazard Area

Planning Unit	Estimated Potential Damage						
	Structure Debris (x 1,000 Tons)[a]	Number of Displaced Households[a]	People Requiring Short-Term Shelter[a]	Value of Structure Damaged[a]	Value of Contents Damaged[a]	Total Value (Structure + Contents) Damaged[a]	Damage as % of Total Value
100-YEAR PROBABILISTIC							
Crescent City Limits	15.23	0	0	$32,495,561	$10,256,522	$42,752,083	0.8%
Crescent City UGA	13.22	1	0	$28,315,080	$9,066,263	$37,381,343	0.7%
Elk Valley Rancheria	0.23	0	0	$501,457	$151,989	$653,446	0.7%
Gasquet	0.51	0	0	$1,126,463	$336,583	$1,463,046	0.3%
Hiouchi	0.35	0	0	$784,357	$234,363	$1,018,720	0.3%
Klamath	1.01	0	0	$2,260,200	$636,592	$2,896,791	0.3%
Smith River	1.40	0	0	$3,105,442	$927,895	$4,033,337	0.3%
Unincorporated County	2.25	0	0	$4,979,978	$1,473,343	$6,453,320	0.5%
Total	**34.20**	**1**	**1**	**$73,568,536**	**$23,083,550**	**$96,652,086**	**0.6%**
BIG LAGOON BALD MOUNTAIN M7.9							
Crescent City Limits	798.85	221	153	$1,458,528,826	$470,261,368	$1,928,790,194	34.6%
Crescent City UGA	720.36	365	240	$1,395,826,538	$451,109,599	$1,846,936,136	35.2%
Elk Valley Rancheria	11.44	2	2	$21,111,631	$6,574,216	$27,685,847	30.5%
Gasquet	5.45	0	0	$10,098,452	$2,786,201	$12,884,653	2.5%
Hiouchi	3.80	0	0	$7,031,561	$1,940,034	$8,971,595	2.5%
Klamath	73.57	2	2	$130,219,570	$36,113,787	$166,333,357	19.6%
Smith River	15.03	0	0	$27,839,502	$7,681,024	$35,520,526	2.5%
Unincorporated County	152.03	65	82	$290,483,662	$89,420,599	$379,904,260	28.6%
Total	**1,780.53**	**656**	**479**	**$3,341,139,740**	**$1,065,886,827**	**$4,407,026,568**	**28.6%**
TRINIDAD ALT 1 M7.5							
Crescent City Limits	25.57	1	1	$54,341,764	$17,818,454	$72,160,218	1.3%
Crescent City UGA	22.93	6	4	$50,896,749	$17,669,864	$68,566,614	1.3%
Elk Valley Rancheria	0.37	0	0	$816,995	$277,070	$1,094,066	1.2%
Gasquet	0.37	0	0	$1,291,393	$665,675	$1,957,068	0.4%
Hiouchi	0.26	0	0	$899,198	$463,510	$1,362,708	0.4%
Klamath	9.50	0	0	$18,319,371	$4,780,542	$23,099,913	2.7%
Smith River	1.02	0	0	$3,560,124	$1,835,139	$5,395,263	0.4%
Unincorporated County	4.27	0	0	$9,184,556	$2,909,878	$12,094,434	0.9%
Total	**64.27**	**8**	**5**	**$139,310,151**	**$46,420,133**	**$185,730,284**	**1.2%**
CASCADIA M9.0							
Crescent City Limits	338.58	79	51	$589,311,825	$155,440,554	$744,752,379	13.4%
Crescent City UGA	369.56	249	160	$706,241,402	$204,670,601	$910,912,002	17.4%
Elk Valley Rancheria	6.35	2	1	$11,924,460	$3,319,256	$15,243,716	16.8%
Gasquet	16.71	2	1	$29,790,827	$7,626,874	$37,417,701	7.2%
Hiouchi	11.64	1	1	$20,743,379	$5,310,599	$26,053,977	7.2%
Klamath	42.48	0	0	$72,354,907	$16,719,131	$89,074,038	10.5%
Smith River	46.07	6	3	$82,127,616	$21,025,833	$103,153,448	7.2%
Unincorporated County	100.36	63	79	$194,547,554	$55,194,204	$249,741,758	18.8%
Total	**931.76**	**402**	**297**	**$1,707,041,969**	**$469,307,051**	**$2,176,349,020**	**14.1%**

a. Calculated using a Census tract level, general building stock (GBS) analysis in Hazus 4.0.

FLOOD

Exposure in the Flood Hazard Area							
	Estimated Exposure in the Flood Hazard Area						
Planning Unit	Population Exposed[a]	% of Population Exposed	Buildings Exposed[b]	Structure Value Exposed[b]	Contents Value Exposed[b]	Total Value Exposed (Structure + Contents)[b]	% of Total Value Exposed
100-YEAR FLOOD							
Crescent City Limits	8	0.1%	11	$72,149,064	$72,020,032	$144,169,096	2.6%
Crescent City UGA	60	0.5%	28	$93,536,810	$75,524,805	$169,061,615	3.2%
Elk Valley Rancheria	0	0.0%	0	$0	$0	$0	0.0%
Gasquet	101	14.4%	42	$45,646,415	$25,113,918	$70,760,333	13.6%
Hiouchi	63	8.5%	27	$13,898,760	$10,543,930	$24,442,690	6.8%
Klamath	158	11.8%	64	$90,326,851	$85,892,186	$176,219,037	20.8%
Smith River	54	2.8%	29	$57,836,051	$67,190,196	$125,026,247	8.7%
Unincorporated County	240	6.4%	90	$45,792,244	$38,261,192	$84,053,436	6.3%
Total	**684**	**2.5%**	**291**	**$419,186,195**	**$374,546,258**	**$793,732,453**	**5.2%**
500-YEAR FLOOD							
Crescent City Limits	8	0.1%	11	$72,149,064	$72,020,032	$144,169,096	2.6%
Crescent City UGA	60	0.5%	28	$93,536,810	$75,524,805	$169,061,615	3.2%
Elk Valley Rancheria	0	0.0%	0	$0	$0	$0	0.0%
Gasquet	145	20.7%	60	$80,991,274	$42,786,347	$123,777,621	23.9%
Hiouchi	75	10.2%	32	$15,189,079	$11,189,090	$26,378,169	7.3%
Klamath	158	11.8%	64	$90,326,851	$85,892,186	$176,219,037	20.8%
Smith River	60	3.1%	35	$81,893,219	$95,570,720	$177,463,939	12.4%
Unincorporated County	288	7.7%	108	$56,716,336	$47,317,788	$104,034,124	7.8%
Total	**793**	**2.9%**	**338**	**$490,802,633**	**$430,300,966**	**$921,103,599**	**6.0%**

a. Percent of residential buildings exposed multiplied by the Estimated Population (calculated as the 2010 Census population multiplied by the countywide percent change in population (-2.96%) between the American Community Survey 2006-2010 and 2012-2016 5-Year Estimates).
b. Values based on Del Norte County tax parcel data received August 2017.

Structures in the Flood Hazard Area by Land Use Type

Planning Units	Number of Structures within the Flood Hazard Area[a]								
	Acres of Floodplain	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
100-YEAR FLOOD									
Crescent City Limits	67	1	10	0	0	0	0	0	11
Crescent City UGA	1,578	20	8	0	0	0	0	0	28
Elk Valley Rancheria	0	0	0	0	0	0	0	0	0
Gasquet	389	41	1	0	0	0	0	0	42
Hiouchi	964	26	1	0	0	0	0	0	27
Klamath	4,740	50	12	0	0	1	1	0	64
Smith River	3,029	19	4	5	1	0	0	0	29
Unincorporated County	9,130	86	3	1	0	0	0	0	90
Total	**19,896**	**243**	**39**	**6**	**1**	**1**	**1**	**0**	**291**
500-YEAR FLOOD									
Crescent City Limits	67	1	10	0	0	0	0	0	11
Crescent City UGA	1,578	20	8	0	0	0	0	0	28
Elk Valley Rancheria	0	0	0	0	0	0	0	0	0
Gasquet	425	59	1	0	0	0	0	0	60
Hiouchi	976	31	1	0	0	0	0	0	32
Klamath	4,740	50	12	0	0	1	1	0	64
Smith River	3,206	21	6	7	1	0	0	0	35
Unincorporated County	9,406	103	4	1	0	0	0	0	108
Total	**20,398**	**285**	**42**	**8**	**1**	**1**	**1**	**0**	**338**

a. Values based on Del Norte County tax parcel data received August 2017.

Critical Facilities and Infrastructure in the Flood Hazard Area

Planning Unit	Number of Facilities in the Flood Hazard Area								
	Crescent City Limits	Crescent City UGA	Elk Valley Rancheria	Gasquet	Hiouchi	Klamath	Smith River	Unincorporated County	Total
100-YEAR FLOOD									
Bridges	0	1	0	1	4	13	7	3	**29**
Communication	0	0	0	0	0	0	0	0	**0**
Fuel Storage	0	0	0	0	0	0	0	0	**0**
Government Function	0	1	0	0	0	1	0	0	**2**
Hazardous Materials	0	0	0	0	0	0	2	0	**2**
Medical & Health	0	0	0	0	0	0	0	0	**0**
Other Critical Function	0	0	0	0	0	3	3	0	**6**
Power	0	0	0	0	1	0	0	0	**1**
Protective Function	0	0	0	0	0	1	0	0	**1**
Schools	0	0	0	0	0	1	0	0	**1**
Societal Function	0	0	0	0	0	0	0	0	**0**
Wastewater	0	0	0	0	0	1	0	0	**1**
Water Supply	0	0	0	0	0	0	0	1	**1**
Total	**0**	**2**	**0**	**1**	**5**	**20**	**12**	**4**	**44**
500-YEAR FLOOD									
Bridges	0	1	0	1	4	13	8	4	**31**
Communication	0	0	0	0	0	0	0	0	**0**
Fuel Storage	0	0	0	0	0	0	0	0	**0**
Government Function	0	1	0	0	0	1	0	0	**2**
Hazardous Materials	0	0	0	0	0	0	2	0	**2**
Medical & Health	0	0	0	0	0	0	0	0	**0**
Other Critical Function	0	0	0	0	0	3	3	0	**6**
Power	0	0	0	0	1	0	0	0	**1**
Protective Function	0	0	0	0	0	1	0	0	**1**
Schools	0	0	0	0	0	1	0	0	**1**
Societal Function	0	0	0	0	0	0	0	0	**0**
Wastewater	0	0	0	0	0	1	0	0	**1**
Water Supply	0	0	0	0	0	0	0	1	**1**
Total	**0**	**2**	**0**	**1**	**5**	**20**	**13**	**5**	**46**

Potential Damage in the Flood Hazard Area

Planning Units	Estimated Potential Damage						
	Structure Debris (Tons)[a]	Displaced Population[b]	Buildings Impacted[c]	Value of Structure Damaged[c]	Value of Contents Damaged[c]	Total Value Damaged (Structure + Contents) [c]	Damage as % of Total Value
100-YEAR FLOOD							
Crescent City Limits	12,822	2	4	$444,774	$1,046,758	$1,491,532	0.0%
Crescent City UGA	3,098	7	20	$16,790,583	$22,780,209	$39,570,792	0.8%
Elk Valley Rancheria	0	0	0	$0	$0	$0	0.0%
Gasquet	7,512	16	29	$965,559	$568,952	$1,534,511	0.3%
Hiouchi	3,949	20	27	$6,572,228	$8,266,878	$14,839,105	4.1%
Klamath	44,976	53	58	$35,680,872	$56,959,862	$92,640,735	10.9%
Smith River	2,310	12	15	$687,814	$1,020,162	$1,707,977	0.1%
Unincorporated County	4,594	66	81	$2,813,919	$1,932,524	$4,746,444	0.4%
Total	**79,262**	**176**	**234**	**$63,955,749**	**$92,575,346**	**$156,531,095**	**1.0%**
500-YEAR FLOOD							
Crescent City Limits	12,822	2	4	$444,780	$1,046,760	$1,491,540	0.0%
Crescent City UGA	3,098	7	20	$16,790,580	$22,780,200	$39,570,780	0.8%
Elk Valley Rancheria	0	0	0	$0	$0	$0	0.0%
Gasquet	14,127	28	47	$9,727,420	$12,870,570	$22,597,990	4.4%
Hiouchi	4,314	20	30	$7,322,730	$8,842,260	$16,164,990	4.5%
Klamath	44,976	53	58	$35,680,840	$56,959,800	$92,640,640	10.9%
Smith River	2,931	15	21	$2,714,370	$6,334,460	$9,048,830	0.6%
Unincorporated County	5,794	86	91	$9,426,020	$5,022,830	$14,448,850	1.1%
Total	**88,062**	**213**	**271**	**$82,106,740**	**$113,856,880**	**$195,963,620**	**1.3%**

a. Calculated using a Census block level, general building stock (GBS) analysis in Hazus 4.0.
b. Calculated using a Census block level, general building stock (GBS) analysis in Hazus 4.0, and adjusted to reflect the estimated population.
c. Calculated using a user-defined analysis in Hazus 4.0.

LANDSLIDE

Exposure in the Landslide Hazard Area

Planning Unit	Estimated Exposure in the Landslide Hazard Area						
	Population Exposed[a]	% of Population Exposed	Buildings Exposed[b]	Structure Value Exposed[b]	Contents Value Exposed[b]	Total Value Exposed (Structure + Contents)[b]	% of Total Value Exposed
Very High Landslide Susceptibility Zone (Category X - includes existing landslides)[c]							
Crescent City Limits	0	0.00%	0	$0	$0	$0	0.00%
Crescent City UGA	0	0.00%	0	$0	$0	$0	0.00%
Elk Valley Rancheria	0	0.00%	0	$0	$0	$0	0.00%
Gasquet	12	1.75%	5	$1,127,296	$563,648	$1,690,944	0.33%
Hiouchi	5	0.66%	2	$516,128	$258,064	$774,192	0.21%
Klamath	54	4.03%	20	$47,516,580	$30,162,360	$77,678,940	9.16%
Smith River	83	4.33%	29	$7,379,234	$3,689,617	$11,068,851	0.77%
Unincorporated County	50	1.34%	18	$4,319,103	$2,159,551	$6,478,654	0.49%
Total	**204**	**0.74%**	**74**	**$60,858,340**	**$36,833,240**	**$97,691,580**	**0.63%**
High Landslide Susceptibility Zone (Categories VII, VIII and IX)[c]							
Crescent City Limits	8	0.10%	1	258,064	129,032	387,096	0.01%
Crescent City UGA	117	0.99%	40	10,859,657	6,397,993	17,257,650	0.33%
Elk Valley Rancheria	0	0.00%	0	0	0	0	0.00%
Gasquet	309	44.21%	136	127,679,881	112,615,330	240,295,211	46.34%
Hiouchi	257	34.75%	110	57,241,742	42,999,071	100,240,814	27.76%
Klamath	316	23.70%	106	47,845,941	37,248,181	85,094,122	10.04%
Smith River	641	33.43%	237	180,404,530	137,637,275	318,041,805	22.25%
Unincorporated County	296	7.92%	111	52,422,198	38,968,489	91,390,687	6.89%
Total	**1,944**	**7.00%**	**741**	**476,712,014**	**375,995,372**	**852,707,386**	**5.54%**
Moderate Landslide Susceptibility Zone (Categories V and VI)[c]							
Crescent City Limits	323	4.35%	51	99,693,708	78,603,254	178,296,961	3.20%
Crescent City UGA	603	5.10%	219	168,339,554	147,382,817	315,722,371	6.02%
Elk Valley Rancheria	4	3.85%	2	4,839,484	4,710,452	9,549,936	10.53%
Gasquet	110	15.79%	46	15,326,868	9,954,144	25,281,012	4.88%
Hiouchi	211	28.52%	89	34,059,051	22,914,785	56,973,836	15.78%
Klamath	44	3.32%	18	29,115,618	27,632,169	56,747,788	6.69%
Smith River	195	10.15%	79	87,868,982	86,435,151	174,304,134	12.19%
Unincorporated County	193	5.15%	72	30,083,455	21,913,858	51,997,313	3.92%
Total	**1,683**	**6.06%**	**576**	**469,326,721**	**399,546,630**	**868,873,351**	**5.64%**

a. Percent of residential buildings exposed multiplied by the Estimated Population (calculated as the 2010 Census population multiplied by the countywide percent change in population (-2.96%) between the American Community Survey 2006-2010 and 2012-2016 5-Year Estimates)

b. Values based on Del Norte County tax parcel data received August 2017.

c. Susceptibility to deep-seated landslides data received from California Geological Survey August 2016. Source data originally published May 2011.

Structures in the Landslide Hazard Area by Land Use Type								
Planning Unit	Number of Structures within the Landslide Hazard Area[a]							
	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Very High Landslide Susceptibility Zone (Category X - includes existing landslides)[b]								
Crescent City Limits	0	0	0	0	0	0	0	0
Crescent City UGA	0	0	0	0	0	0	0	0
Elk Valley Rancheria	0	0	0	0	0	0	0	0
Gasquet	5	0	0	0	0	0	0	5
Hiouchi	2	0	0	0	0	0	0	2
Klamath	17	1	0	0	1	1	0	20
Smith River	29	0	0	0	0	0	0	29
Unincorporated County	18	0	0	0	0	0	0	18
Total	**71**	**1**	**0**	**0**	**1**	**1**	**0**	**74**
High Landslide Susceptibility Zone (Categories VII, VIII and IX)[b]								
Crescent City Limits	1	0	0	0	0	0	0	1
Crescent City UGA	39	0	0	0	0	1	0	40
Elk Valley Rancheria	0	0	0	0	0	0	0	0
Gasquet	126	9	0	0	0	0	1	136
Hiouchi	106	4	0	0	0	0	0	110
Klamath	100	5	0	0	0	1	0	106
Smith River	224	7	6	0	0	0	0	237
Unincorporated County	106	5	0	0	0	0	0	111
Total	**702**	**30**	**6**	**0**	**0**	**2**	**1**	**741**
Moderate Landslide Susceptibility Zone (Categories V and VI)[b]								
Crescent City Limits	43	8	0	0	0	0	0	51
Crescent City UGA	201	15	0	0	2	0	1	219
Elk Valley Rancheria	1	1	0	0	0	0	0	2
Gasquet	45	1	0	0	0	0	0	46
Hiouchi	87	2	0	0	0	0	0	89
Klamath	14	4	0	0	0	0	0	18
Smith River	68	8	3	0	0	0	0	79
Unincorporated County	69	3	0	0	0	0	0	72
Total	**528**	**42**	**3**	**0**	**2**	**0**	**1**	**576**

a. Values based on Del Norte County tax parcel data received August 2017.
b. Susceptibility to deep-seated landslides data received from California Geological Survey August 2016. Source data originally published May 2011.

Critical Facilities and Infrastructure in the Landslide Hazard Area

Planning Unit	Number of Facilities in the Landslide Hazard Area								
	Crescent City Limits	Crescent City UGA	Elk Valley Rancheria	Gasquet	Hiouchi	Klamath	Smith River	Unincorporated County	Total
Very High Landslide Susceptibility Zone (Category X - includes existing landslides)									
Bridges	0	0	0	2	0	3	0	0	**5**
Communication	0	0	0	0	0	0	0	0	**0**
Fuel Storage	0	0	0	0	0	0	0	0	**0**
Government Function	0	0	0	0	0	0	0	0	**0**
Hazardous Materials	0	0	0	0	0	0	0	0	**0**
Medical & Health	0	0	0	0	0	0	0	0	**0**
Other Critical Function	0	0	0	0	0	0	0	0	**0**
Power	0	0	0	1	0	0	0	0	**1**
Protective Function	0	0	0	0	0	0	0	0	**0**
Schools	0	0	0	0	0	0	0	0	**0**
Societal Function	0	0	0	0	0	0	0	0	**0**
Wastewater	0	0	0	0	0	0	0	0	**0**
Water Supply	0	0	0	0	0	1	1	1	**3**
Total	**0**	**0**	**0**	**3**	**0**	**4**	**1**	**1**	**9**
High Landslide Susceptibility Zone (Categories VII, VIII and IX)									
Bridges	0	0	0	8	3	1	3	5	**20**
Communication	0	0	0	0	0	0	1	0	**1**
Fuel Storage	0	0	0	0	0	0	1	0	**1**
Government Function	0	0	0	1	0	0	0	0	**1**
Hazardous Materials	0	0	0	0	0	0	2	0	**2**
Medical & Health	0	0	0	0	0	0	0	0	**0**
Other Critical Function	0	0	0	0	0	0	1	0	**1**
Power	0	0	0	0	0	0	0	0	**0**
Protective Function	0	0	0	0	0	0	0	0	**0**
Schools	0	0	0	0	0	0	1	0	**1**
Societal Function	0	0	0	0	0	1	0	0	**1**
Wastewater	0	0	0	0	0	0	0	0	**0**
Water Supply	0	1	0	0	2	0	8	1	**12**
Total	**0**	**1**	**0**	**9**	**5**	**2**	**17**	**6**	**40**
Moderate Landslide Susceptibility Zone (Categories V and VI)									
Bridges	0	0	0	2	2	1	2	3	**10**
Communication	0	0	0	1	2	1	0	0	**4**
Fuel Storage	0	0	0	0	0	0	0	0	**0**
Government Function	0	0	0	0	1	0	2	0	**3**
Hazardous Materials	1	0	0	0	0	0	2	0	**3**
Medical & Health	0	0	0	0	0	0	0	0	**0**
Other Critical Function	0	0	1	0	1	0	0	0	**2**
Power	0	0	0	0	2	0	0	0	**2**
Protective Function	0	0	0	0	0	0	0	0	**0**
Schools	0	0	0	1	0	0	0	0	**1**
Societal Function	0	0	0	0	0	0	0	0	**0**
Wastewater	0	0	0	0	0	0	1	0	**1**
Water Supply	0	0	0	0	0	0	3	0	**3**
Total	**1**	**0**	**1**	**4**	**8**	**2**	**10**	**3**	**29**

TSUNAMI

Exposure in the Tsunami Hazard Area

Planning Units	Estimated Exposure in the Tsunami Hazard Area: Population Exposed[a]	% of Population Exposed	Buildings Exposed[b]	Structure Value Exposed[b]	Contents Value Exposed[b]	Total Value Exposed (Structure + Contents)[b]	% of Total Value Exposed
Crescent City Limits	1,727	23%	417	$1,987,423,572	$1,658,759,274	$3,646,182,847	65.4%
Crescent City UGA	330	3%	158	$413,244,399	$374,615,140	$787,859,539	15.0%
Elk Valley Rancheria	0	0%	0	$0	$0	$0	0.0%
Gasquet	0	0%	0	$0	$0	$0	0.0%
Hiouchi	0	0%	0	$0	$0	$0	0.0%
Klamath	158	12%	69	$159,663,443	$140,262,096	$299,925,539	35.4%
Smith River	318	17%	120	$145,340,951	$101,109,906	$246,450,857	17.2%
Unincorporated County	59	2%	22	$11,362,661	$9,275,880	$20,638,541	1.6%
Total	**2,591**	**9%**	**786**	**$2,717,035,027**	**$2,284,022,295**	**$5,001,057,322**	**32.5%**

a. Percent of residential buildings exposed multiplied by the Estimated Population (calculated as the 2010 Census population multiplied by the countywide percent change in population (-2.96%) between the American Community Survey 2006-2010 and 2012-2016 5-Year Estimates)

b. Values based on Del Norte County tax parcel data received August 2017.

Structures in the Tsunami Hazard Area by Land Use Type

Planning Units	Acres of Tsunami Inundation Zone	Number of Structures within the Tsunami Hazard Area[a]: Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Crescent City Limits	535	230	164	1	0	13	7	2	417
Crescent City UGA	3,623	110	46	2	0	0	0	0	158
Elk Valley Rancheria	44	0	0	0	0	0	0	0	0
Gasquet	0	0	0	0	0	0	0	0	0
Hiouchi	0	0	0	0	0	0	0	0	0
Klamath	2,455	50	19	0	0	0	0	0	69
Smith River	2,076	111	9	0	0	0	0	0	120
Unincorporated County	6,607	21	1	0	0	0	0	0	22
Total	**15,340**	**522**	**239**	**3**	**0**	**13**	**7**	**2**	**786**

a. Values based on Del Norte County tax parcel data received August 2017.

Critical Facilities and Infrastructure in the Tsunami Hazard Area

Planning Unit	Number of Facilities in the Tsunami Hazard Area								
	Crescent City Limits	Crescent City UGA	Elk Valley Rancheria	Gasquet	Hiouchi	Klamath	Smith River	Unincorporated County	Total
Bridges	0	1	0	0	0	9	1	2	**13**
Communication	1	0	0	0	0	0	0	0	**1**
Fuel Storage	2	0	0	0	0	0	0	0	**2**
Government Function	9	2	0	0	0	0	1	0	**12**
Hazardous Materials	0	0	0	0	0	0	0	0	**0**
Medical & Health	1	0	0	0	0	0	0	0	**1**
Other Critical Function	1	0	0	0	0	1	2	0	**4**
Power	0	0	0	0	0	0	0	0	**0**
Protective Function	4	0	0	0	0	0	0	0	**4**
Schools	0	0	0	0	0	0	0	0	**0**
Societal Function	4	0	0	0	0	1	0	0	**5**
Wastewater	1	0	0	0	0	1	1	0	**3**
Water Supply	0	0	0	0	0	0	0	0	**0**
Total	**23**	**3**	**0**	**0**	**0**	**12**	**5**	**2**	**45**

Potential Damage in the Tsunami Hazard Area

Planning Units	Estimated Potential Damage							
	Structure Debris (Tons)[a]	Displaced Population [b]	People Requiring Short-Term Shelter[b]	Buildings Impacted [c]	Value of Structure Damaged[c]	Value of Contents Damaged[c]	Total Value (Structure + Contents) Damaged[c]	Damage as % of Total Value
Crescent City Limits	136,111	1,033	780	234	$396,972,248	$783,411,672	$1,180,383,920	21.2%
Crescent City UGA	28,562	85	76	90	$37,614,045	$89,389,973	$127,004,018	2.4%
Elk Valley Rancheria	0	0	0	0	$0	$0	$0	0.0%
Gasquet	0	0	0	0	$0	$0	$0	0.0%
Hiouchi	0	0	0	0	$0	$0	$0	0.0%
Klamath	13,794	29	14	49	$27,830,141	$58,159,977	$85,990,118	10.1%
Smith River	7,256	70	41	18	$6,807,812	$14,973,515	$21,781,327	1.5%
Unincorporated County	335	6	3	12	$425,442	$175,694	$601,136	0.0%
Total	**186,059**	**1,222**	**914**	**403**	**$469,649,688**	**$946,110,830**	**$1,415,760,518**	**9.2%**

a. Calculated using a Census block level, general building stock (GBS) analysis in Hazus 4.0.
b. Calculated using a Census block level, general building stock (GBS) analysis in Hazus 4.0, and adjusted to reflect the estimated population.
c. Calculated using a user-defined analysis in Hazus 4.0.

WILDLAND FIRE

Exposure in the Wildland Fire Hazard Area							
	Estimated Exposure in the Wildland Fire Hazard Area						
Planning Units	Population Exposed[a]	% of Population Exposed	Buildings Exposed [b]	Structure Value Exposed[b]	Contents Value Exposed[b]	Total Value Exposed (Structure + Contents)[b]	% of Total Value Exposed
Very High Fire Severity Zone[c]							
Crescent City Limits	0	0.0%	0	$0	$0	$0	0.0%
Crescent City UGA	0	0.0%	0	$0	$0	$0	0.0%
Elk Valley Rancheria	0	0.0%	0	$0	$0	$0	0.0%
Gasquet	675	96.5%	295	$288,974,423	$225,719,256	$514,693,679	99.3%
Hiouchi	531	71.8%	231	$174,726,181	$130,497,690	$305,223,871	84.5%
Klamath	98	7.3%	31	$9,241,269	$4,620,635	$13,861,904	1.6%
Smith River	66	3.4%	35	$63,031,118	$83,215,019	$146,246,138	10.2%
Unincorporated County	232	6.2%	93	$69,482,033	$58,914,547	$128,396,580	9.7%
Total	**1,602**	**5.8%**	**685**	**$605,455,024**	**$502,967,147**	**$1,108,422,171**	**7.2%**
High Fire Severity Zone[c]							
Crescent City Limits	0	0.0%	0	$0	$0	$0	0.0%
Crescent City UGA	3	0.0%	1	$258,064	$129,032	$387,096	0.0%
Elk Valley Rancheria	0	0.0%	0	$0	$0	$0	0.0%
Gasquet	0	0.0%	0	$0	$0	$0	0.0%
Hiouchi	65	8.9%	28	$11,386,120	$7,983,770	$19,369,891	5.4%
Klamath	290	21.8%	120	$194,669,256	$170,986,682	$365,655,939	43.1%
Smith River	140	7.3%	76	$201,109,958	$191,624,694	$392,734,652	27.5%
Unincorporated County	101	2.7%	38	$14,829,909	$10,673,829	$25,503,738	1.9%
Total	**600**	**2.2%**	**263**	**$422,253,308**	**$381,398,008**	**$803,651,315**	**5.2%**
Moderate Fire Severity Zone[c]							
Crescent City Limits	150	2.0%	61	$635,395,803	$464,571,881	$1,099,967,684	19.7%
Crescent City UGA	7,586	64.2%	2,702	$1,739,631,868	$1,479,832,993	$3,219,464,861	61.4%
Elk Valley Rancheria	98	100.0%	32	$46,943,195	$43,777,542	$90,720,737	100.0%
Gasquet	25	3.5%	10	$2,580,638	$1,290,319	$3,870,958	0.7%
Hiouchi	143	19.3%	60	$21,925,797	$14,557,448	$36,483,245	10.1%
Klamath	938	70.4%	326	$261,674,419	$206,081,712	$467,756,131	55.2%
Smith River	1,346	70.1%	499	$378,592,383	$279,032,370	$657,624,753	46.0%
Unincorporated County	3,374	90.2%	1,262	$648,665,479	$505,104,384	$1,153,769,863	87.0%
Total	13,659	49.2%	4,952	$3,735,409,582	$2,994,248,651	$6,729,658,232	43.7%

a. Percent of residential buildings exposed multiplied by the Estimated Population (calculated as the 2010 Census population multiplied by the countywide percent change in population (-2.96%) between the American Community Survey 2006-2010 and 2012-2016 5-Year Estimates)
b. Values based on Del Norte County tax parcel data received August 2017.
c. Fire hazard severity data downloaded from CAL FIRE website in July 2017.

Structures in the Wildland Fire Hazard Area by Land Use Type								
	Number of Structures within the Wildland Fire Hazard Area[a]							
Planning Units	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Very High Fire Severity Zone[b]								
Crescent City Limits	0	0	0	0	0	0	0	0
Crescent City UGA	0	0	0	0	0	0	0	0
Elk Valley Rancheria	0	0	0	0	0	0	0	0
Gasquet	275	16	0	0	3	0	1	295
Hiouchi	219	12	0	0	0	0	0	231
Klamath	31	0	0	0	0	0	0	31
Smith River	23	2	10	0	0	0	0	35
Unincorporated County	83	8	0	0	0	2	0	93
Total	**631**	**38**	**10**	**0**	**3**	**2**	**1**	**685**
High Fire Severity Zone[b]								
Crescent City Limits	0	0	0	0	0	0	0	0
Crescent City UGA	1	0	0	0	0	0	0	1
Elk Valley Rancheria	0	0	0	0	0	0	0	0
Gasquet	0	0	0	0	0	0	0	0
Hiouchi	27	1	0	0	0	0	0	28
Klamath	92	24	0	0	0	4	0	120
Smith River	49	17	5	2	1	2	0	76
Unincorporated County	36	1	0	0	0	1	0	38
Total	**205**	**43**	**5**	**2**	**1**	**7**	**0**	**263**
Moderate Fire Severity Zone[b]								
Crescent City Limits	20	39	1	0	0	1	0	61
Crescent City UGA	2,529	149	12	0	4	5	3	2,702
Elk Valley Rancheria	26	4	0	0	0	1	1	32
Gasquet	10	0	0	0	0	0	0	10
Hiouchi	59	1	0	0	0	0	0	60
Klamath	297	23	0	0	2	4	0	326
Smith River	470	26	1	0	2	0	0	499
Unincorporated County	1,208	45	2	0	3	2	2	1,262
Total	**4,619**	**287**	**16**	**0**	**11**	**13**	**6**	**4,952**

a. Values based on Del Norte County tax parcel data received August 2017.
b. Fire hazard severity data downloaded from CAL FIRE website in July 2017.

Critical Facilities and Infrastructure in the Wildland Fire Hazard Area									
	Number of Facilities in the Wildland Fire Hazard Area								
Planning Unit	Crescent City Limits	Crescent City UGA	Elk Valley Rancheria	Gasquet	Hiouchi	Klamath	Smith River	Unincorporated County	Total
Very High Fire Severity Zone									
Bridges	0	0	0	17	3	1	3	10	**34**
Communication	0	0	0	1	2	1	0	0	**4**
Fuel Storage	0	0	0	0	1	0	0	0	**1**
Government Function	0	0	0	1	1	0	1	1	**4**
Hazardous Materials	0	0	0	0	0	0	0	0	**0**
Medical & Health	0	0	0	0	0	0	0	0	**0**
Other Critical Function	0	0	0	1	1	0	0	0	**2**
Power	0	0	0	1	3	0	1	0	**5**
Protective Function	0	0	0	1	1	0	0	0	**2**
Schools	0	0	0	1	0	1	0	0	**2**
Societal Function	0	0	0	1	2	0	0	0	**3**
Wastewater	0	0	0	0	0	0	0	0	**0**
Water Supply	0	0	0	0	2	0	1	0	**3**
Total	**0**	**0**	**0**	**24**	**16**	**3**	**6**	**11**	**60**
High Fire Severity Zone									
Bridges	0	0	0	0	1	5	4	0	**10**
Communication	0	0	0	0	0	0	1	0	**1**
Fuel Storage	0	0	0	0	0	0	0	0	**0**
Government Function	0	0	0	0	0	1	2	0	**3**
Hazardous Materials	0	0	0	0	0	0	3	0	**3**
Medical & Health	0	0	0	0	0	0	0	0	**0**
Other Critical Function	0	0	0	0	0	1	0	0	**1**
Power	0	0	0	0	0	0	0	0	**0**
Protective Function	0	0	0	0	0	1	2	0	**3**
Schools	0	0	0	0	0	0	0	0	**0**
Societal Function	0	0	0	0	0	1	3	0	**4**
Wastewater	0	0	0	0	0	1	2	0	**3**
Water Supply	0	0	0	0	0	1	0	0	**1**
Total	**0**	**0**	**0**	**0**	**1**	**11**	**17**	**0**	**29**
Moderate Fire Severity Zone									
Bridges	0	3	0	0	5	11	2	5	**26**
Communication	0	0	0	0	0	0	2	0	**2**
Fuel Storage	1	0	0	0	0	0	2	0	**3**
Government Function	3	3	1	0	1	0	3	0	**11**
Hazardous Materials	1	0	0	0	0	0	4	0	**5**
Medical & Health	0	1	0	0	0	0	1	0	**2**
Other Critical Function	1	1	6	0	0	2	3	0	**13**
Power	1	1	0	0	0	0	1	1	**4**
Protective Function	0	0	0	0	0	0	0	2	**2**
Schools	1	1	1	0	0	0	1	2	**6**
Societal Function	1	1	0	0	0	1	2	2	**7**
Wastewater	1	0	0	0	0	0	1	0	**2**
Water Supply	0	2	0	0	0	1	11	5	**19**
Total	**10**	**13**	**8**	**0**	**6**	**15**	**33**	**17**	**102**

SEA LEVEL RISE

Exposure in the Sea Level Rise Hazard Area							
	Estimated Exposure in the Sea Level Rise Hazard Area						
Planning Units	Population Exposed[a]	% of Population Exposed	Buildings Exposed[b]	Structure Value Exposed[b]	Contents Value Exposed[b]	Total Value Exposed (Structure + Contents)[b]	% of Total Value Exposed
Sea Level Rise 1 Foot[c]							
Crescent City Limits	0	0.00%	0	$0	$0	$0	0.00%
Crescent City UGA	0	0.00%	0	$0	$0	$0	0.00%
Elk Valley Rancheria	0	0.00%	0	$0	$0	$0	0.00%
Gasquet	0	0.00%	0	$0	$0	$0	0.00%
Hiouchi	0	0.00%	0	$0	$0	$0	0.00%
Klamath	3	0.24%	1	$258,064	$129,032	$387,096	0.05%
Smith River	3	0.15%	1	$258,064	$129,032	$387,096	0.03%
Unincorporated County	3	0.07%	1	$95,041	$47,520	$142,561	0.01%
Total	**9**	**0.03%**	**3**	**$611,168**	**$305,584**	**$916,752**	**0.01%**
Sea Level Rise 4 Feet[c]							
Crescent City Limits	0	0.00%	0	0	0	0	0.00%
Crescent City UGA	0	0.00%	0	0	0	0	0.00%
Elk Valley Rancheria	0	0.00%	0	0	0	0	0.00%
Gasquet	0	0.00%	0	0	0	0	0.00%
Hiouchi	0	0.00%	0	0	0	0	0.00%
Klamath	9	0.71%	3	448,145	224,072	672,217	0.08%
Smith River	6	0.30%	2	626,842	313,421	940,264	0.07%
Unincorporated County	3	0.07%	1	95,041	47,520	142,561	0.01%
Total	**18**	**0.06%**	**6**	**1,170,028**	**585,014**	**1,755,042**	**0.01%**

a. Percent of residential buildings exposed multiplied by the Estimated Population (calculated as the 2010 Census population multiplied by the countywide percent change in population (-2.96%) between the American Community Survey 2006-2010 and 2012-2016 5-Year Estimates)
b. Values based on Del Norte County tax parcel data received August 2017.
c. Sea level rise data downloaded from NOAA Digital Coast website in July 2017.

Structures in the Sea Level Rise Hazard Area by Land Use Type								
	Number of Structures within the Sea Level Rise Hazard Area[a]							
Planning Units	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Sea Level Rise 1 Foot[b]								
Crescent City Limits	0	0	0	0	0	0	0	0
Crescent City UGA	0	0	0	0	0	0	0	0
Elk Valley Rancheria	0	0	0	0	0	0	0	0
Gasquet	0	0	0	0	0	0	0	0
Hiouchi	0	0	0	0	0	0	0	0
Klamath	1	0	0	0	0	0	0	1
Smith River	1	0	0	0	0	0	0	1
Unincorporated County	1	0	0	0	0	0	0	1
Total	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**3**
Sea Level Rise 4 Feet[b]								
Crescent City Limits	0	0	0	0	0	0	0	0
Crescent City UGA	0	0	0	0	0	0	0	0
Elk Valley Rancheria	0	0	0	0	0	0	0	0
Gasquet	0	0	0	0	0	0	0	0
Hiouchi	0	0	0	0	0	0	0	0
Klamath	3	0	0	0	0	0	0	3
Smith River	2	0	0	0	0	0	0	2
Unincorporated County	1	0	0	0	0	0	0	1
Total	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**6**

a. Values based on Del Norte County tax parcel data received August 2017.
b. Sea level rise data downloaded from NOAA Digital Coast website in July 2017.

Critical Facilities and Infrastructure in the Sea Level Rise Hazard Area									
	Number of Facilities in the Sea Level Rise Hazard Area								
Planning Unit	Crescent City Limits	Crescent City UGA	Elk Valley Rancheria	Gasquet	Hiouchi	Klamath	Smith River	Unincorporated County	Total
Sea Level Rise 1 Foot									
Bridges	0	0	0	0	0	0	0	2	**2**
Communication	0	0	0	0	0	0	0	0	**0**
Fuel Storage	0	0	0	0	0	0	0	0	**0**
Government Function	0	0	0	0	0	0	0	0	**0**
Hazardous Materials	0	0	0	0	0	0	0	0	**0**
Medical & Health	0	0	0	0	0	0	0	0	**0**
Other Critical Function	0	0	0	0	0	0	2	0	**2**
Power	0	0	0	0	0	0	0	0	**0**
Protective Function	0	0	0	0	0	0	0	0	**0**
Schools	0	0	0	0	0	0	0	0	**0**
Societal Function	0	0	0	0	0	0	0	0	**0**
Wastewater	0	0	0	0	0	0	0	0	**0**
Water Supply	0	0	0	0	0	0	0	0	**0**
Total	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**4**
Sea Level Rise 4 Feet									
Bridges	0	0	0	0	0	1	0	2	**3**
Communication	0	0	0	0	0	0	0	0	**0**
Fuel Storage	0	0	0	0	0	0	0	0	**0**
Government Function	0	0	0	0	0	0	0	0	**0**
Hazardous Materials	0	0	0	0	0	0	0	0	**0**
Medical & Health	0	0	0	0	0	0	0	0	**0**
Other Critical Function	0	0	0	0	0	0	2	0	**2**
Power	0	0	0	0	0	0	0	0	**0**
Protective Function	0	0	0	0	0	0	0	0	**0**
Schools	0	0	0	0	0	0	0	0	**0**
Societal Function	0	0	0	0	0	0	0	0	**0**
Wastewater	0	0	0	0	0	0	0	0	**0**
Water Supply	0	0	0	0	0	0	0	0	**0**
Total	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**2**	**5**

Appendix D. Plan Adoption Resolutions from Planning Partners

U.S. Department of Homeland Security
1111 Broadway, Suite 1200
Oakland, CA. 94607-4052

FEMA

March 29, 2019

Jay Sarina
Emergency Services Director and County Admin Officer
Del Norte County Office of Emergency Services
981 H Street
Crescent City, CA 95531

Dear Mr. Sarina:

We have completed our final review of the *2018- Del Norte County Operational Area Hazard Mitigation Plan*, officially adopted by the Del Norte County on January 22, 2019, and found the plan to be in conformance with Title 44 Code of Federal Regulations (CFR) Part 201.6 *Local Mitigation Plans*. A list of the status of participating jurisdictions is enclosed with this letter.

The approval of this plan ensures Del Norte County's continued eligibility for project grants under FEMA's Hazard Mitigation Assistance programs, including the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, and Flood Mitigation Assistance Program. All requests for funding, however, will be evaluated individually according to the specific eligibility, and other requirements of the particular program under which applications are submitted.

Also, approved hazard mitigation plans are eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Additional information regarding the CRS can be found at https://www.fema.gov/national-flood-insurance-program-community-rating-system or through your local floodplain manager.

FEMA's approval of the *2018- Del Norte County Operational Area Hazard Mitigation Plan* is for a period of five years, effective starting the date of this letter. Prior to March 29, 2024, Del Norte County and all participating jurisdictions are required to review and revise the plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval in order to continue to be eligible for mitigation project grant funding. The enclosed plan review tool provides additional recommendations to incorporate into the plan during the plan maintenance process.

If you have any questions regarding the planning or review processes, please contact the FEMA Region IX Hazard Mitigation Planning Team at fema-r9-mitigation-planning@fema.dhs.gov.

Sincerely,

Juliette Hayes
Director
Mitigation Division
FEMA, Region IX

Enclosure

cc: Julie Norris, Mitigation and Dam Safety Branch Chief, California Governor's Office of Emergency Services
Jennifer Hogan, State Hazard Mitigation Officer, California Governor's Office of Emergency Services

A RESOLUTION OF THE DEL NORTE COUNTY BOARD OF SUPERVISORS AUTHORIZING THE ADOPTION OF THE DEL NORTE COUNTY LOCAL HAZARD MITIGATION PLAN UPDATE

RESOLUTION NO. 2019-004

WHEREAS, all of Del Norte County has exposure to natural hazards that increase the risk to life, property, environment and the County's economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre- and post-disaster hazard mitigation programs; and

WHEREAS; a coalition of Del Norte County, Cities, Towns, Tribes and Special Districts with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the Del Norte County Local planning area; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the Del Norte County Board of Supervisors:

1.) Adopts in its entirety, Volume I and the introduction, chapter 1 - the Unincorporated Del Norte County jurisdictional annex, and the appendices of Volume II of the Del Norte County Local Hazard Mitigation Plan (HMP).

2.) Will use the adopted and approved portions of the HMP to guide pre- and post-disaster mitigation of the hazards identified.

3.) Will coordinate the strategies identified in the HMP with other planning programs and mechanisms under its jurisdictional authority.

4.) Will continue its support of the Steering Committee and continue to participate in the Planning Partnership as described by the HMP.

5.) Will help to promote and support the mitigation successes of all HMP Planning Partners.

PASSED AND ADOPTED on this 22nd day of January, 2019, by the following vote:

YES: Supervisor Howard, Gitlin, Cowan, Hemmingsen, Berkowitz
NO: None
ABSENT: None
ABSTAIN: None

Lori L Cowan, Chair
Board of Supervisors

ATTEST: Kylie Goughnour

Kylie Goughnour, Clerk
Board of Supervisors

Date: 01/22/19

By: Kylie Goughnour

RESOLUTION NO. 2019-05

A RESOLUTION OF THE CITY COUNCIL OF CITY OF CRESCENT CITY, CALIFORNIA AUTHORIZING THE ADOPTION OF THE DEL NORTE COUNTY LOCAL HAZARD MITIGATION PLAN UPDATE

WHEREAS, all of Del Norte County has exposure to natural hazards that increase the risk to life, property, environment and the County's economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre- and post-disaster hazard mitigation programs; and

WHEREAS; a coalition of Del Norte County, Cities, Towns, Tribes and Special Districts with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the Del Norte County Local planning area; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the City Council of the City of Crescent City:

1.) Adopts in its entirety, Volume I and the introduction, chapter 2 – the City of Crescent City jurisdictional annex, and the appendices of Volume II of the Del Norte County Local Hazard Mitigation Plan (HMP).

2.) Will use the adopted and approved portions of the HMP to guide pre- and post-disaster mitigation of the hazards identified.

3.) Will coordinate the strategies identified in the HMP with other planning programs and mechanisms under its jurisdictional authority.

4.) Will continue its support of the Steering Committee and continue to participate in the Planning Partnership as described by the HMP.

5.) Will help to promote and support the mitigation successes of all HMP Planning Partners.

PASSED AND ADOPTED on this 4th day of February, 2019, by the following vote:

AYES:	Council Members Fallman, Greenough, Wright, Kime, and Mayor Inscore
NOES:	None
ABSTAIN:	None
ABSENT:	None

Blake Inscore, Mayor

Robin Patch, City Clerk

Elk Valley
Rancheria,
California

2332 Howland Hill Road
Crescent City, CA 95531

Phone 707.464.4680
Fax: 707.465.2638
www.elk-valley.com

RESOLUTION OF THE ELK VALLEY RANCHERIA, CALIFORNIA
CRESCENT CITY, CALIFORNIA

RESOLUTION NO: 2019-01

DATE APPROVED: January 14, 2019

SUBJECT: **ACCEPTANCE OF VOLUME 1 AND THE ELK VALLEY RANCHERIA, CALIFORNIA PORTION OF VOLUME 2 OF THE DEL NORTE COUNTY LOCAL HAZARD MITIGATION PLAN**

WHEREAS: The Elk Valley Rancheria did on November 23, 1994, adopt its Tribal Constitution and Bylaws which was approved by the Commissioner of Indian Affairs on December 27, 1994, and, by tribal law, the sovereign authority of the Tribe over the matter described herein is delegated to the Tribal Council, acting by law;

WHEREAS: Article II of the Constitution establishes the jurisdiction and territory of the Elk Valley Rancheria to affiliated Indian Country which is located contiguous to the Rancheria, or other lands acquired for or by the tribe

WHEREAS: All of Del Norte County has exposure to natural hazards that increase the risk to life, property, environment and the County's economy; and

WHEREAS: Pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS: The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre- and post-disaster hazard mitigation programs; and

WHEREAS: A coalition of Del Norte County, Cities, Towns, Tribes and Special Districts with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the Del Norte County Local planning area; and

WHEREAS: The coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED: The Tribal Council hereby approves and accepts volume 1 and the Elk Valley Rancheria, California portion of volume 2 of the Del Norte County Local Hazard Mitigation Plan.

BE IT FURTHER RESOLVED that the Tribal Council does hereby authorize the Chairperson of the Elk Valley Rancheria, California, or, in the Chairperson's absence, the Vice-Chairperson, to execute and deliver all other documents that are necessary to implement the intent and purpose of this Resolution.

CERTIFICATION

I, the undersigned, as Chairman of the Elk Valley Rancheria Tribal Council do hereby certify that the Tribal Council, composed of nine (9) members, of which 7 were present constituting a quorum at a regular meeting thereof, duly and regularly called, noticed and convened, and held this 14th day of January, 2019, and that this Resolution was duly adopted by a vote of 6 for and 0 against, and that said Resolution has not been rescinded or amended in any way since its adoption.

Dated this 14th day of January, 2019.

ATTESTED:

Dale A. Miller

By: Dale A. Miller
Its: Tribal Council Chairman

Christina Jones

By: Christina Jones
Its: Tribal Council Secretary

TRIBAL COUNCIL OF EVR

BIG ROCK
COMMUNITY SERVICES DISTRICT

P.O. Box 453
Crescent City, CA 95531
(707) 464-7769

RESOLUTION #2019-1

RESOLUTION OF THE BIG ROCK COMMUNITY SERVICES DISTRICT
AUTHORIZING THE ADOPTION OF THE
DEL NORTE COUNTY LOCAL HAZARD MITIGATION PLAN UPDATE

WHEREAS, all of Del Norte County has exposure to natural hazards that increase the risk to life, property, the environment, and the County's economy; and

WHEREAS, pro-active mitigation of known hazards prior to experiencing a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, the Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre- and post-disaster hazard mitigation programs; and

WHEREAS, a coalition of the *County of Del Norte*, *City of Crescent City*, Tribes, and Special Districts with similar planning objectives has been formed to pool resources and create consistent mitigation strategies within the Del Norte County Local Planning Area; and

WHEREAS, this coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy:

NOW, THEREFORE, BE IT RESOLVED that the *Big Rock CSD* Board of Directors/Trustees

a. Adopts in its entirety, Volume I and the Introduction, Chapter 4 (the *Big Rock CSD's* current Jurisdictional Annex), and the Appendices of Volume II of the Del Norte Local Hazard Mitigation Plan (HMP).

b. Will use the adopted and approved portions of the HMP to guide pre- and post-disaster mitigation of the hazards identified.

c. Will coordinate the strategies identified in the HMP with other planning programs and mechanisms under its jurisdictional authority.

d. Will continue its support of the Steering Committee and continue to participate in the Planning Partnership as described by the HMP.

e. Will help to promote and support the mitigation successes of all HMP Planning Partners.

PASSED AND ADOPTED by the Board Members of the *Big Rock Community Services District* on this 21st day of February 21, 2019, by the following polled vote:

AYES: Craig Bradford, Alan Porteous, Art Aten, Charles Swenson, Mike Finley

NOES: None

ABSENT: None

Craig Bradford, President
Board of Directors/Trustees

ATTEST: Sandy Moreno

Sandy Moreno
Secretary to the Board

/

RESOLUTION 2019-01
A RESOLUTION OF THE GASQUET COMMUNITY SERVICES DISTRICT
AUTHORIZING THE ADOPTION OF THE
DEL NORTE COUNTY LOCAL HAZARD MITIGATION PLAN UPDATE

WHEREAS, all of Del Norte County has exposure to natural hazards that increase the risk to life, property, environment and the County's economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre- and post-disaster hazard mitigation programs; and

WHEREAS; a coalition of Del Norte County, Cities, Towns, Tribes and Special Districts with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the Del Norte County Local planning area; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the GASQUET COMMUNITY SERVICES DISTRICT:

1.) Adopts in its entirety, Volume I and the introduction, chapter 5 - the Gasquet Community Services District's jurisdictional annex, and the appendices of Volume II of the Del Norte County Local Hazard Mitigation Plan (HMP).

2.) Will use the adopted and approved portions of the HMP to guide pre- and post-disaster mitigation of the hazards identified.

3.) Will coordinate the strategies identified in the HMP with other planning programs and mechanisms under its jurisdictional authority.

4.) Will continue its support of the Steering Committee and continue to participate in the Planning Partnership as described by the HMP.

5.) Will help to promote and support the mitigation successes of all HMP Planning Partners.

PASSED AND ADOPTED on this 14th of January 2019, by the following vote:

YES: [signatures]

NO: —

ABSENT: Martha Morgan

ABSTAIN: —

ATTEST: Eileen Rutledge
Secretary/Treasurer

Board Chairman MARK Dodd

KLAMATH COMMUNITY SERVICES DISTRICT
219 Salmon Ave
P.O. Box 430
Klamath, CA 95548
Accounting Office : (707) 464-7769 or fax (707) 667-7707
District Office : (707) 482-0723

BOARD ORDER

The following is a certified copy of a portion of proceedings of the regular public session meeting of the Klamath Community Services District held on January 16, 2019.

Regarding New Business agenda item "Resolution 2019-01 Adoption of the Del Norte County Operational Area Hazard Mitigation Plan." *In its public meeting on January 16, 2019, the Board of Directors/Trustees adopted unanimously Resolution No. 2019-01 A Resolution Authorizing the Adoption of the Del Norte County Local Hazard Mitigation Plan Update."*

I, Laurette Taylor, Secretary to the Board of Directors/Trustees of the Klamath Community Services District, do hereby certify the foregoing to be a full, true and correct extract of the original order made in the above entitled minutes by said Board of Directors/Trustees at a meeting held in Klamath California on January 16, 2019, and the same now appears of record in my office.

IN WITNESS WHEREOF*, we have placed our hands and affixed our testaments on this 16st day of January 2019.*

Laurette Taylor
Laurette Taylor
Secretary

Margaret Caldwell
Margaret Caldwell, President
Board of Directors/Trustees

Attached : Resolution 2019-01 Adoption of the Del Norte County Operational Area Hazard Mitigation Plan

KLAMATH COMMUNITY SERVICES DISTRICT
BOARD OF DIRECTORS/TRUSTEES

RESOLUTION NO. 2019-01
A RESOLUTION AUTHORIZING THE ADOPTION OF THE
DEL NORTE COUNTY LOCAL HAZARD MITIGATION PLAN UPDATE

WHEREAS, all of Del Norte County has exposure to natural hazards that increase the risk to life, property, environment and the County's economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre- and post-disaster hazard mitigation programs; and

WHEREAS; a coalition of Del Norte County, Cities, Towns, Tribes and Special Districts with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the Del Norte County Local planning area; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the Klamath Community Services District Board of Directors:

1.) Adopts in its entirety, Volume I and the introduction, chapter 6 – the Klamath Community Services District jurisdictional annex, and the appendices of Volume II of the Del Norte County Local Hazard Mitigation Plan (HMP).

2.) Will use the adopted and approved portions of the HMP to guide pre- and post-disaster mitigation of the hazards identified.

3.) Will coordinate the strategies identified in the HMP with other planning programs and mechanisms under its jurisdictional authority.

4.) Will continue its support of the Steering Committee and continue to participate in the Planning Partnership as described by the HMP.

5.) Will help to promote and support the mitigation successes of all HMP Planning Partners.

PASSED AND ADOPTED on 16th day of January, 2019, by the following vote:

YES: 4
NO: 0
ABSENT:
ABSTAIN:

ATTEST: Laurette Taylor
Laurette Taylor, Secretary

Margaret Caldwell
Margaret Caldwell, President

RESOLUTION NO. 2019-2
A RESOLUTION OF THE SMITH RIVER COMMUNITY SERVICES DISTRICT AUTHORIZING THE ADOPTION OF THE DEL NORTE COUNTY LOCAL HAZARD MITIGATION PLAN UPDATE

WHEREAS, all of Del Norte County has exposure to natural hazards that increase the risk to life, property, environment and the County's economy; and

WHEREAS, pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre- and post-disaster hazard mitigation programs; and

WHEREAS, a coalition of Del Norte Counties, Cities, Towns, Tribes and Special Districts with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the Del Norte County Local planning area; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing , evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the Smith River Community Services District Board:

1) Adopts in its entirety, Volume I and the introduction, chapter 7—the Smith River CSD jurisdictional annex, and the appendices of Volume II of the Del Norte County Local Hazard Mitigation Plan (HMP)
2) Will use the adopted and approved portions of the HMP to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the HMP with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Steering Committee and continue to participate in the Planning Partnership as described by the HMP.
5) Will help to promote and support the mitigation successes of all HMP Planning Partners.

PASSED AND ADOPTED ON THIS: 25TH Day of March, 2019 by the following vote:

Yes: Tim Reichlin, Ernie Silva, Bruce Kohler, Jo Ann Van Valkenburgh, Robert Dytewski
No: None
Absent: None
Abstain: None

Robert Dytewski
Robert Dytewski, President
Smith River Community Services District

ATTEST: Kathryn Demry
Kathryn Demry, Secretary to the
Smith River CSD Board of Directors

RESOLUTION No. 19-002

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE CRESCENT FIRE PROTECTION DISTRICT AUTHORIZING THE ADOPTIONS OF THE DEL NORTE COUNTY LOCAL HAZARD MITIGATION PLAN UPDATE

WHEREAS, all of Del Norte County has exposure to natural hazards that increase the risk to life, property, environment and the County's economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre- and post-disaster hazard mitigation programs; and

WHEREAS; a coalition of Del Norte County, Cities, Towns, Tribes and Special Districts with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the Del Norte County Local planning area; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of the Crescent Fire Protection District:

1.) Adopts in its entirety, Volume I and the introduction, chapter 8 - the Crescent Fire Protection District jurisdictional annex, and the appendices of Volume II of the Del Norte County Local Hazard Mitigation Plan (HMP).

2.) Will use the adopted and approved portions of the HMP to guide pre- and post-disaster mitigation of the hazards identified.

3.) Will coordinate the strategies identified in the HMP with other planning programs and mechanisms under its jurisdictional authority.

4.) Will continue its support of the Steering Committee and continue to participate in the Planning Partnership as described by the HMP.

5.) Will help to promote and support the mitigation successes of all HMP Planning Partners.

PASSED AND ADOPTED by the Board of Directors of the Crescent Fire Protection District on this 20th day of February, 2019 by the following polled vote:

AYES: 5
NOES: 0
ABSTAIN: 0
ABSENT: 0

Jim Nelson

Jim Nelson, Chairman of the Board

ATTEST:

Vanessa Duncan

Vanessa Duncan, Clerk of the Board

RESOLUTION NO. 2019-03

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE SMITH RIVER FIRE PROTECTION DISTRICT AUTHORIZING THE ADOPTION OF THE DEL NORTE COUNTY LOCAL HAZARD MITIGATION PLAN UPDATE

WHEREAS, all of Del Norte County has exposure to natural hazards that increase the risk to life, property, environment and the County's economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre- and post-disaster hazard mitigation programs; and

WHEREAS; a coalition of Del Norte County, Cities, Towns, Tribes and Special Districts with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the Del Norte County Local planning area; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of the Smith River Fire Protection District:

1.) Adopts in its entirety, Volume I and the introduction, chapter 9 - the Smith River Fire Protection District jurisdictional annex, and the appendices of Volume II of the Del Norte County Local Hazard Mitigation Plan (HMP).

2.) Will use the adopted and approved portions of the HMP to guide pre- and post-disaster mitigation of the hazards identified.

3.) Will coordinate the strategies identified in the HMP with other planning programs and mechanisms under its jurisdictional authority.

4.) Will continue its support of the Steering Committee and continue to participate in the Planning Partnership as described by the HMP.

5.) Will help to promote and support the mitigation successes of all HMP Planning Partners.

PASSED AND ADOPTED on this seventh day of February, 2019, by the following vote:

YES: 3

NO: Ø

ABSENT: 1

ABSTAIN: Ø

ATTEST: Elaine Fallgren
Chair, Elaine Fallgren

Alyce Pearson
Administrative Assistant, Alyce Pearson

RESOLUTION NO. 2019-01
A RESOLUTION OF THE BOARD OF COMMISSIONERS OF THE CRESCENT CITY HARBOR DISTRICT AUTHORIZING THE ADOPTION OF THE DEL NORTE COUNTY LOCAL HAZARD MITIGATION PLAN UPDATE

WHEREAS, all of Del Norte County has exposure to natural hazards that increase the risk to life, property, environment and the County's economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre- and post-disaster hazard mitigation programs; and

WHEREAS; a coalition of Del Norte County, Cities, Tribes and Special Districts including the Crescent City Harbor District with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the Del Norte County Local planning area; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the BOARD OF COMMISSIONERS OF THE CRESCENT CITY HARBOR DISTRICT:

1.) Adopts in its entirety, Volume I and the Introduction, Chapter 10 – the Crescent City Harbor District jurisdictional annex, and the appendices of Volume II of the Del Norte County Local Hazard Mitigation Plan (HMP).

2.) Will use the adopted and approved portions of the HMP to guide pre- and post-disaster mitigation of the hazards identified.

3.) Will coordinate the strategies identified in the HMP with other planning programs and mechanisms under its jurisdictional authority.

4.) Will continue its support of the Steering Committee and continue to participate in the Planning Partnership as described by the HMP.

5.) Will help to promote and support the mitigation successes of all HMP Planning Partners.

PASSED AND ADOPTED on this 22nd day of January, 2019, by the following vote:

YES: FOUR
NO: NONE
ABSENT: ONE
ABSTAIN: NONE

ATTEST: James Ramsey
James Ramsey
Commission President

Wesley White
Commission Secretary