



LOCAL HAZARD MITIGATION PLAN CITY OF SEAL BEACH

PUBLIC REVIEW DRAFT
JUNE 2025

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REST ROOMS



INTRODUCTION



WHAT'S DIFFERENT ABOUT THE 2025 PLAN?

- Alignment with updated guidance from the 2025 FEMA Local Mitigation Planning Policy Guide, effective April 2025.
- Additional considerations included for climate change and socially vulnerable populations (SVPs)
- Review and confirmation of previously identified mitigation goals.

SECTION 1: INTRODUCTION

The City of Seal Beach (City) strives to reduce hazards and improve resilience through capital improvement projects, innovative planning, and emergency management practices. The City has developed this 2025 City of Seal Beach Local Hazard Mitigation Plan (LHMP) update in an effort to reduce potential future loss of life and property damage, resulting from natural or human-caused hazards.

Natural and human-caused hazards can cause significant damage to communities, businesses, public infrastructure, and the environment. The impacts to residents and businesses within communities can be immense, and infrastructure damage can result in regional, economic, and public health consequences. Municipal services and critical infrastructure are vulnerable to a variety of hazards that can result in disruption to operations and services which could include damage to structures, loss of power or other systems, or contamination of natural resources. By planning for natural and human-caused hazards, and implementing projects that mitigate risk, cities can reduce costly damage and improve reliability of service following a disaster incident.

Previously, the City prepared the 2019 LHMP to implement a hazard mitigation strategy within the community. This LHMP expired on August 27, 2024. Thus, this 2025 iteration of the plan serves as a comprehensive hazard mitigation plan update.

No community can be protected against all potential impacts from natural or human-caused hazards. Hazard events often result in periods of emergency response and recovery before returning to “normal” operations. However, communities can reduce potential impacts by taking actions to become more resilient. This LHMP provides a blueprint for the City to reduce threats posed by hazards that may impact people, infrastructure, or operations. Proper planning, prior to a natural or human-caused disaster, will allow the City to return to “normal” sooner, with fewer impacts and disruption to the community.

1.1 PLAN PURPOSE

The purpose of this LHMP is to provide City staff and City leaders with clear direction for hazard mitigation action planning. This LHMP identifies natural and human-caused hazards that threaten City infrastructure, operations, and people. This LHMP also provides resources, information, and strategies to reduce these risks.

Hazard mitigation plays an important role in reducing disaster impacts by identifying effective and feasible actions to reduce the risks posed by potential hazards before an occurrence. This plan has been developed and updated to be consistent with current standards and regulations, ensuring the understanding of hazards facing the community reflects the best available information and present-day conditions.

The LHMP does not supersede any internal plans or strategies. Rather, the LHMP enhances the ability of the City to identify, inform, and mitigate hazard risks unique to Seal Beach. Information in this LHMP will be used to help guide and coordinate mitigation actions and serve as a tool for City decision-makers to specifically direct mitigation activities and resources.

This LHMP incorporates the latest policy guidance from the Federal Emergency Management Agency (FEMA) Local Mitigation Planning Policy Guide, released April 19, 2022, and effective April 19, 2023. Specifically, this LHMP responds to updated policy guidance relating to climate change, socially vulnerable populations, and equity.

1.2 PLAN AUTHORITY

Federal

The federal Robert T. Stafford Disaster Relief and Emergency Act (Stafford Act), as amended by the Disaster Mitigation Act of 2000 (DMA 2000) and supported by various regulations, directs hazard mitigation planning activities, including creation of this plan. The Stafford Act requires State, local, and tribal governmental entities that wish to be eligible for federal hazard mitigation grant funds to submit a hazard mitigation plan, identifying the natural and man-made hazards, risks, and vulnerabilities of each jurisdiction (United States Code [USC] Title 42, Section 5156[a]). FEMA has promulgated Code of Federal Regulations (CFR) Title 44, Part 201 to carry out the hazard mitigation planning requirements in the Stafford Act. These regulations direct the planning process, plan content, and FEMA approval of hazard mitigation plans. This LHMP complies with the Stafford Act and DMA 2000, along with the appropriate sections of Title 44 of the CFR, including parts 201, 206 and 322.

State

California Government Code Section 8685.9 (Assembly Bill [AB] 2140) limits the State of California's share of disaster relief funds paid out to local governments to 75 percent of the funds not paid for by federal disaster relief efforts, unless the jurisdiction has adopted a valid hazard mitigation plan consistent with DMA 2000. This LHMP is consistent with current standards and regulations, as outlined by Cal OES. It uses the best available information, and its mitigation actions reflect best practices and community values. This LHMP meets the requirements of current State and federal guidelines and ensures the City of Seal Beach is eligible for all appropriate benefits under State and federal law and practices. This LHMP has been prepared to meet FEMA and Cal

OES requirements, thus making the City eligible for funding and technical assistance from State and federal hazard mitigation programs.

1.3 PLAN ADOPTION

Following FEMA approval of the LHMP, the Seal Beach City Council will formally adopt the LHMP. Copies of the resolution are provided in [Appendix A, *City of Seal Beach Adoption Resolution*](#).

1.4 PLAN ORGANIZATION

The LHMP is organized into seven sections to reflect the logical progression of activities undertaken to develop a hazard mitigation strategy, and includes all relevant documentation required to meet the necessary criteria for FEMA approval. Each section is described briefly below.

Section 1.0: Introduction and Purpose describes the background and purpose of the LHMP, as well as the authority established for its development.

Section 2.0: Planning Process describes the LHMP planning process, as well as the meetings and outreach activities undertaken to engage City officials and staff, stakeholders, and members of the public.

Section 3.0: Community Profile provides the history, geography, demographics, and socioeconomics of the City of Seal Beach, including land use and development trends. This section also evaluates social vulnerability through a variety of environmental justice indices and identifies applicability to the planning area.

Section 4.0: Hazards Assessment identifies and profiles the natural and human-caused hazards affecting the City, identifies the vulnerability and risk associated with each hazard, and provides a vulnerability assessment to critical facilities in relation to each of those hazards.

Section 5.0: Mitigation Strategy identifies the mitigation strategy and actions to reduce potential risks to the City's critical facilities, residents, and business owners and assesses the City's capabilities to implement and achieve the objectives of the mitigation actions.

Section 6.0: Plan Maintenance and Capabilities discusses implementation of the Plan, including the process to monitor, evaluate, update, and maintain the LHMP, and identifies opportunities for continued public involvement.

Section 7.0: References identifies the various resources utilized throughout the LHMP.

1.5 MITIGATION GOALS

The City has adopted the following goals for reducing disaster risk:

- Reduce the threat to life, injury and property damage for Seal Beach residents, employees and visitors.
- Keep critical services and government functions operational by protecting key infrastructure in Seal Beach.
- Protect natural systems from current and future hazard conditions.
- Coordinate mitigation activities among City departments and neighboring jurisdictions.

- Strengthen resiliency in Seal Beach through partnerships with community members, local businesses, and community organizations.

1.6 CHANGES IN HAZARD MITIGATION PRIORITIES

The LHMP Planning Team (described below) felt that the overall hazard mitigation goals from the previous plan remained accurate for current planning purposes. These goals are listed above in the previous section. In addition, several hazards previously addressed and profiled are carried over into this update, including wildfire, landslide, flood, climate change, and seismic hazards.

Changes to the LHMP planning process were driven largely by the 2023 FEMA policy update. This LHMP update relied on the input of a cross section of representatives who participated in the LHMP Planning Team, including representatives from internal City departments and external stakeholders (neighboring jurisdictions, nonprofits/NGOs, public safety agencies, and others). This diverse representation on the LHMP Planning Team produced mitigation actions that consider a variety of perspectives across the planning area.

Similarly, the recent FEMA policy update requires additional consideration for socially vulnerable populations (SVPs) within the planning area. Organizations that represent and serve SVPs were included as part of the LHMP Planning Team (as discussed in [Section 2.0](#)) and hazard specific impacts are discussed in both [Section 3.0](#) and [Section 4.0](#). Mitigation actions targeted to reducing vulnerability and risk associated with SVPs are included in [Section 5.0](#).

A significant change in this LHMP update includes consideration for human-caused hazards, including pandemic, active shooter, power outage/public safety power shutoff, and trail derailment. All hazards that were previously identified for the City of Seal Beach in the previous plan were carried out through this plan update.

Mitigation actions from the 2019 LHMP are discussed and reviewed in [Section 5.0](#). Mitigation actions from the 2019 LHMP were identified as either completed, in progress or no longer relevant to the LHMP update. New mitigation actions are also highlighted in [Section 5.0](#) and are generally organized by hazard type.



**CITY OF SEAL BEACH
POLICE DEPARTMENT**



2

PLANNING PROCESS



WHAT'S DIFFERENT ABOUT THE 2025 PLAN?

- Jurisdiction elected to increase the number of considered hazards from the previous plan, from 9 hazards to 20 hazards based on community input.
- Outreach included a wider range of stakeholders, including representatives who serve socially vulnerable populations.
- Public outreach efforts were increased through pop-up events, workshops, and engagement during standing City meetings and events.
- Virtual meetings were added to increase engagement.
- The City received over 200 responses to the public survey.

SECTION 2: PLANNING PROCESS

This section describes each stage of the planning process used to develop the LHMP. This LHMP follows a prescribed series of planning steps which includes organizing resources, assessing risk, developing the mitigation strategy, drafting the plan, reviewing/revising the plan, and adopting and submitting the plan for approval. Each step is further described in this section.

Hazard mitigation planning in the United States is guided by statutory regulations described in the Disaster Mitigation Act of 2000 (DMA 2000) and implemented through Title 44 Code of Federal Regulations (CFR) Parts 201 and 206. FEMA hazard mitigation plan guidelines outline a four-step planning process for the development and approval of hazard mitigation plans. [Table 2-1, *DMA 2000 CFR Crosswalk*](#), lists the specific CFR excerpts that contain the requirements for approval, and identifies the applicable section of this LHMP.

2.1 ORGANIZING RESOURCES

The first step in the planning process involved organization of resources, including identifying the LHMP Project Management Team, convening the LHMP Planning Team, and reviewing background materials and documents.

Table 2-1
DMA 2000 CFR Crosswalk

DMA 2000 (44 CFR 201.6)	2025 LHMP Plan Section
(1) Organize Resources	Section 2
201.6(c)(1)	Organize to prepare the plan
201.6(b)(1)	Involve the public
201.6(b)(2) and (3)	Coordinate with other agencies
(2) Assess Risks	Section 4
201.6(c)(2)(i)	Assess the hazard
201.6(c)(2)(ii) and (iii)	Assess the problem
(3) Develop the Mitigation Plan	Section 5
201.6(c)(3)(i)	Set goals
201.6(c)(3)(ii)	Review possible activities (actions)
201.6(c)(3)(iii)	Draft an action plan
(4) Plan Maintenance	Section 6
201.6(c)(5)	Adopt the plan
201.6(c)(4)	Implement, evaluate, and revise

2.1.1 LHMP PROJECT MANAGEMENT TEAM

The LHMP Project Management Team was responsible for day-to-day coordination of the LHMP work program, including forming and assembling the LHMP Planning Team; scheduling meetings; preparing, reviewing, and disseminating meeting materials; coordinating, scheduling, and participating in community engagement activities and meetings; and coordinating document review. The LHMP Project Management Team was led by Brian Gray, Emergency Services Coordinator – Sergeant of the City of Seal Beach Police Department.

The LHMP Project Management Team worked with the LHMP Consultant Team throughout the development of the LHMP. The LHMP Consultant Team consisted of hazard mitigation/planning professionals from Michael Baker International. The LHMP Consultant Team provided guidance and support to the City through facilitation of the planning process, data collection, community engagement, and meeting materials and document development.

LHMP Planning Team

The LHMP Project Management Team worked with the LHMP Consultant Team to identify stakeholders to participate in the LHMP. Stakeholders included representatives from internal city departments, along with several external entities including neighboring jurisdictions, utilities, professional organizations, community-based organizations, schools/academia, and other non-profits/NGOs.

The LHMP Project Management team carefully selected stakeholders to represent a cross section of relevant community lifelines. Community lifelines are defined by FEMA as a fundamental service in the community that, when stabilized, enables all other aspects of society. When disrupted, decisive intervention (e.g., rapid service re-establishment or employment of contingency response solutions) is required. Community lifelines are categorized as follows:



PLANNING PROCESS AT A GLANCE

The LHMP public outreach process was specifically designed to maximize participation and input from all community members, including underserved groups and vulnerable populations.

200+
Survey Responses
Received



 **33**
Stakeholders

 **4**
Outreach
Events

 **7**
Stakeholder
Meetings

 **14**
Day Public
Comment
Period

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

Stakeholders were notified via email, advising them of the City's efforts to prepare an updated LHMP and requesting their involvement in preparation of the Plan, including an invitation to attend the LHMP Planning Team meetings. The list of stakeholders included in this notification effort is summarized in [Table 2-2, LHMP Planning Team and Community Lifelines](#) below.

**Table 2-2
LHMP Planning Team and Community Lifelines**

Agency or Utility Name	Community Lifeline
<i>Local and Regional Agencies Involved in Hazard Mitigation Activities</i>	
City of Seal Beach	Government Service
Orange County Fire Authority Division 1	Government Service; Safety and Security
Caltrans	Transportation
County of Orange/OCSD OEM	Safety and Security; Government Service
Los Alamitos Unified School District	Government Service; Safety and Security
McGaugh Elementary	Government Service; Safety and Security
Municipal Water District of Orange County	Food, Hydration, Shelter; Water Systems
<i>Agencies with the Authority to Regulate Development</i>	
City of Seal Beach	Government Service
<i>Agencies of Neighboring Communities</i>	
City of Garden Grove	Government Service
City of Los Alamitos	Government Service
City of Westminster	Government Service
Joint Forces Training Base, Los Alamitos	Government Service
Seal Beach Naval Weapons Station	Government Service
<i>Representatives of Business Academia, and other Private Organizations</i>	
SoCal Gas	Energy
Southern California Edison	Energy; Communications
Boeing	Safety and Security; Transportation
Optum*	Health and Medical
<i>Representatives of Nonprofit Organizations/Community Based Organizations</i>	
Seal Beach Chamber of Commerce	Communications
Leisure World Info Council*	Safety and Security; Food, Hydration, Shelter
Seal Beach Animal Care Center	Food, Hydration, Shelter

Agency or Utility Name	Community Lifeline
Golden Rain Foundation/Leisure World*	Safety and Security; Food, Hydration, Shelter
Friends of SB National Wildlife Refuge	Safety and Security
Save Our Beach	Safety and Security

*Indicates an LHMP Planning Team member who provides services to socially vulnerable populations or other “high-risk” populations within the planning area. Refer to Section 3.8.2 for further discussion.

In addition to external stakeholders, the LHMP Planning Team included City of Seal Beach staff members, representing a diverse cross-section of departments and responsibilities. Members of the LHMP Planning Team represented the following City departments and divisions:

- Police
- Community Development (Planning, building and safety)
- Marine Safety
- Community Services/Recreation
- Fire
- Public Works (Engineering, water, sewer, maintenance, capital projects)
- Finance
- City Manager
- City Clerk

The LHMP Planning Team worked together to ensure the success of the planning process and is responsible for its implementation and future maintenance. The committee’s key responsibilities included:

- Participation in LHMP Planning Team meetings
- Collection of valuable local information and other requested data
- Decision on plan process and content
- Development and prioritization of mitigation actions for the LHMP
- Review and comment on plan drafts
- Coordination and involvement in the public engagement process

Table 2-3, *LHMP Planning Team*, identifies both LHMP Project Management Team and LHMP Planning Team members, along with their roles in plan development.

**Table 2-3
LHMP Planning Team**

Name	Title/Role	Organization	Planning Team Role
<i>LHMP Project Management Team</i>			
Brian Gray	Sergeant Emergency Services Coordinator	City of Seal Beach	City Project Manager – Organization of LHMP Planning Team and meetings, development of and participation in community outreach, hazard identification, capabilities assessment, mitigation actions and prioritization, plan coordination and review.

Name	Title/Role	Organization	Planning Team Role
Alexa Smittle	Community Development Director	City of Seal Beach	Project goals and objectives identification, hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion, draft LHMP review/comment.
<i>LHMP Planning Team</i>			
Michael Henderson	Chief of Police	City of Seal Beach	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion
Nick Nicholas	Police Captain	City of Seal Beach	Hazard identification and prioritization
Nicholas Bolin	Marine Safety Lieutenant	City of Seal Beach	Hazard identification and prioritization
David Spitz	Engineering	City of Seal Beach	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion
Iris Lee	Public Works Director	City of Seal Beach	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion
Bill Dorman	Building Official	City of Seal Beach	Hazard identification and prioritization
Reanna Gonzalez	Building and Safety	City of Seal Beach	Hazard identification and prioritization
Kathryn Cho	Deputy Director Public Works	City of Seal Beach	Hazard identification and prioritization
Tim Kelsey	Recreation Manager	City of Seal Beach	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion
Joe Bailey	Marine Safety Chief	City of Seal Beach	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion

Michael Baker International, Inc.

Name	Title/Role	Organization	Planning Team Role
Barbara Arenado	Finance Director	City of Seal Beach	Hazard identification and prioritization
Lisa Landau	Mayor, Council District 3	City of Seal Beach	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion
Joe Kalmick	City Council District 1	City of Seal Beach	Hazard identification and prioritization
Ben Wong	City Council District 2	City of Seal Beach	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion
Patty Senecal	City Council District 4	City of Seal Beach	Hazard identification and prioritization
Nathan Steele	Mayor Pro Tem, Council District 5	City of Seal Beach	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion
Vicki Hickman	Emergency Planning Committee (EPC) Coordinator	Seal Beach Animal Care Center	Hazard identification and prioritization
Marthina Williams	Secretary	Leisure World Info Council	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion
Nick Massetti	Treasurer	Leisure World Info Council	Hazard identification and prioritization
Eloy Gomez	Health and Safety Specialist	Leisure World	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion
Wendy Wood	Principal	McGaugh Elementary School	Hazard identification and prioritization
Jerry Friedman	Director, Safety & Student Services	Los Alamitos Unified School District	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion

Name	Title/Role	Organization	Planning Team Role
Melissa Mendoza	Community Shift Supervisor	City of Garden Grove	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion
Gabriela Landeros	Emergency Management Specialist	MWDOC	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion
Cathy Winans	President	Seal Beach Animal Care Center	Hazard identification and prioritization
Craig Covey	Division Chief	OCFA Division 1	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion
Daren DeLeon	President	Seal Beach Chamber of Commerce	Hazard identification and prioritization
Anna Burton	Emergency Manager	City of Westminster	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion
Lance Fuller	Emergency Manager	Joint Forces Training Base	Hazard identification and prioritization
Blake Perez	Public Affairs Manager	SoCal Gas	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion
Tony Cardenas	Government Relations Manager	SoCal Edison	Critical facilities review, risk assessment/ vulnerability discussion
Tamika Lang	Senior Manager	Boeing	Hazard identification and prioritization, critical facilities review, risk assessment/ vulnerability discussion

A series of LHMP Planning Team meetings and smaller focus group meetings were hosted during the LHMP update process. LHMP Planning Team Meeting #1 was hosted during January 2025 to introduce the LHMP, outline the planning process, and discuss priority natural hazards for the

plan. Stakeholders on the LHMP Planning Team were then invited to participate in focus group meetings, hosted in February – April 2025. Focus groups were either held with a single stakeholder or a group of stakeholders with similar responsibilities or interests. The meeting series was concluded with the LHMP Planning Team Meeting #4, hosted on April 15, 2025. The purpose of the conclusion meeting was to present vulnerability/risk assessment findings and present mitigation actions. The meeting series is summarized below in Table 2-4, LHMP Planning Team and Focus Group Meeting Summary.

Meetings were held both in-person and virtually via Microsoft Teams, to accommodate stakeholders near the city, distributed throughout the region, and remote staff serving on the LHMP Consultant team. Meeting materials, including PowerPoint presentations, sign-in sheets, agendas, notes, and other relevant handouts, are provided in Appendix B, LHMP Planning Team Documentation.

**Table 2-3
LHMP Planning Team**

Meeting Date/Time	Meeting Title	Attendees	Meeting Agenda
November 19, 2024 4:00 PM – 5:00 PM	LHMP Kickoff Meeting	LHMP Planning Team (all)	<ul style="list-style-type: none"> • Project Background • Purpose & Requirements of the LHMP • Project Goals, Objectives and Expectations • Hazard Identification and Prioritization
February 12, 2025 2:00 PM – 4:00 PM	LHMP Planning Team Stakeholder Meeting #1	LHMP Planning Team (all)	<ul style="list-style-type: none"> • Critical Facilities Review • Risk/Vulnerability Discussion • Mitigation Action Discussion
March 25, 2025 2:00 PM – 4:00 PM	Focus Group Meeting #1	Internal City Staff	<ul style="list-style-type: none"> • Critical Facilities Review • Risk/Vulnerability Discussion • Mitigation Action Discussion
March 26, 2025 2:00 PM – 3:00 PM	Focus Group Meeting #2	Neighboring Jurisdictions, School District, Public Utilities and Public Safety Agencies	<ul style="list-style-type: none"> • Critical Facilities Review • Risk/Vulnerability Discussion • Mitigation Action Discussion

Meeting Date/Time	Meeting Title	Attendees	Meeting Agenda
April 3, 2025 2:00 PM – 4:00 PM	Focus Group Meeting #3	Attendees Nonprofits and NGOs	<ul style="list-style-type: none"> • Critical Facilities Review • Risk/Vulnerability Discussion • Mitigation Action Discussion
April 15, 2025 2:00 PM – 3:00 PM	Focus Group Meeting #4	Remaining Stakeholders	<ul style="list-style-type: none"> • Critical Facilities Review • Risk/Vulnerability Discussion • Mitigation Action Discussion
June 24, 2025 3:00 PM – 4:00 PM	LHMP Planning Team Stakeholder Meeting #2	LHMP Planning Team (all)	<ul style="list-style-type: none"> • Draft LHMP Review

Documentation of this process is included in Appendix B, LHMP Planning Team Documentation.

2.1.2 PUBLIC OUTREACH

A public outreach and engagement strategy was developed to maximize public involvement in the LHMP planning process, including underserved groups and vulnerable populations. The LHMP public outreach strategy included a dedicated webpage, a community survey, a community outreach event, and public review draft distribution, as described below; refer to Appendix B, LHMP Planning Team Documentation.

Webpage

A dedicated webpage was developed on the City’s website for the LHMP planning process and advertised through the City’s social media channels. The webpage provided information on the LHMP, and how the public can get involved in the planning process. Contact information was included for comments or questions via email. A link to complete the community survey was posted to encourage participation. The website was updated throughout the planning process and provided notifications and access to LHMP materials. The draft LHMP was also made available for public review on this webpage, available here: <https://sealbeachpd.com/local-hazard-mitigation-plan/>

Virtual outreach on the City’s website posted for the entirety of the LHMP development process allowing for maximum audience reach, including underserved and vulnerable populations. Traditionally, virtual outreach has the ability to reach community members who may be unable to attend in-person meetings or hearings. Individuals can access all information at their own convenience and have the ability to communicate directly with City staff regarding questions or comments.



DEFINITIONS:

Whole Community: *engaging the full capacity of private and nonprofit sectors, including businesses, faith-based and disability organizations, and the general public, in conjunction with the participation of local, tribal, state, and Federal governmental partners (FEMA).*

Social Vulnerability: *characteristics of a person or group that affect their capacity to anticipate, cope with, resist, and recover from the impact of a discrete and identifiable disaster in nature or society.*

Community Survey

A community survey was developed to obtain input about various hazard mitigation topics. In addition to basic demographic information (e.g., zip code and age), the survey asked participants to identify specific safety concerns, including identifying what hazards they felt were most likely to impact their neighborhood or property. Participants were also asked what actions they had taken to be more resistant to hazards, and preferences for future communication methods from the City. A survey link was posted on the LHMP webpage, City social media outlets, and a QR code was distributed on a printed handout at the community outreach events. Members of the LHMP Planning Team also distributed the survey link to colleagues and constituents within their jurisdiction.

Take Our Community Survey on Natural Hazards!

The City of Seal Beach is preparing a Local Hazard Mitigation Plan (LHMP):
The LHMP provides a framework for our community to reduce vulnerability from natural hazard events (such as earthquakes, drought, flood) and man-made hazards (such as terrorism and cyber attacks).

Take our Community Survey:
Your participation in the planning process is extremely important and vital to the success of the LHMP. **To plan for future disasters, we need your feedback!**

The survey should take approximately 10 minutes to complete and is anonymous. Your information will be kept confidential. The results of the survey will be included within the LHMP.

City of Seal Beach Local Hazard Mitigation Plan

The survey was opened on November 19, 2024, and closed on May 2, 2025. A total of 226 responses were received. Of the 226 participants, approximately 54 percent provided contact information and requested notification when the draft LHMP becomes available for public review. Survey respondents reported the highest level of concern for seismic related hazards, coastal erosion, terrorism/cyberattacks and drought. Approximately 35 percent of survey respondents reported signing up for emergency alerts and assembling an emergency supply kit. Regarding social vulnerability, more than 80 percent of survey participants identified age (including children under the age of 18 and seniors over the age of 65) as a characteristic that would increase vulnerability in the event of a natural disaster.

Input received was generally similar with feedback from the in-person and stakeholder outreach as outlined below. Survey input directly influenced the final hazard rankings, provided in [Section 4.0, Hazard Assessment](#). Further details received allow the City to better target future outreach and engagement activities regarding the LHMP. The survey specifically provides outreach with underserved and vulnerable populations who may not have the capacity or ability to attend in-

person outreach events or hearings. A detailed community outreach summary is included in [Appendix B, *LHMP Planning Team Documentation*](#).

Environmental Quality Control Board Meeting and Study Session

The first community outreach session facilitated for the LHMP was a presentation and study session during a regularly scheduled Environmental Quality Control Board (EQCB) Meeting on Wednesday, February 17th from 6:00 PM to 8:00 PM. In coordination with the City Project Management Team, the LHMP consultant (Michael Baker International) provided an in-depth presentation on the LHMP update. Several topical areas were covered, including the LHMP planning process, hazard identification and prioritization, and social vulnerability characteristic identification. This presentation allowed for questions and answers both from the EQCB and members of the public who attended the hearing. In addition, the hearing was live streamed and posted on the City's YouTube channel for asynchronous viewing.

Chamber of Commerce Breakfast Presentation

The second community outreach event included a presentation from the City Project Management Team at the Seal Beach Chamber of Commerce General Membership Meeting, on March 13th at 7:30 AM. A ten minute presentation on the LHMP update was included as part of the City Update's agenda. This update was presented to members of the business community within Seal Beach, many of whom are also local residents. During this meeting, the community survey was promoted as a way to provide input and feedback on the LHMP planning process.

Leisure World Workshop

The third community outreach event included a workshop held at Leisure World Clubhouse #4 on Wednesday, March 19th from 3:00 to 5:00 PM. In coordination with the City Project Management Team, the LHMP consultant (Michael Baker International) provided a presentation on the LHMP update along with several interactive opportunities to provide input. This outreach event included informational boards illustrating mapped hazard zones, the opportunity to vote on high priority hazard reduction, and identify socially vulnerable populations within the planning area. Hard copies of the community survey along with a written comment card were also provided to workshop attendees.

As Leisure World represents a significant concentration of socially vulnerable populations (primarily seniors over the age of 65 on fixed income, along with disabled persons) in Seal Beach, priority was given to scheduling a workshop specifically for this audience. This location was selected due to accessibility to seniors within the community, as Clubhouse #4 is walkable for



Sargent Brian Gray presenting the LHMP update at Chamber of Commerce Breakfast



LHMP Pop-Up Booth at the Seal Beach Car Show.

significant portions of Leisure World. In addition, Clubhouse #4 is accessible by Leisure World transit. The City Project Management Team worked with Leisure World staff to identify the most popular day/time to maximize attendance. Overall, the workshop was attended by approximately 45 residents from Leisure World.

Seal Beach Car Show Pop-Up

The final community outreach event was hosted on Saturday, April 26th from 8:00 AM to 4:00 PM at the Seal Beach Car Show on Main Street. In coordination with City staff, the consultant team set up a pop-up booth near the welcome and registration tent to receive community input on the LHMP. Participants had the opportunity to vote on high priority hazards and review informational boards on the LHMP update. Flyers advertising the community survey along with comment cards were also provided. Despite a brief period of rain during the morning, over 60 individuals stopped by the booth to discuss the LHMP update.

The pop-up booth was selected as a method to engage the whole community, with the “come to them” approach. Some segments of the community are less likely to attend formal workshops or hearings, but are interested in easily accessible engagement at public events such as the Seal Beach Car Show. In addition, the central location of the Car Show on Main Street enhanced participation, as many attendees walked or bicycled to the event. Participants at the pop-up booth included those who reside in Seal Beach or frequently visit, and hazard prioritization voting was accessible for participants of all ages.

Public Review Draft LHMP

A draft of the LHMP was made available on the LHMP webpage for the public to review and comment for a two-week period beginning June 18, 2025 and ending on July 2, 2025. Notification of the draft LHMP availability for review and comment was distributed via the City’s website and email listservs. **The LHMP received [TBD] comments on the draft LHMP.** Documentation of this process is included in [Appendix B, LHMP Planning Team Documentation](#).

2.1.3 REVIEW AND INCORPORATE EXISTING INFORMATION

The LHMP Planning Team referenced a variety of plans, studies, data, and technical reports available from local, State, and federal sources to prepare the LHMP update. Primary sources were reviewed and incorporated as part of the LHMP planning process, and are listed in [Table 2-4, Existing Plans, Studies, Reports, and Other Technical Data/Information](#). A complete list of references is included in [Section 13.0, References](#).

**Table 2-4
Existing Plans, Studies, Reports, and Other Technical Data/Information**

Existing Plans, Studies, Reports	Planning Process / Area of Document Inclusion
City of Seal Beach General Plan	Multiple Plan Elements
City of Seal Beach Capital Improvement Plan	Multiple Plan Elements
City of Seal Beach Emergency Operations Plan	Multiple Plan Elements
City of Seal Beach Urban Water Management Plan	Hazard Profiles
City of Seal Beach Water Shortage Contingency Plan	Hazard Profiles
City of Seal Beach Cyber Response Plan	Hazard Profiles
2018 Orange County Tsunami Annex	Hazard Profiles
City of Seal Beach 2021 – 2029 Housing Element	Multiple Plan Elements
Whittier Narrows Dam Safety Modification EIR	Hazard Profiles
City of Seal Beach 2023 Local Coastal Program (Draft Form)	Multiple Plan Elements
Main Street Specific Plan	Multiple Plan Elements
2025 Irvine Ranch Water District Dam Safety Program	Hazard Profiles

2.2 ASSESS RISKS

In accordance with FEMA requirements, the LHMP Planning Team identified and prioritized the hazards affecting the City and assessed vulnerability from those hazards. Results from this phase of the LHMP planning process aided subsequent identification of appropriate mitigation actions to reduce risk from these hazards; refer to [Section 5.0, *Mitigation Strategy*](#).

2.2.1 IDENTIFY/PROFILE HAZARDS

Based on a review of past hazards, as well as a review of existing plans, reports, and other technical studies, data, and information, the LHMP Planning Team determined which specific hazards could affect the City. Content for each hazard profile is provided in [Sections 4 through 10](#).

2.2.2 ASSESS VULNERABILITIES

Hazard profiling exposes the unique characteristics of individual hazards and begins the process of determining which areas within the City are vulnerable to specific hazards. The vulnerability assessment included input from the LHMP Planning Team and a GIS overlaying method to map hazard risk assessments. Using these methodologies, critical facilities impacted by hazards were identified and potential loss estimates were determined, where available. Detailed information on the vulnerability assessments for each hazard is provided in [Sections through 10](#).

2.3 DEVELOP MITIGATION PLAN

2.3.1 IDENTIFY GOALS

The LHMP Planning Team reviewed mitigation goals from the previous 2019 LHMP and made minor editorial changes for clarification. Hazard mitigation goals were discussed during Meeting #1, before finalization and incorporation into the LHMP. The Mitigation Goals are included in Section 1.0, *Introduction*.

2.3.2 DEVELOP CAPABILITIES ASSESSMENT

A capabilities assessment is a comprehensive review of all mitigation capabilities and tools currently available to the City for mitigation action implementation, prescribed in the LHMP. The LHMP Planning Team identified the planning and regulatory; administrative and technical; financial; and education and outreach capabilities to implement mitigation actions, as detailed in Section 5.0, *Mitigation Strategy*.

2.3.3 IDENTIFY MITIGATION ACTIONS

As part of the LHMP planning process, the LHMP Planning Team worked to identify and develop mitigation actions, after which mitigation actions were prioritized as high, medium, or low. A detailed discussion of the identification and prioritization of mitigation actions, and the creation of the implementation strategy is provided in Section 5.0, *Mitigation Strategy*.

2.3.4 PLAN ADOPTION AND SUBMITTAL

This plan will be submitted to Cal OES and FEMA for review. Upon receiving “approvable pending adoption” notification from FEMA, this plan will be presented for consideration and approval by the Seal Beach City Council. If approved, a copy of the resolution will be provided in Appendix A, *City of Seal Beach LHMP Adoption Resolution*.

2.3.5 PLAN MAINTENANCE

Plan maintenance procedures, found in Section 12.0, *Plan Maintenance*, include the measures the City will take to ensure the LHMP’s continuous long-term implementation. The procedures also include the manner in which the LHMP will be regularly monitored, reported upon, evaluated, and updated to remain a current and meaningful planning document.



Seal Beach Police Facility Dog Yosa in attendance at the LHMP Planning Team Meeting #1. From Canine Companions®, Yosa assists her handler, Captain Nick Nicholas, during his work with victims, witnesses, and community members exposed to traumatic events.



3

COMMUNITY PROFILE



WHAT'S DIFFERENT ABOUT THE 2025 PLAN?

- The City experienced a slight increase in population since the previous LHMP.
- The number of identified critical facilities has increased.
- Socially Vulnerable Populations (SVPs) have been identified, composed of the following groups:
 - Persons aged 65 or older
 - Persons under the age of 17
 - Persons with a disability
 - Unemployed individuals
 - Persons experiencing a high pollution burden
 - Tourists, visitors, and special event attendees.

SECTION 3: COMMUNITY PROFILE

3.1 PHYSICAL SETTING

The City of Seal Beach is located along the most northwestern point of Orange County, adjacent to the Pacific Ocean. The City covers approximately 11.51 square miles of land area and 1.72 square miles of water area for a total of 13.23 square miles. A significant portion of Seal Beach is occupied by Naval Weapons Station Seal Beach, a military base. The City of Seal Beach is bordered by the City of Long Beach and the Alamitos Bay to the northwest, the City of Los Alamitos and census-designated community Rossmoor to the north, the City of Huntington Beach to the southeast, and the Cities of Westminster and Garden Grove to the east. The City is relatively flat and sits at an elevation of 15 feet above sea level.

3.2 HISTORY

The Gabrielino-Tongva (Tongva) people, who were known for their skills in basket weaving, fishing and hunting, have inhabited the Los Angeles Basin for thousands of years. Tongva villages were located around the Los Angeles River, San Gabriel River, Santa Ana River, and other coastal areas. One such village was located in present-day Seal Beach called Motuucheyngna, which was part of a larger ceremonial and trading center.^{1,2} The Tongva people defined their world as Tovaangar, which is also the origin for the name of the people. This tribe also became known as “Gabrielino”, or sometimes called “Gabrieleño”, associated with the San Gabriel Mission where many tribe members were taken.

The first permanent European presence in Orange County was the 1776 establishment of Mission San Juan Capistrano to the south. After Mexico (including California before the Treaty of Guadalupe Hidalgo) became independent from Spain in 1821, the missions were secularized while large portions of land were granted to prominent figures. The area of modern-day Seal Beach became part of the Rancho Los Alamitos grant given to Spanish soldier Manuel Nieto.³

After Mexico’s cessation of California to the United States in 1884, an area east of modern-day Seal Beach became home to a group of German immigrants who established “Anaheim.” This group established a port called Anaheim Landing near where the Naval Weapons Station is today. The port grew and developed into what is now the downtown area of Seal Beach. In the early 1900s, the settlement eventually shifted from being a shipping center to a resort town and cemented this transition by changing its name to Bay City in 1903. Connections to Los Angeles via the burgeoning Pacific Electric rail system allowed visitors easy access to Bay City. The City subsequently adopted the name Seal Beach when it became an officially incorporated city in 1915.⁴ The advent of the Second World War prompted the next cycle of the City of Seal Beach’s growth. It was during this time that the Naval Weapons Station was built, and the aerospace industry took root in the city. The Leisure World community was also established during the late 1960s, an innovative senior living facility that was the largest development of its kind. Today, the Seal Beach is still a tourist destination and boasts a population of more than 24,000 residents.^{5,6}

¹ Tongva People, *Villages*, https://www.tongvapeople.org/?page_id=696, accessed January 8, 2025.

² Tongva People: A dynamic study of the Villages and Locations of the Gabrielino-Tongva Indians, *Introduction*, <https://www.tongvapeople.org/>, accessed June 13, 2022.

³ Orange County Historical Society, *A Brief History of Orange County*, https://www.orangecountyhistory.org/wp/?page_id=38, accessed January 10, 2025.

⁴ City of Seal Beach, *About Seal Beach*, <https://www.sealbeachca.gov/About-Seal-Beach>, accessed January 10, 2025.

⁵ United States Census Bureau, *Seal Beach Quick Facts*, <https://www.census.gov/quickfacts/fact/table/sealbeachcitycalifornia/PST045223>, accessed January 10, 2025.

⁶ City of Seal Beach General Plan, *Land Use Element*, <https://www.sealbeachca.gov/Portals/0/Documents/Land%20Use%20Element.pdf>, adopted 2003, accessed January 8, 2025.



COMMUNITY PROFILE AT A GLANCE

Social vulnerability is defined as characteristics of a person or group that affect their capacity to anticipate, cope with, resist, and recover from the impact of a discrete and identifiable disaster in nature or society.

Socially Vulnerable Populations in Seal Beach Include:



*People with
Disabilities*



*Unemployed
Persons*



*Elderly
Persons*



*People Facing
High Levels of
Pollution*



24,868
City Population



61.2
Median Age



1.90
*Average
Household Size*

3.3 DEMOGRAPHICS

Basic demographic and socioeconomic data for the City of Seal Beach (population, education, employment, and housing) obtained from the U.S. Census 2023 American Community Survey (ACS) has been summarized in the sections below.⁷

3.3.1 POPULATION

Table 3-1, *City of Seal Beach and Orange County Population and Housing Data (2023)*, provides an overview of the City's and County's demographics.

**Table 3-1
City of Seal Beach and Orange County Population and Housing Data (2023)**

Category	City of Seal Beach	Orange County
Total Population	24,868	3,164,063
Percent of Residents that are children (under 18 years)	13.1%	21.3%
Percent of Residents that are senior citizens (65 and over)*	43.7%	15.8%
Median Age (years)	61.2	39.1
Median Household Income	\$83,045	\$113,702
Median House Value (Owner-occupied housing units w/ a mortgage)	\$1,192,500	\$938,700
Occupied Housing Units	13,369	1,074,105
Percent of Renter-Occupied Housing Units	24.1%	43.6%
Percent of Owner-Occupied Housing Units	75.9%	56.4%
Average Household Size	1.90	3.47

Seal Beach is home to Leisure World, a gated 55+ age-restricted community, which accounts for approximately 36 percent of the City's total population. The presence of this development impacts the socioeconomic profile of the City, as discussed in the following sections.

Source: US Census Bureau, *2023 American Community Survey 5-Year Estimates*,

https://data.census.gov/profile/Seal_Beach_city,_California?g=160XX00US0670686, accessed April 9, 2025.

The City of Seal Beach has an estimated population of 24,868 people according to 2023 American Community Survey 5-year estimates. In terms of age demographics, residents under the age of 18 make up 13.1 percent of the City's population, which is less than that of Orange County at 21.3 percent. The median age of City residents is 61.2 years of age. Comparatively, the median age of Orange County residents is 39.1 years of age. The population of senior citizens in the City is approximately 43.7 percent, which is approximately 27.9 percent higher than the 15.8 percent of senior citizens in Orange County. Overall, these metrics show that Seal Beach has a comparatively older population than that of the County, which can be attributed, at least in part, to the age-restricted Leisure World community of over 9,000 residents

Seal Beach has a lower median household income, yet a higher median home ownership rate compared to Orange County as a whole. Median household income in the City is \$83,045, which is

⁷ The 2023 American Community Survey (ACS) 5-year estimates is the most current 5-year data profile available. It represents 60 months of collected data and provides the most reliable and largest data set.

lower than the Orange County median income of \$113,702. Owner-occupied housing units in the City accounts for 75.9 percent of total occupied housing, which is higher than the 56.4 percent of owner-occupied housing units in the County. The median home value in the City is \$1,192,500 compared to a median Orange County home value of \$938,700. The City also has a lower average household size at 1.9 compared to the County’s average household size of 3.47.⁸ Table 3-2, *City of Seal Beach and Orange County Racial and Ethnic Composition (2023)*, provides an overview of the City’s and County’s racial/ethnic demographics.

**Table 3-2
City of Seal Beach and Orange County Racial and Ethnic Composition (2023)**

Race or Ethnicity	City of Seal Beach		Orange County	
	Population	Percentage of Population	Population	Percentage of Population
White	19,953	80.2%	1,911,509	60.4%
Black or African American	506	2.0%	84,846	2.7%
American Indian and Alaskan Native	459	1.8%	62,657	2.0%
Asian	4,048	16.3%	791,027	25.0%
Native Hawaiian and Other Pacific Islander	82	0.3%	23,135	0.7%
Other Race	2,287	9.2%	789,922	25.0%
Two or More Races	2,249	9.0%	129,850	4.1%
Hispanic or Latino (of any race) ¹	3,071	12.3%	1,080,480	34.1%
Total	24,868	N/A*	3,164,063	N/A*

¹ Hispanic or Latino persons are not counted as a separate racial or ethnic category; persons who identify as Hispanic or Latino are also included in other racial or ethnic categories. Totals may vary slightly due to rounding.

*Percentages do not equal 100% as some individuals identified as more than one race.

Source: US Census Bureau, 2023: American Community Survey 5-Year Estimates, *DP05 Demographic and Housing Estimate*, https://data.census.gov/profile/Seal_Beach_city,_California?g=160XX00US0670686, accessed April 9, 2025.

The majority racial/ethnic population in Seal Beach is white at 80.2 percent of residents. In contrast, the white population of Orange County accounts for 60.4 percent. The Asian population of the City constitutes 16.3 percent, which is lower than the 25.0 percent Asian population of the County. Hispanic or Latino persons of any race constitute 12.3 percent of the City’s residents in comparison to 34.1 percent of County residents. Percentages of Black or African American is about 2.0 percent, slightly lower than Orange County at 2.7 percent. Similarly, the City’s American Indian and Alaskan Native population at 1.8 percent is slightly lower compared to the County’s at 2.0 percent. The City of Seal Beach also has a lower Native Hawaiian and Other Pacific Islander population at 0.3 percent compared to the County’s 0.7 percent.

Persons identifying as “other race” account for 9.2 percent of the City’s population, while those reporting two or more races make up 9.0 percent of the City’s population. Percentages of “other

⁸ American 2023 American Community Survey 5-Year Estimates, *S1101 Households and Families*, https://data.census.gov/table/ACSST5Y2023.S1101?q=S1101:%20Households%20and%20Families&g=050XX00US06059_160XX00US0670686, accessed January 8, 2025.

race” and two or more races of Orange County are 25.0 percent and 4.1 percent, respectively. The overall racial/ethnic composition of the City is generally less diverse than that of the Orange County.

3.3.2 EDUCATIONAL ATTAINMENT

Educational attainment is analyzed based upon the population of individuals aged 25 and over. Residents in the City of Seal Beach have a higher level of educational attainment compared to Orange County; refer to [Table 3-3, *City of Seal Beach and Orange County Educational Attainment \(2023\)*](#).

**Table 3-3
City of Seal Beach and Orange County Educational Attainment (2023)**

Educational Attainment (Age 25 and Over)	City of Seal Beach		Orange County	
	Population	Percentage of Population	Population	Percentage of Population
Less than 9 th Grade	389	1.9%	160,449	7.3%
9 th to 12 th Grade, No Diploma	559	2.7%	127,451	5.8%
High School Graduate	3,173	15.3%	379,386	17.2%
Some College, No Degree	4,017	19.4%	411,837	18.7%
Associate Degree	1,980	9.6%	168,956	7.7%
Bachelor’s Degree	5,986	28.9%	601,466	27.3%
Graduate or Professional Degree	4,587	22.2%	355,582	16.1%
Total*	20,691	100.0%	2,205,127	100.0%

*Totals may vary slightly due to rounding.

Source: US Census Bureau, 2023: American Community Survey 5-Year Estimates, *S1501 Educational Attainment*. https://data.census.gov/profile/Seal_Beach_city,_California?g=160XX00US0670686, accessed April 9, 2025.

Of the City’s population aged 25 years and older, 22.2 percent attained a graduate or professional degree, 28.9 percent attained a bachelor’s degree, and 9.6 percent attained an associate degree. Thus, about 60.7 percent of the City’s population has completed a higher education degree. In comparison, the County’s higher education degree attainment is as follows: 16.1 percent attained a graduate or professional degree, 27.3 percent attained a bachelor’s degree, and 7.7 percent attained an associate degree. Approximately 4.6 percent of adults in the City of Seal Beach have not completed high school compared to approximately 13.1 percent of adults in the County.

3.3.3 EMPLOYMENT

According to the 2023 American Community Survey 5-Year Estimate, there are 22,077 residents over 16 years of age in the City of Seal Beach, and 9,873 were in the labor force.⁹ Out of the 9,873 people in the labor force, 9,204 (41.7 percent) were employed and 485 (2.2 percent) were unemployed.

The educational services and health care/social services sector employed the largest number of City residents (26.6 percent), followed by professional, scientific, and management, and administrative and waste management services (12.3 percent); finance and insurance, and real

⁹ 2023 American Community Survey 5-Year Estimates, *DP03 Selected Economic Characteristics*, https://data.census.gov/table/ACSDP5Y2023.DP03?q=DP03%20Selected%20Economic%20Characteristic%20san%20bernardino%20county&g=050XX00US06059_160XX00US0670686, accessed January 8, 2025.

estate and rental and leasing (10.4 percent); manufacturing (9.5 percent); retail trade (8.8 percent); and other services. The median household income in the City was \$83,045.

While approximately 23.6 percent of employees work from home, a majority of Seal Beach residents commute for work. The average commute travel time is 30 minutes.¹⁰

3.3.4 HOUSING

According to the US Census Bureau 2023 American Survey 5-Year Estimates, there are housing units within the City, 88.6 percent of which are occupied.¹¹ The most prevalent type of housing with the City of Seal Beach is multifamily units at 48.2 percent.¹² This is followed by single-family detached (32.6 percent), single-family attached (10.4 percent), multifamily, 2-4 units (7.7 percent), and mobile homes (1.1 percent).¹³

The City of Seal Beach has had continuous structure-built growth as shown in [Table 3-4, *Years Structure Built Growth*](#). The majority of housing units were built within the last 70 years, with the majority of development occurring between 1960 to 1979.¹⁴ The United States Census Bureau estimates an average household size of 1.90 persons per household in the City.¹⁵

**Table 3-4
Years Structure Built Growth**

Year Structure Built	Percentage
Built 2020 or later	0.8%
Built 2010 to 2019	7.9%
Built 2000 to 2009	8.4%
Built 1990 to 1999	10.9%
Built 1980 to 1989	14.6%
Built 1970 to 1979	22.4%
Built 1960 to 1969	18.0%
Built 1950 to 1959	12.5%
Built 1940 to 1949	1.9%
Built 1939 or earlier	2.5%

Source: 2023 American Community Survey 5-Year Estimates, *DP04 Selected Housing Characteristics*, https://data.census.gov/table/ACSDP5Y2023.DP04?q=DP04%20Selected%20Housing%20Characteristics%20&g=050XX00US06059_160XX00US,0670686, accessed June 10, 2025.

¹⁰ Ibid.

¹¹ 2023 American Community Survey 5-Year Estimates, *DP04 Selected Housing Characteristics*, https://data.census.gov/table/ACSDP5Y2023.DP04?q=DP04%20Selected%20Housing%20Characteristics%20&g=050XX00US06059_160XX00US,0670686, accessed January 8, 2025.

¹² City of Seal Beach, *2021 - 2029 Housing Element*, https://www.sealbeachca.gov/Portals/0/Documents/6th%20Seal%20Beach%20Housing%20Element_Adopted-compressed.pdf?ver=2022-02-10-091549-117, adopted February 7, 2022, accessed January 8, 2025.

¹³ Ibid.

¹⁴ 2023 American Community Survey 5-Year Estimates, *DP04 Selected Housing Characteristics*, https://data.census.gov/table/ACSDP5Y2023.DP04?q=DP04%20Selected%20Housing%20Characteristics%20&g=050XX00US06059_160XX00US,0670686, accessed January 8, 2025.

¹⁵ 2023 American Community Survey 5-Year Estimates, *DP04 Selected Housing Characteristics*, https://data.census.gov/table/ACSDP5Y2023.DP04?q=DP04%20Selected%20Housing%20Characteristics%20&g=050XX00US06059_160XX00US,0670686, accessed

3.4 LAND USE AND EXISTING DEVELOPMENT

The Seal Beach General Plan guides the development of the City. The City of Seal Beach General Plan assigns land use designations to all land located within its incorporated boundaries; refer to [Figure 3-1, Seal Beach Zoning Map](#) and [Figure 3-2, Seal Beach Land Use Map](#). [Table 3-5, Seal Beach Land Use Summary](#) and [Table 3-6, Seal Beach Land Use Intensity/Density Standards](#) identifies the current General Plan land use designations and descriptions of the typical uses allowed in each designation.

The primary land uses within the City are military at 60.8 percent, followed by open space at 17.1 percent, residential at 14.4 percent, industrial at 2.4 percent, and commercial at 2.2.

The Seal Beach Naval Weapons Station is the eastern portion of the city, bordering the both Westminster and Huntington Beach. Included as part of this military installation is the Seal Beach National Wildlife Refuge – in addition to the Los Cerritos Wetlands, these areas constitute significant open space within Seal Beach. Residential land use is distributed throughout Seal Beach, including a variety of housing types from low, medium and high densities. Light industrial uses are primarily concentrated within the Boeing Specific Plan area and adjacent parcels near the intersection of Westminster Boulevard and Seal Beach Boulevard. Commercial hubs are distributed throughout the City, include Main Street/Pacific Coast Highway in the Old Town Neighborhood and Old Ranch Town Center/Shops at Rossmoor along Seal Beach Boulevard.

**Table 3-5
Seal Beach Land Use Summary**

Designation	Proposed/ Developed (acres)	Undeveloped (acres)	Total Acres	Description
<i>Residential</i>				
Low (LDR)	353.7	0.0	353.7	Minimum lot area of 5,000 square feet per dwelling unit
Medium (MDR)	505.4	0.0	505.4	Minimum lot area of 2,500 square feet per dwelling unit; minimum lot area of 2,500 square feet per dwelling unit in Planning Area 1 south of Pacific Coast Highway
High (HDR)	166.4	0.0	166.4	Minimum lot area of 1350 square feet per dwelling unit, Minimum lot area of 2178 square feet per dwelling unit in Planning Area 1 South of Pacific Coast Highway and Marina Drive, Minimum lot area of 960 square feet per dwelling unit in Planning Area 4, consisting of Rossmoor Business Center
<i>Commercial</i>				
Professional Office (PO)	16.4	0.0	16.4	Professional and medical offices of all types, architects, engineers, real estate and insurance offices, banks,

Michael Baker International, Inc.

Designation	Proposed/ Developed (acres)	Undeveloped (acres)	Total Acres	Description
Service (SC)	49.3	0.0	49.3	savings and loan establishments and other types of financial activities. Consists of commercial establishments selling a broad range of convenience and consumer good or providing a variety of personal services. Structures involved would usually be two main types 1) those located along streets with heavy pedestrian traffic along sidewalks with stores usually cost to right way of way lines, 2) establishment which customers travel by automobile and where stores may be set back from the road, possibly in a unified development, to provide parking
General (GC)	75.4	18.0	93.4	Primarily highway-oriented commercial use for automobile service stations, automobile sales, automobile repair, motels and hotels, restaurants and other related uses.
<i>Industrial</i>				
Light (LI)	67.0	50.0	117.0	Boeing Integrated Defense Systems Headquarters facility at the intersection of Seal Beach Boulevard and Westminster Avenue
Oil Extraction (OE)	54.6	0.0	54.6	Oil separation facility that separated oil and seawater pumped to the on-shore facilities from an offshore oil island that has recently been decommissioned and dismantled.
<i>Open Space</i>				
Open Space (OS)	0.0	42.7	42.7	Nature trails, environmental educational purposes, beachfront,
Golf Course (GC)	156.8	0.0	156.8	Private Old Ranch Golf Course with a public golf driving range
Wetlands & Wildlife Refuge (WWR)	100.0	920.0	1,020.0	Los Cerritos Wetland along Pacific Coast Highway and Seal Beach National Wildlife Refuge
Park (P)	65.4	19.0	65.4	Parks and recreational spaces including Gum Grove Nature Park, Sunset Marina Park,

Designation	Proposed/ Developed (acres)	Undeveloped (acres)	Total Acres	Description
School (S)	15.3	0.0	15.3	Eisenhower Park, Arbor Park, Bluebell Park, Zoeter Field One school in the City: McGaugh Elementary School. Due to very limited population growth proposed by the Land Use Element, no additional schools are proposed or needed for the community.
Community Facility (CF)	61.8	0.0	61.8	Includes public community facilities for residents and tourists.
Military	4,336.0*	0.0	4,336.0*	Located on the eastern boundary of the Seal Beach community
Beach (B)	0.0	80.3	80.3	Includes recreational areas, and beach areas.
Total	6,023.5	1,111.0	7,134.5	

Source: City of Seal Beach General Plan, *Land Use Element Land Use Tables*, <https://www.sealbeachca.gov/Portals/0/Documents/Land%20Use%20Tables.pdf>, adopted February 28, 2011, accessed January 8, 2025.

**Table 3-6
Land Use Intensity/Density Standards**

Land Use Designation	Minimum Lot Area	Building Intensity Dwelling Units per Acre (DU/Acre)*	Density (Persons/acre)**
Residential	-	-	-
Low-Density Residential	5,000 sq. ft.	9.0 DU/Acre	16.5
Medium-Density Residential	2,500 sq. ft.	17.0 DU/Acre	31.0
High-Density Residential	-	-	-
Planning Area 1	2,178 sq. ft.	20.0 DU/Acre	36.6
Planning Area 2,3	1,350 sq. ft.	32.2 DU/Acre	58.9
Planning Area 4	960 sq. ft.	45.3 DU/Acre	82.8
Commercial	-	-	-
Professional Office	7,000 sq. ft.	0.50-0.60 FAR	1 Employee/ 300 sq. ft.
Service Commercial	7,000 sq. ft.	0.60-0.75 FAR	1 Employee/333 sq. ft.
General Commercial	7,000 sq. ft.	0.60-0.80 FAR	1 Employee 450 sq. ft.
Industrial	-	-	-
Light Industrial	10,000 sq. ft.	0.70 FAR	1 Employee 470 sq. ft.

Figure 3-1
Seal Beach Zoning Map

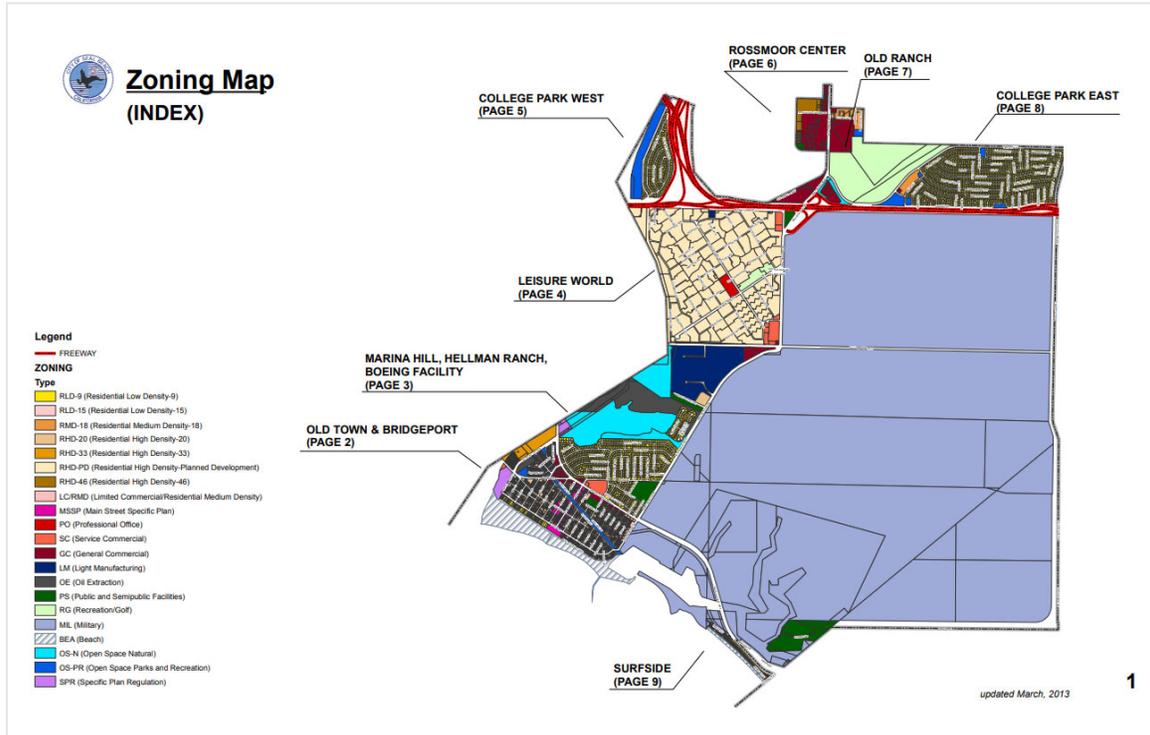
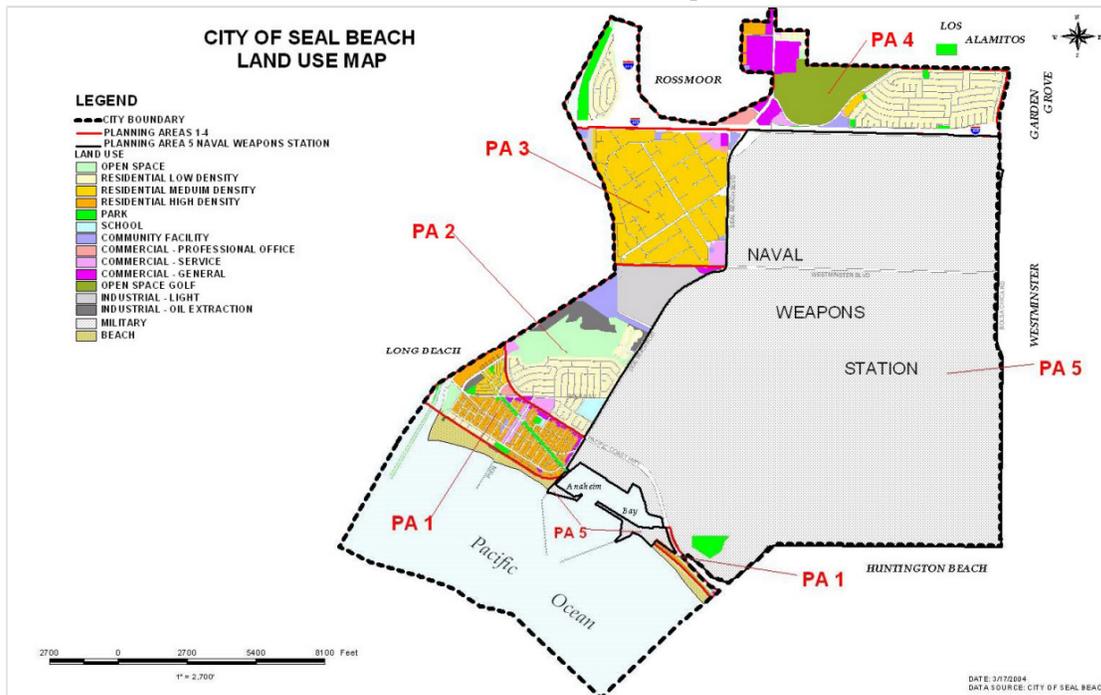


Figure 3-2
Seal Beach Land Use Map



The City is also in the process of developing its Local Coastal Program, which consist of planning documents used by local governments to guide development in the coastal zone, in partnership with the Coastal Commission. LCPs contain rules and regulations for future development and protection of coastal resources, by specifying appropriate location, type, and scale of new or changed uses. LCPs must be in compliance with the broad requirements of the California Coastal Act and reflect the unique and specific community characteristics of the jurisdiction. Each LCP consists of a Land Use Plan (LUP) and Local Implementation Plan (LIP). The LUP designates land use classifications, and goals/policies guiding development (similar in nature to a City's General Plan, but specifically for the coastal zone). The LIP includes measures to implement the LUP, typically through the zoning ordinance. In May 2023, the City of Seal Beach submitted a revised Draft Land Use Plan to the Coastal Commission for their comment and feedback.

3.5 DEVELOPMENT TRENDS AND FUTURE DEVELOPMENT

Since the previous iteration of the 2019 LHMP, population patterns have remained the same, while development and land use in the planning area has not substantially changed. The City population increased nominally, from approximately 24,510 individuals in the 2019 LHMP to 24,868 in this current LHMP – representing a gain of 358 individuals or 1.46 percent increase of the City population.^{16,17} As minor and small-scale changes in land use occurred while the previous 2019 LHMP was active, risk and vulnerability associated with the majority of hazards listed in the LHMP nominally increased. Any differences related to specific hazards are further discussed within the hazard profiles in [Section 4](#).

For future land use, development trends and population patterns, the City of Seal Beach General Plan is a key guide. Most recently, future growth is also projected in the 2021 – 2029 Housing Element. A key indicator of projected growth is the California Department of Housing and Community Development (HCD) Regional Housing Need Allocation (RHNA). The RHNA represents the minimum number of housing units the City is required to provide “adequate sites” for zoning and is one of the primary threshold criteria to achieve State approval of the Housing Element. It is noted that the RHNA represents a planning target for new residential growth and is not a building quota.

As required by the RHNA determination, the City is required to account for the growth of an additional 1,243 housing units at varying income levels. The RHNA allocation for 2021 – 2029 for the City as follows in [Table 3-7, City of Seal Beach RHNA Allocation](#):

Table 3-7
City of Seal Beach RHNA Allocation

Income Level	Percent of AMI*	Units	Percent
Very Low**	Up to - 50%	258	20.8

January 8, 2025.

ach, Local Hazard Mitigation Plan,

[https://www.sealbeachca.gov/Portals/0/Documents/Seal%20Beach%20HMP-](https://www.sealbeachca.gov/Portals/0/Documents/Seal%20Beach%20HMP-20181018_Public%20Review_wAppendices.pdf)

20181018_Public%20Review_wAppendices.pdf, adopted 2019, accessed January 14, 2025.

¹⁷ NCHstats, *California Population 2024 – 5 Regions with the Largest Increases*,

<https://nchstats.com/california-population-growth/>, updated January 2, 2025, accessed January 9, 2025.

Income Level	Percent of AMI*	Units	Percent
Low	51 - 80%	201	16.2
Moderate	81 - 120%	239	19.2
Above Moderate	120%+	545	43.8
Total		1,243	100%

*AMI – Area Median Income

**Includes the extremely low-income category, which is estimated as half the VL need pursuant to Government Code Sec. 65583(a)(1)

Source: City of Seal Beach, 2021

The City is required to demonstrate an availability of land, zoning provisions, and development standards that facilitate and encourage affordable housing development. The majority of sites that are identified for potential housing development as part of the 2021 – 2029 Housing Element include Accurate Storage, Shops at Rossmoor, Old Ranch Town Center, Old Ranch Country Club, Leisure World, Seal Beach Plaza, Seal Beach Center, Main Street Specific Plan Area, and 99 Marina.¹⁸ While it is unknown how much of the residential growth associated with the Housing Element Update will be approved or constructed within the five-year period of this LHMP, it is reasonable to assume that some level of residential development will occur. Any residential growth in the planning area is generally associated with population growth. Discussions on how projected growth could impact risk and vulnerability is discussed on a hazard-by-hazard basis within [Section 4.0](#).

In addition to the RHNA requirements, the City of Seal Beach Public Works is overseeing the design and construction of various capital improvement projects. See [Table 3-8, Major Capital Improvement Projects](#), for a description and status of current and future development projects.

**Table 3-8
Major Capital Improvement Projects**

Project	Description
Beach and Pier	<ul style="list-style-type: none"> Life Guard/Police Department Substation 8th/10th Street Lot and ADA Ramps Tidelands Facility Security System Update Pier Concrete Abutment Structural Testing/Phase 2 Rehabilitation
Building and Facilities	<ul style="list-style-type: none"> Tennis Center Improvement Project Revitalization Plan North Seal Beach Community Center North Seal Beach Community Center Phase 2 Building Improvement Program Council Chambers Improvements

¹⁸ City of Seal Beach, *Housing Element 2021 – 2029*, https://www.sealbeachca.gov/Portals/0/Documents/6th%20Seal%20Beach%20Housing%20Element_Adopted-compressed.pdf?ver=2022-02-10-091549-117, accessed January 13, 2025.

Project	Description
	<ul style="list-style-type: none"> • Annual Playground Resurfacing Program • Citywide ADA Improvements • SBTPC Court Resurfacing (All Courts) and LED Lighting Upgrades
Sewer	<ul style="list-style-type: none"> • Sewer Mainline Improvement Program • Pump Station 35 Upgrades
Storm Drain	<ul style="list-style-type: none"> • San Gabriel River Trash Mitigation Initiative • 2024 Environmental Clean Up – Galleon Way – Grant Match • Storm Drain Cleaning
Street and Transportation	<ul style="list-style-type: none"> • Lampson Bike Trail Gap Closure Project • Main Street Improvements Program • Seal Beach Blvd Traffic Signal Synchronization • Annual Slurry Seal Program • Annual Local Paving Program • Arterial Street Resurfacing Program • Annual ADA Improvements – Public R/W • Annual Striping Program • Citywide Traffic Signal Improvement Program • OCTA 405 Widening Co-Op Project • Seal Beach Blvd at North Gate Road Improvements • Alley Repair
Water	<ul style="list-style-type: none"> • Beverly Manor Water Pump Station Rehabilitation • SCADA Improvement Upgrade Project • Lampson Well Head Treatment • LCWA Watermain Lining • I-405 Improvement Project Waterline Relocation

Source: City of Seal Beach, *Adopted Operating & Capital Improvement Budget Fiscal Year 2025-2026*, <https://www.sealbeachca.gov/Portals/0/Documents/City%20Manager/Proposed%20Budget%20FY%2025-26.pdf?ver=2025-05-02-182639-930×tamp=1746235780157>, accessed June 13, 2025.

3.6 INFRASTRUCTURE SYSTEMS

Infrastructure systems within the City of Seal Beach, such as roadways, water and wastewater facilities, storm drains, solid waste, electricity, natural gas, telecommunications and circulations provide vital community and individual functions. These facilities and distribution systems are owned, operated, and maintained by the City of Seal Beach and other agencies. The ability for infrastructure systems to remain operational during hazard events and emergencies will contribute to the City's ability to withstand or recover sooner from hazard events.

3.6.1 TRANSPORTATION

The City of Seal Beach is accessible via Interstate 405 (I-405), Interstate 605 (I-605), and State Route 22 (SR-22). Seal Beach has 34 miles of road including both residential streets and main thoroughfares. Principal arterials in the planning area include Pacific Coast Highway (PCH) and Westminster Avenue providing east-west access, and Seal Beach Boulevard providing north-south access. Minor arterials and major collectors support the overall connectivity and transportation system. The roads in Seal Beach are serviced by the City of Seal Beach Public Works Department, with the exception of Pacific Coast Highway, which is under the jurisdiction of California Department of Transportation (Caltrans), and private roads, including all of Leisure World, and smaller streets in the Heron Pointe and Surfside Colony developments. The Street Maintenance

section of the PWD is responsible for maintaining all city streets, sidewalks, curbs and gutters. The I-405, I-605, and SR-22 are maintained by Caltrans, with the Orange County Transportation Authority (OCTA) involved in improvement projects and overall coordination for the I-405 and SR-22 freeways in this region.

3.6.2 WATER AND WASTEWATER

The City of Seal Beach sources approximately 85 percent of its water supply from local groundwater, via three local wells. The remaining demand is met through water supplied by the Municipal Water District of Orange County (MWDOC) via the Metropolitan Water District of Southern California (MWD), originating from Northern California and the Colorado River.

The City of Seal Beach does not have its own wastewater services, instead the City collects wastewater through its local sewer system which consists of 34 miles of sewer lines, six pump stations, and 800 manholes. The City then transports the collected wastewater to the Orange County Sanitation District (OCSD) for treatment.

3.6.3 ELECTRICITY

Southern California Edison (SoCal Edison) provides electricity to the City of Seal Beach. Electricity is distributed from power plants through power lines and substations. Substations within the City include the Norseal Substation (ID SS1184).¹⁹ Power lines within the City are both underground and above ground.

3.6.4 NATURAL GAS

Southern California Gas (SoCal Gas) provides gas service to the City of Seal Beach. According to SoCal Gas's Gas Transmission Pipeline Map, major gas transmission lines are present within the city underneath Lampson Avenue from east to west. Additionally, the City has high pressure distribution lines running through Pacific Coast Highway, Bolsa Ave, Seal Beach Blvd, I-405, I-22, and Bolsa Chica Rd.²⁰

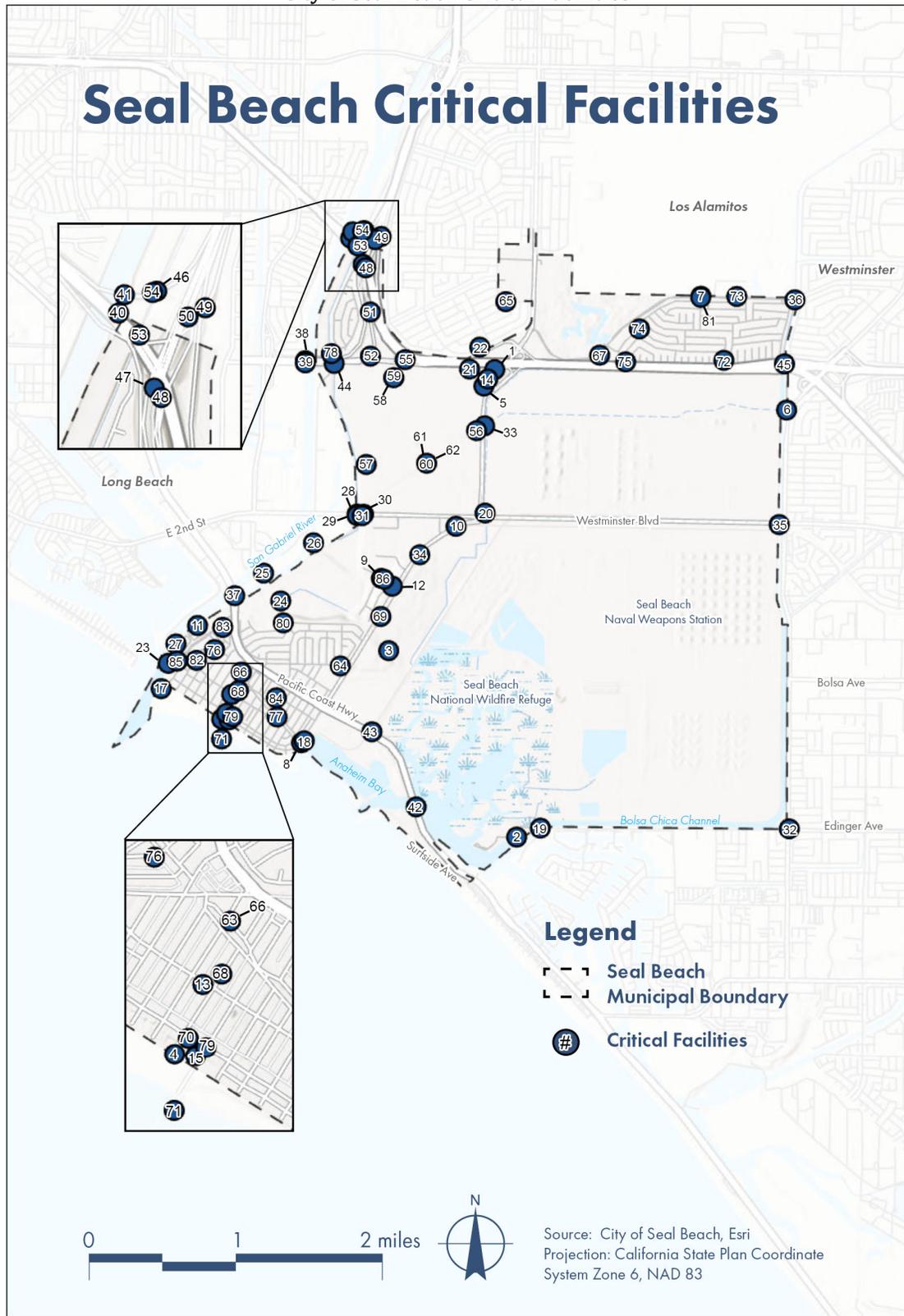
3.6.5 CRITICAL FACILITIES

The LHMP Planning Committee identified 80 critical facilities for incorporation in the hazard vulnerability/risk analysis. Seal Beach critical facilities are summarized by asset type in [Table 3-8, *City of Seal Beach Critical Facilities*](#). Critical facilities are owned, operated, and maintained mainly by the City and other various agencies. Critical facilities serve an important function in the operations of the municipal government and in serving the community. These facilities include government buildings (police stations, fire stations, community centers, etc.), parks, water and wastewater facilities, public schools, and utilities. Damage to these facilities caused by a hazard event has the potential to impair response and recovery and may lead to disruption of services. Critical facilities may also assist in evacuations, serve as assembly points or temporary shelters, or provide a supportive role in preparing for and recovering from hazard events.

¹⁹ California Energy Commission, *Statewide Operational Substations*, <https://www.energy.ca.gov/search/site?keys=SUBSTATIONS>, accessed January 8, 2025.

²⁰ SoCalGas, Gas Transmission Pipeline Interactive Map – Orange, <https://socialgas.maps.arcgis.com/apps/webappviewer/index.html?id=53da2bbb31574e0ab0f14f9bc2618d89>, accessed January 13, 2025.

Figure 3-3
City of Seal Beach Critical Facilities



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Table 3-9
City of Seal Beach Critical Facilities

ID	Name	Facility Type	Community Lifeline
1	3101 ½ N Gate Rd - Potable water reservoir, well and pump station.	Water Systems	Water Systems
2	2901 Edinger Ave - Sewer lift pump station	Water Systems	Water Systems
3	601 Gardner - Potable water reservoir and pump station	Water Systems	Water Systems
4	Sewer lift pump station - 800 Ocean Ave	Water Systems	Water Systems
5	Potable water well - 2700 North Gate Rd	Water Systems	Water Systems
6	Potable water well - 3333 Bolsa Chica Rd	Water Systems	Water Systems
7	Potable water well - 4307 Lampson Ave	Water Systems	Water Systems
8	Sewer lift pump station - 200 Seal Beach Blvd	Water Systems	Water Systems
9	Sewer lift pump station - 1776 ½ Adolfo Lopez Dr	Water Systems	Water Systems
10	Sewer lift pump station - 2701 Seal Beach Blvd	Water Systems	Water Systems
11	Stormwater pump station - 43 ½ Riversea Rd	Water Systems	Water Systems
12	Seal Beach Police Department	Water Systems	Water Systems
13	OCFA Fire Station 44	Government Services	Safety and Security, Communications
14	OCFA Fire Station 48	Government Services	Safety and Security, Communications
15	Seal Beach Marine Safety Headquarters	Government Services	Safety and Security, Communications
16*	OC-35 Import Waterline Turnout	Transportation	Transportation
17	Sewer lift station - 1st St	Water Systems	Water Systems
18	Stormwater Pump Station - 202 Seal Beach Blvd (County owned)	Water Systems	Water Systems
19	Bridge to Sunset Aquatic Park (not City-owned)	Transportation	Transportation
20	OC San Regional Wastewater Collections Station (not City-owned)	Water Systems	Water Systems
21	Leisure World Water Well (inactive)	Water Systems	Water Systems
22	OC San Wastewater Station - (3112 Yellowtail, Rossmoor)	Water Systems	Water Systems
23	San Gabriel River Bike Trail Entry Point	Transportation	Transportation
24	Los Cerritos Wetlands Restoration	Wetlands	Safety and security

ID	Name	Facility Type	Community Lifeline
	(not City-owned)		
25	Hellman Oil Field (not City-owned)	Oil Field	Hazardous Materials
26	Stormwater Pump Station (County owned)	Water Systems	Water Systems
27	Bridge 53C1998 – San Gabriel River (Local)	Bridge	Transportation
28	Bridge 55C0041L – Los Alamitos Channel (Local)	Bridge	Transportation
29	Bridge 55C0041R – Los Alamitos Channel (Local)	Bridge	Transportation
30	Bridge 55C0042L - Federal Storm Channel (Local)	Bridge	Transportation
31	Bridge 55C0042R - Federal Storm Channel (Local)	Bridge	Transportation
32	Bridge 55C0075 - Westminster Channel (Local)	Bridge	Transportation
33	Bridge 55C0104 – Federal Storm Channel (Local)	Bridge	Transportation
34	Bridge 55C0105M - Pedestrian Walkway (Local)	Bridge	Transportation
35	Bridge 55C0108 – Bolsa Chica Channel (Local)	Bridge	Transportation
36	Bridge 55C0160 – Bolsa Chica Channel (Local)	Bridge	Transportation
37	Bridge 53 0060 – San Gabriel River (State)	Bridge	Transportation
38	Bridge 53 0302L – San Gabriel River (State)	Bridge	Transportation
39	Bridge 53 0302R – San Gabriel River (State)	Bridge	Transportation
40	Bridge 53 1185 – San Gabriel River (State)	Bridge	Transportation
41	Bridge 53 1737H – San Gabriel River (State)	Bridge	Transportation
42	Bridge 55 0010 – Anaheim Bay (State)	Bridge	Transportation
43	Bridge 55 0065 – Kitt Highway, US Navy RR (State)	Bridge	Transportation

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ID	Name	Facility Type	Community Lifeline
44	Bridge 55 0310 – Los Alamitos Channel (State)	Bridge	Transportation
45	Bridge 55 0334 – Bolsa Chica Ditch (State)	Bridge	Transportation
46	Bridge 55 0347H – Service Rd (State)	Bridge	Transportation
47	Bridge 55 0412L – Interstate 405 (State)	Bridge	Transportation
48	Bridge 55 0412R – Interstate 405 (State)	Bridge	Transportation
49	Bridge 55 0413F – Rte 405, 605, CONN, RIV (State)	Bridge	Transportation
50	Bridge 55 0415 – E22 - N405 Connector Ramp (State)	Bridge	Transportation
51	Bridge 55 0426G – S605 - S405 Connector (State)	Bridge	Transportation
52	Bridge 55 0428G – State Route 22 (State)	Bridge	Transportation
53	Bridge 55 0441 – Los Alamitos Channel (State)	Bridge	Transportation
54	Bridge 55 0471H – Los Alamitos Channel (State)	Bridge	Transportation
55	Bridge 55 1100G – Interstate 405 (State)	Bridge	Transportation
56	Leisure World Clubhouse 1	Community Facility	Safety and Security
57	Leisure World Clubhouse 2	Community Facility	Safety and Security
58	Leisure World Clubhouse 3	Community Facility	Safety and Security
59	Leisure World Clubhouse 4	Community Facility	Safety and Security
60	Leisure World Clubhouse 5	Community Facility	Safety and Security
61	Leisure World Clubhouse 6	Community Facility	Safety and Security
62	Leisure World Healthcare Center	Healthcare Facility	Health and Medical
63	Mary Wilson Library	Community Facility	Safety and Security, Communications; Food Water, Shelter
64	McGaugh School	Community Facility	Safety and Security; Communications; Food, Water, Shelter
65	North Seal Beach Community Center	Community Facility	Safety and Security; Food, Water, Shelter
66	Seal Beach Senior Center	Community Facility	Safety and Security; Food, Water, Shelter
67	Seal Beach Tennis Center	Community Facility	Safety and Security
68	City Hall	Government Building	Safety and Security
69	Naval Weapons Station Seal Beach	Military Facility	Safety and Security

ID	Name	Facility Type	Community Lifeline
70	Police Substation	Municipal Services	Safety and Security; Communications
71	Seal Beach Ocean Pier	Public Park	Safety and Security
72	Almond Park	Public Park	Safety and Security
73	Arbor Park	Public Park	Safety and Security
74	Aster Park	Public Park	Safety and Security
75	Bluebell Park	Public Park	Safety and Security
76	Corsair Park	Public Park	Safety and Security
77	Electric Avenue Greenbelt	Public Park	Safety and Security
78	Edison Park	Public Park	Safety and Security
79	Eisenhower Park	Public Park	Safety and Security
80	Gum Grove Park	Public Park	Safety and Security
81	Heather Park	Public Park	Safety and Security
82	Marina Park + Community Center	Community Facility	Safety and Security
83	Schooner Park	Public Park	Safety and Security
84	Zoeter Field	Public Park	Safety and Security
85	Beach Maintenance yard	Government Building	Hazardous Materials
86	City Maintenance Yard	Maintenance Yard	Hazardous Materials

*Critical Facility #16 is outside of Seal Beach Municipal Boundary and not mapped

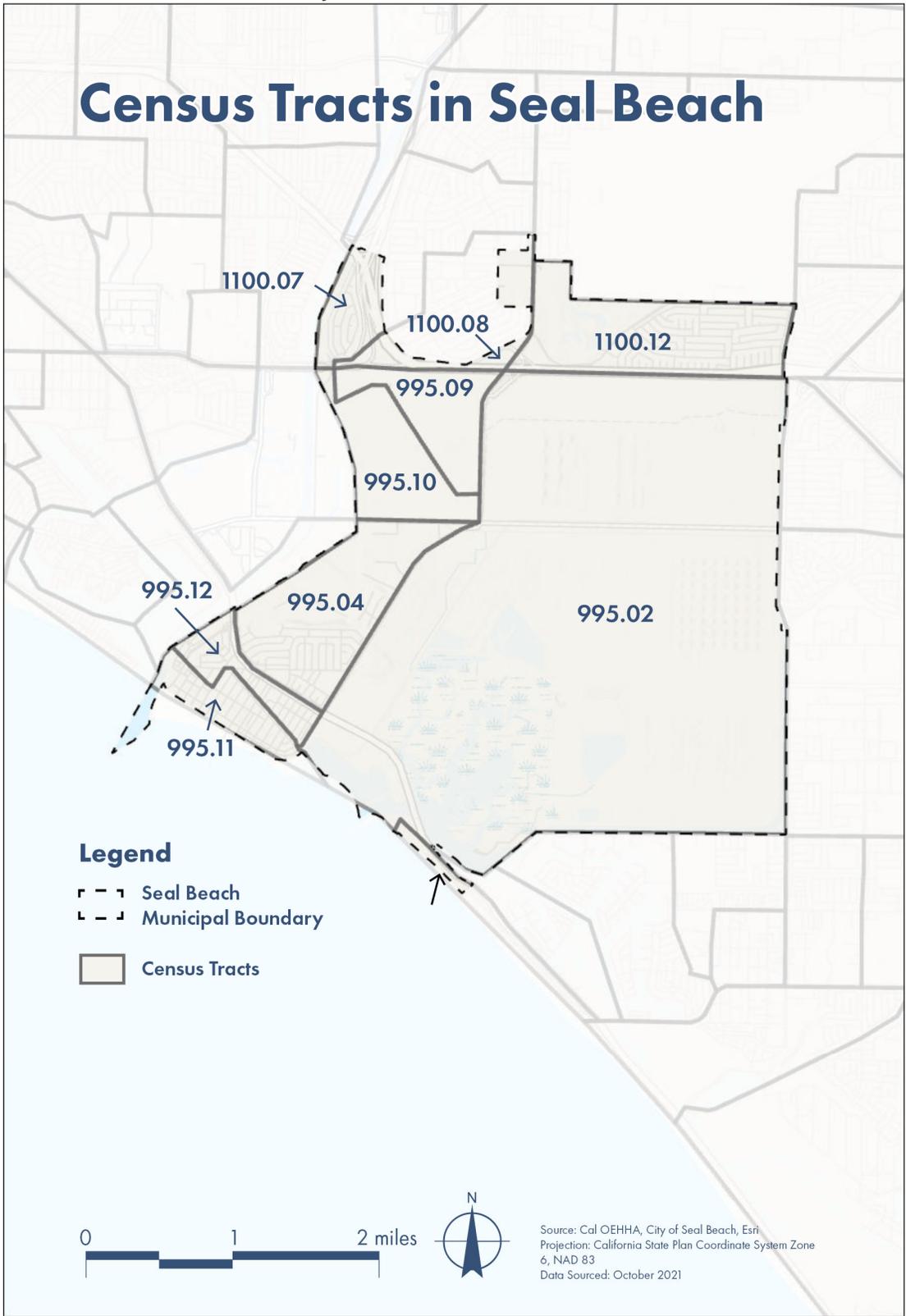
3.7 SOCIALLY VULNERABLE POPULATIONS AND DETERMINATIONS

3.7.1 SVP RESEARCH AND METHODOLOGY

Identification and integration of Socially Vulnerable Populations (SVP) into the hazard mitigation planning process is a new addition from Cal OES and FEMA, as required by the recent Local Mitigation Planning Policy Update. The purpose of this new LHMP section is to identify vulnerable populations within the planning area, along with identifying characteristics that can make individuals more vulnerable to natural and human-caused hazards.

The City of Seal Beach includes a total of 10 census tracts. Of the 10 census tracts, three include portions of residencies and properties that are located within adjacent jurisdictions (Rossmoor and Huntington Beach). Because these census tracts include portions of land in adjacent jurisdictions, the data may be distorted or skewed for the portion within the City of Seal Beach. As a result, demographic information for these tracts reflect neighboring communities as well as Seal Beach. Figure 3-4, *City of Seal Beach Census Tracts* depicts the census tracts in Seal Beach.

Figure 3-4
City of Seal Beach Census Tracts

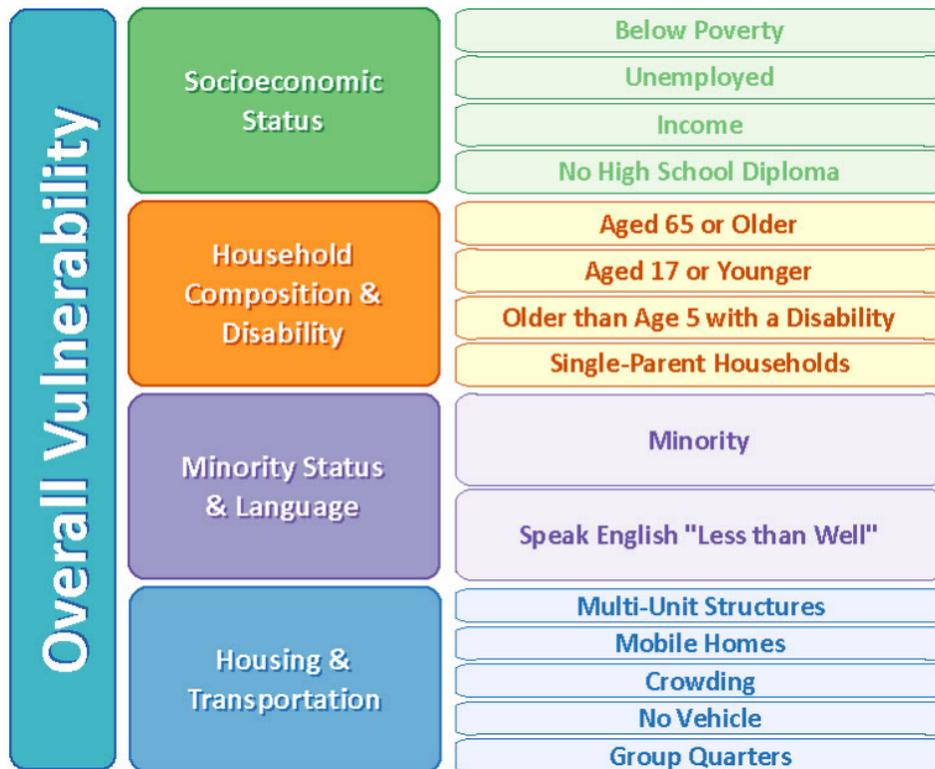


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CDC Social Vulnerability Index

The LHMP Planning Team utilized the Center for Disease Control (CDC) Social Vulnerability Index (SVI) to evaluate the presence of socially vulnerable populations. Social vulnerability is defined by the Center for Disease Control and Prevention as characteristics of a person or group that affect their capacity to anticipate, cope with, resist, and recover from the impact of a discrete and identifiable disaster in nature or society. Several socioeconomic factors or other characteristics influence social vulnerability, as illustrated in [Figure 3-5, *Social Vulnerability Index Themes and Social Factors*](#) below.

**Figure 3-5
Social Vulnerability Index Themes and Social Factors**



Source: CDC and Prevention – National Center for Environmental Health, *Planning for an Emergency: Strategies for Identifying and Engaging At-Risk Groups*, published 2015.

US Census and American Community Survey data at the census tract level was utilized to locate and identify socially vulnerable populations within the planning area. The City of Seal Beach is made up of 10 census tracts. The LHMP Planning Team evaluated California-based and national environmental justice definitions and data indices as a method for locating/identifying socially vulnerable populations within the City of Seal Beach.

[Figure 3-6, *CDC Social Vulnerability Index – Nationwide Comparison \(2020\)*](#), shows the CDC SVI for census tracts within the City. This index was selected because it is most frequently utilized in federal grant evaluations and decision-making, including FEMA hazard mitigation grants. [Table 3-10, *Seal Beach Overall Social Vulnerability Index Scores*](#), shows the SVI score and level of

vulnerability for census tracts within the City. Possible scores range from 0 (lowest vulnerability) to 1 (highest vulnerability).

**Table 3-10
Seal Beach Overall Social Vulnerability Index Scores**

Census Tract	Social Vulnerability Index Scores	
	2022 Statewide Overall SVI Score	Level of Vulnerability
995.02	0.3742	Low-Medium
995.04	0.1028	Low
995.06*	0.0680	Low
995.09	0.6926	Medium-High
995.10	0.5261	Medium-High
995.11	0.2271	Low
995.12	0.2812	Low-Medium
1100.12	0.3195	Low-Medium
1100.07*	0.0446	Low
1100.08	0.3338	Low-Medium

*CalEnviroScreen data shows Census Tract 71.11 as 71.09 and was labeled as 71.09 for this table.

Source: Center of Disease Control/Agency for Toxic Substances and Disease Registry, *CDC/ATSDR Social Vulnerability Index (SVI)*, https://www.atsdr.cdc.gov/placeandhealth/svi/interactive_map.html, accessed January 9, 2025.

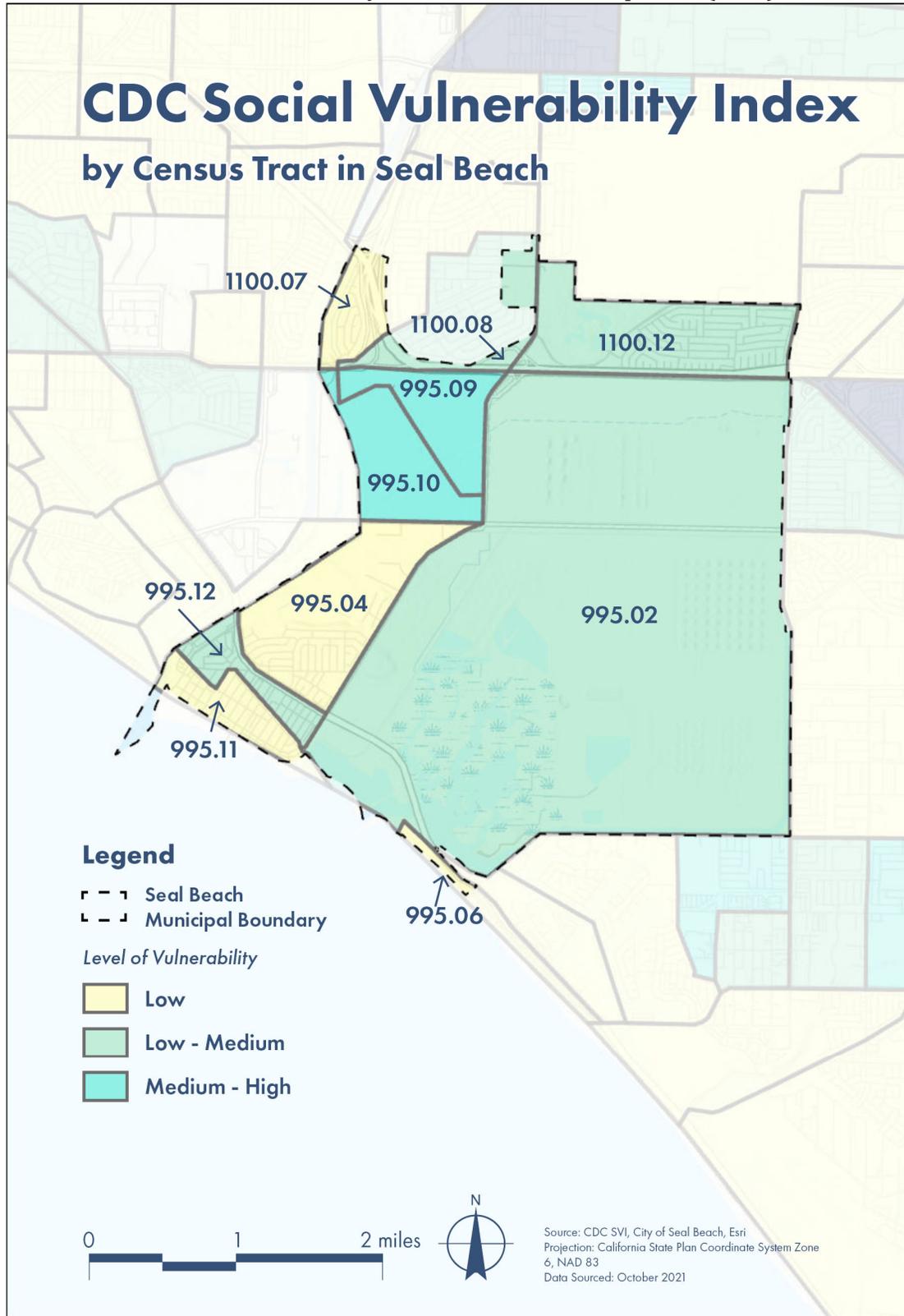
The CDC Social Vulnerability Index reports two census tracts, 995.09 and 995.10, as having medium to high levels of vulnerability within the City. These two census tracts are almost entirely within the Leisure World community. The remaining census tracts within the City have low and low to medium levels of vulnerability.

Several factors are reported to contribute toward the medium to high vulnerability determinations for census tracts within the City. Census tracts within the City indicate social vulnerability based on 16 indicators identified in the SVI including socioeconomic status, household characteristics, racial/ethnic minority status and housing type/transportation. The SVI flags census tracts in the top ten percent (i.e., the 90th percentile) for these demographic, socioeconomic and housing indicators to indicate a high level of vulnerability. Two census tracts have one or more indicator scores that are within the 90th percentile indicating a high level of vulnerability.

According to the CDC, census tracts in City of Seal Beach were included in the 90th percentile for the following indicators:

- Civilians unemployed
- Percentage of persons aged 65 and older
- Percentage of persons under age 17
- Percentage of persons with a disability

Figure 3-6
CDC Social Vulnerability Index – Nationwide Comparison (2020)



Census tract 995.02 (Naval Weapons Station Seal Beach) scored within the 90th percentile for percentage of civilians unemployed. Unemployed persons may have increased vulnerability during disasters due to limited financial resources to prepare, evacuate, and recover from a disaster. Additionally, they may have difficulty accessing essential resources and services such as healthcare, transportation, and emergency assistance. Lastly, unemployed individuals are more likely to live in substandard housing, which may be more susceptible to damage during disasters.

Census tract 995.02 also scored within the 90th percentile for percentage of persons under age 17. This population may face increased vulnerability during disasters due to limited access to resources such as transportation. Individuals under age 17 may have limited knowledge to prepare and respond to disasters on their own.

Census Tracts 995.09 and 995.10 show a high percentage of residents age 65 and older, primarily due to the presence of Leisure World, a gated community designed exclusively for individuals aged 55 and above. As a unique community within the City of Seal Beach composed of a relatively high concentration of retirees, Leisure World presents a localized concentration of potentially vulnerable individuals in a relatively small area. This localized concentration skews composite percentile approaches to social vulnerability, flagging indicators such as linguistic isolation and poverty as high, while the actual presence of low income (due to fixed senior incomes) and linguistic isolation within these communities is not substantially above the statewide average. Additionally, regarding linguistic isolation, Seal Beach as a whole does not meet the State-mandated threshold of 5% limited English proficiency (LEP) that would require local agencies to provide translated materials and bilingual services under the Voting Rights Act and Dymally-Alatorre Bilingual Services Act.²¹ The City will continue to monitor data regarding linguistic isolation and other socioeconomic factors and take appropriate action if the overall percentage of non-English speaking residents exceeds this 5% LEP threshold.

Finally, Leisure World residents (Census Tracts 995.09 and 995.10) may face heightened vulnerability during disasters due to a combination of age-related and disability-related challenges. The area has a high concentration of individuals aged 65 and older, many of whom may experience mobility or health issues, limited access to real-time emergency information, and reliance on caregivers who may not always be available. Additionally, these tracts rank in the 90th percentile for persons with disabilities, further compounding risks through potential barriers to evacuation, inaccessible communication formats, dependence on medical equipment, and limited social support networks. Financial constraints may also hinder both preparedness and recovery efforts for this population.

CalEnviroScreen 4.0

In addition to the CDC Social Vulnerability Index, the LHMP Planning Team utilized the CalEPA DAC criteria based on CalEnviroScreen 4.0 to evaluate the presence of socially vulnerable populations. In May 2022, CalEPA used indicators such as pollution burden and population characteristics listed in [Table 3-11, *CalEnviroScreen 4.0 Indicators*](#). These indicators establish four criteria markers to indicate the presence of a disadvantaged community (DAC) at the census tract level; census tracts meeting one or more criteria are considered disadvantaged. Applicability to the City of Seal Beach is summarized in [Table 3-12, *Seal Beach Disadvantaged Communities Criteria Evaluation*](#), below. While there are no DAC identified Socially Vulnerable Populations within Seal

²¹ California Legislative Information, Chapter 17.5 Use of a Foreign Language in Public Services, https://leginfo.ca.gov/faces/codes_displayText.xhtml?lawCode=GOV&division=7.&title=1.&part=&chapter=17.5.&article=, accessed June 12, 2025.

Beach, data is presented for all census tracts located within the City. Analysis and findings are discussed where relevant.

Table 3-11
CalEnviroScreen 4.0 Indicators

Category	Indicator
Pollution Burden	Ozone
	PM2.5
	Diesel
	Drinking Water
	Lead
	Pesticides
	Toxicity Release
	Traffic
	Cleanup Sites
	Groundwater Threats
	Hazardous Waste
	Impacted Water Bodies
	Solid Waste
Population Characteristics	Asthma
	Low Birth Weight
	Cardiovascular Disease
	Education
	Linguistic Isolation
	Poverty
	Unemployment
Housing Burden	

Source: State of California OEHHA, CalEnviroScreen 4.0 Excel and Data Dictionary, <https://oehha.ca.gov/calenviroscreen/maps-data>, published October 2021, accessed February 25, 2025.

Table 3-12
Seal Beach Disadvantaged Communities Criteria Evaluation

CalEPA DAC Criteria	Applicability to City of Seal Beach
1. Census tracts receiving the highest 25% of overall scores in CalEnviroScreen 4.0.	Not Applicable. The City of Seal Beach does not have any census tracts listed with composite scores at 75 or above. Refer to <u>Table 3-X</u> , below.
2. Census tracts lacking overall scores in CalEnviroScreen 4.0 due to data gaps but receiving the highest 5% of CalEnviroScreen 4.0 cumulative pollution burden scores.	Not Applicable. No data gaps are listed in CalEnviroScreen 4.0 for census tracts within the City of Seal Beach.
3. Census tracts identified in the 2017 DAC designation as disadvantaged as required by SB535, regardless of scores in CalEnviroScreen 4.0.	Not Applicable. No census tracts within the City of Seal Beach were listed in the 2017 DAC designation. Refer to <u>Table 3-X</u> , below.
4. Lands under the control of federally recognized tribes.	Not Applicable. No tribal jurisdiction is located within the City of Seal Beach.

All census tracts within Seal Beach have CalEnviroScreen 4.0 composite scores at or below 50, thus no census tract meets the CalEPA definition of disadvantaged community. However, the City of Seal Beach shows unusually high pollution burden reported by CalEnviroScreen 4.0 (shown in [Table 3-13, Overall CalEnviroScreen Percentiles](#)). CalEnviroScreen 4.0 composite scores, pollution burden percentiles, and population characteristic percentiles are illustrated in [Figure 3-7, CalEnviroScreen 4.0 Pollution Burden by Census Tract in Seal Beach](#), [Figure 3-8, CalEnviroScreen 4.0 Population Characteristics by Census Tract in Seal Beach](#), and [Figure 3-9, CalEnviroScreen 4.0 Composite Scores by Census Tract in Seal Beach](#) respectively. Pollution burden percentile scores include representative data from specific pollution types (ozone, PM 2.5, diesel, lead) and general pollution types (traffic, groundwater threats, impaired water, and drinking water contaminants). Population characteristics include socioeconomic risk factors such as educational attainment, linguistic isolation, and poverty rates.

Table 3-13
Overall CalEnviroScreen 4.0 Percentiles

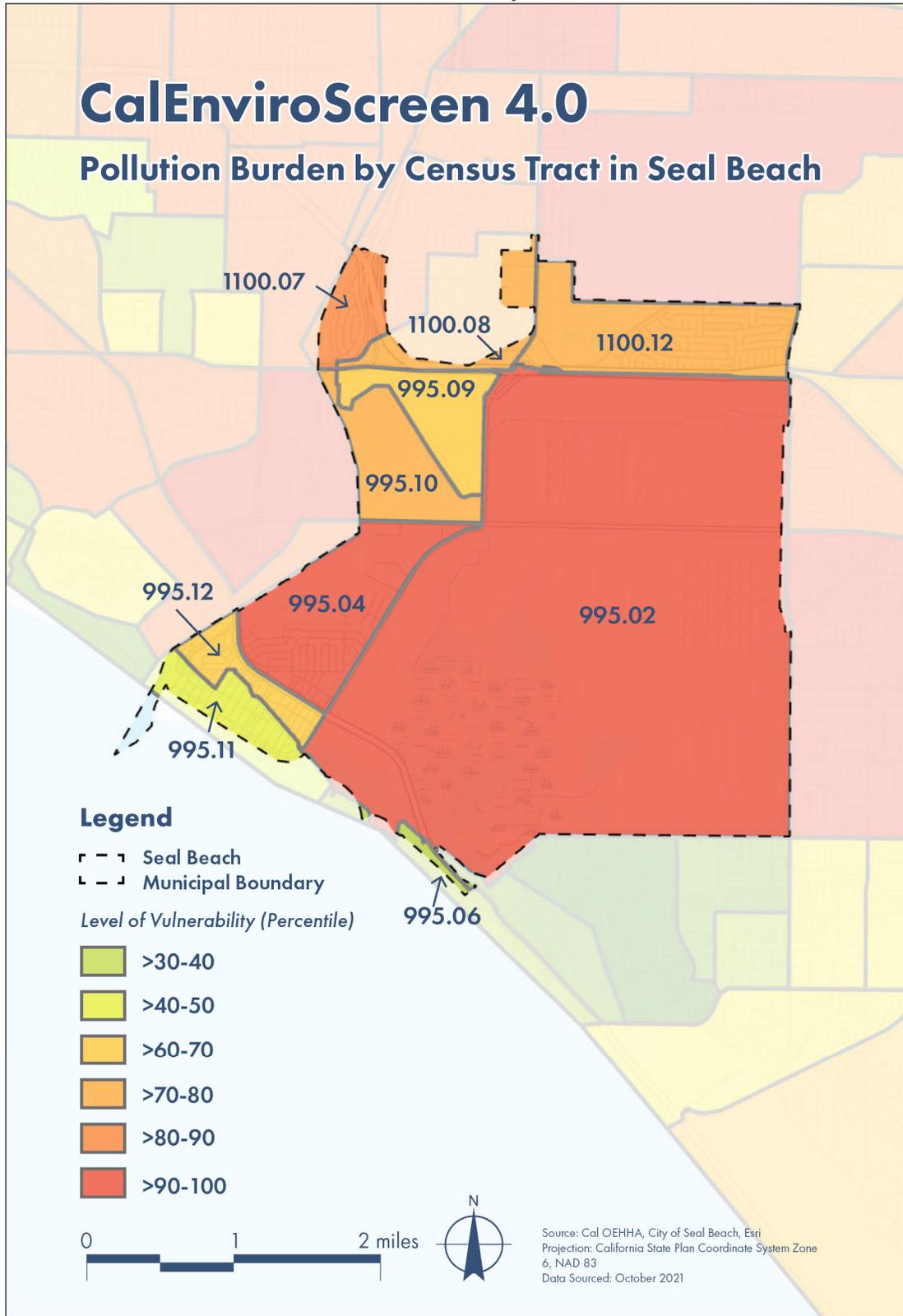
Census Tract	CalEnviroScreen Composite Percentile	Pollution Burden Percentile	Population Characteristics Percentile
995.02	50	90	26
995.04	23	91	6
995.06*	7	34	4
995.09	39	64	26
995.10	38	76	20
995.11	14	48	8
995.12	21	63	10
1100.12	26	71	12
1100.07*	50	88	27
1100.08*	29	79	13

* Census Tract includes land and households outside of the City of Seal Beach jurisdiction.

Source: CalEnviroScreen 4.0,

https://experience.arcgis.com/experience/ed5953d89038431dbf4f22ab9abfe40d/page/Indicators/?views=Pollution-Burden#data_s=id%3AdataSource_25-17c3d89e7e2-layer-1%3A579, accessed January 9, 2025.

Figure 3-7
CalEnviroScreen 4.0 Pollution Burden by Census Tract in Seal Beach



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Figure 3-8
CalEnviroScreen 4.0 Population Characteristics by Census Tract in Seal Beach

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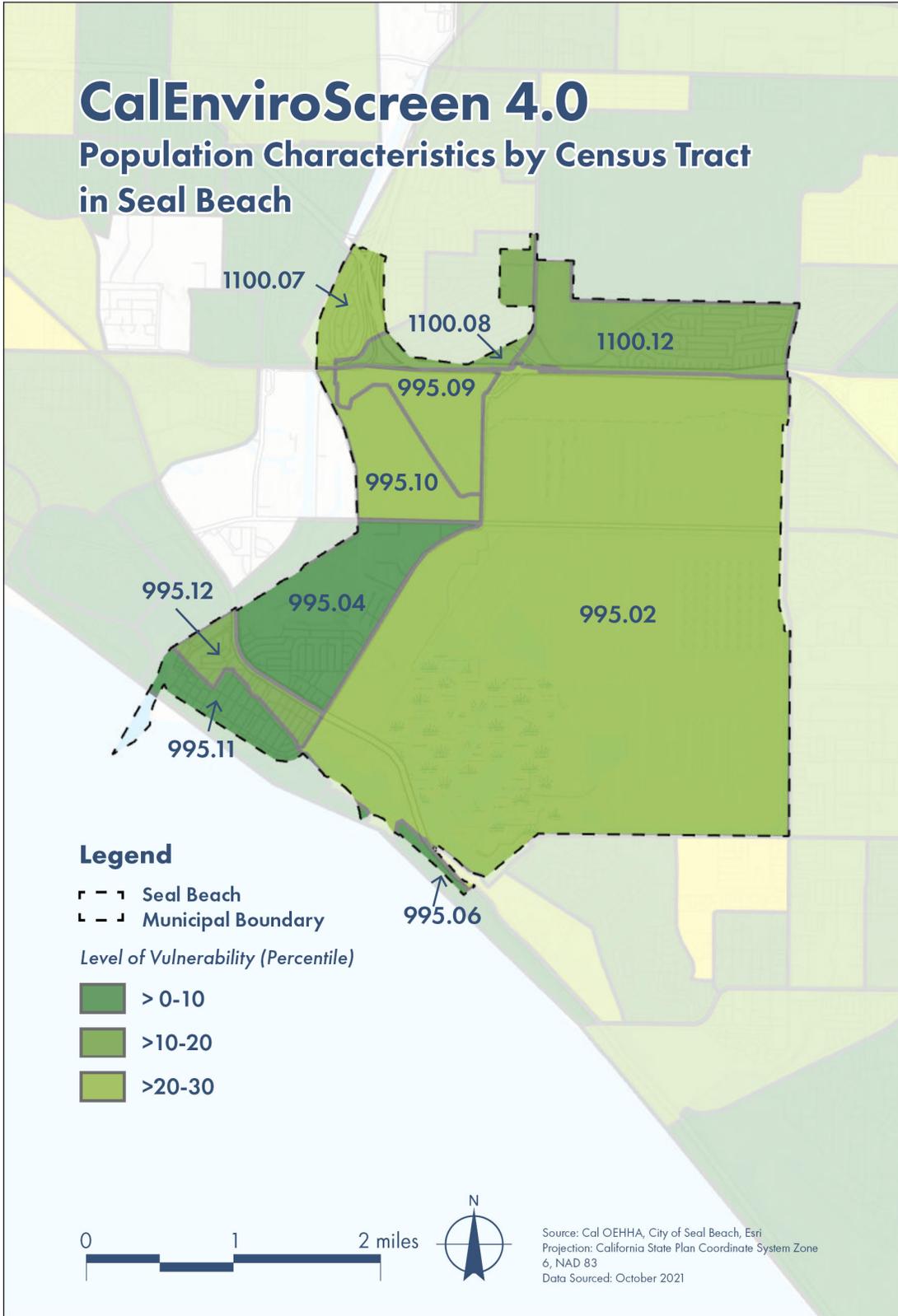
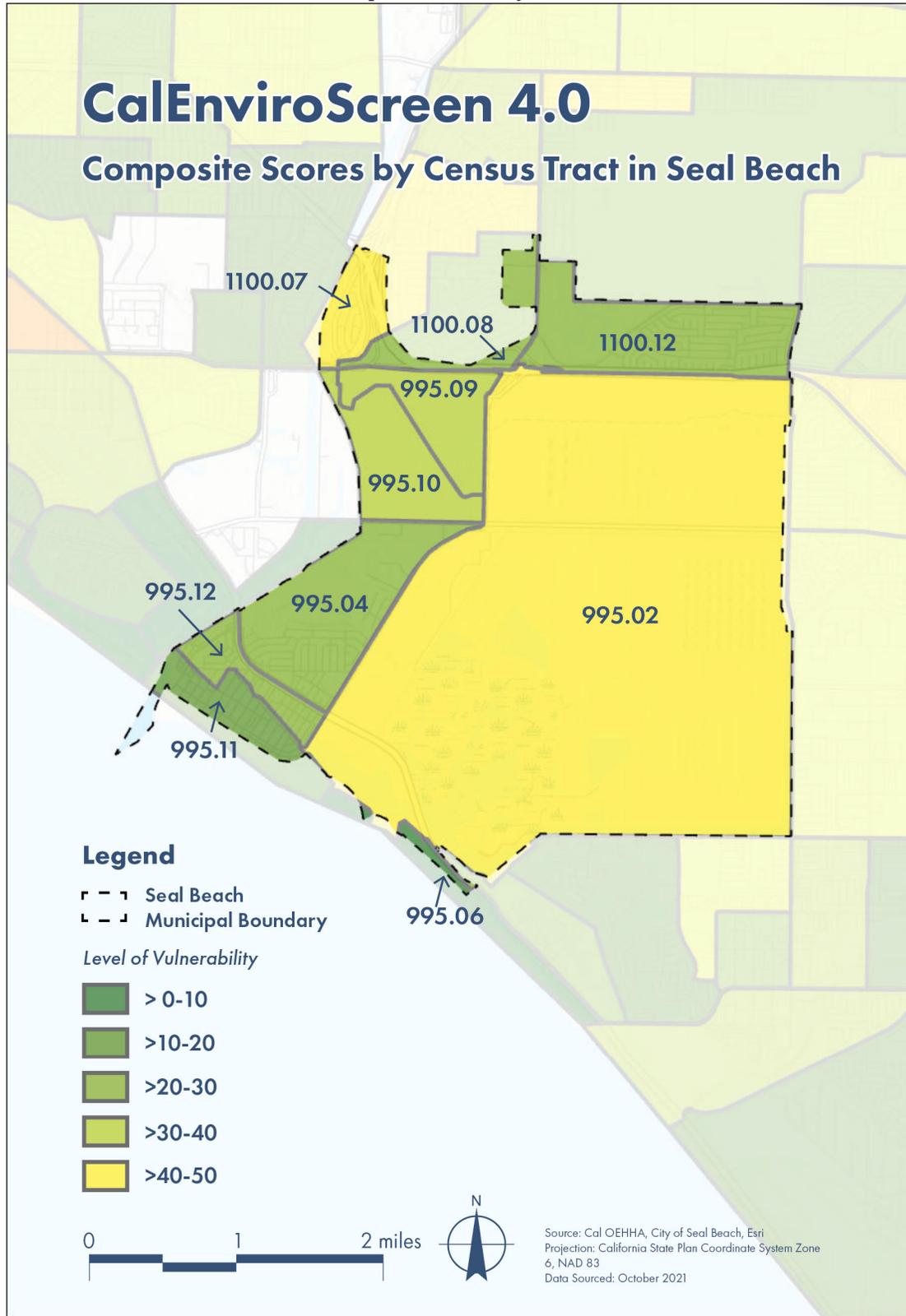


Figure 3-9
CalEnviroScreen 4.0 Composite Scores by Census Tract in Seal Beach



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In [Figure 3-7](#), high percentile scores indicate disadvantageous outcomes, indicating the City experiences significant pollution burden according to CalEnviroScreen. Five of the 10 census tracts within the City have a score of 75 or higher, meaning these tracts are within the top quarter of pollution burdened census tracts within California. These tracts include Census Tracts 995.02, 995.04, 995.10, 1100.07 and 1100.08. Census Tract 995.02 and 995.04 have the highest Pollution Burden Percentile scores at 90 and 91 respectively, indicating these census tracts are in the top ten percent of pollution burdened communities in California.

3.7.2 SVP DETERMINATION

Based on the SVI data and other socially vulnerable populations discussed above, the LHMP Planning Team determined that for the purposes of this LHMP, the following Census Tracts would be formally established as an SVP:

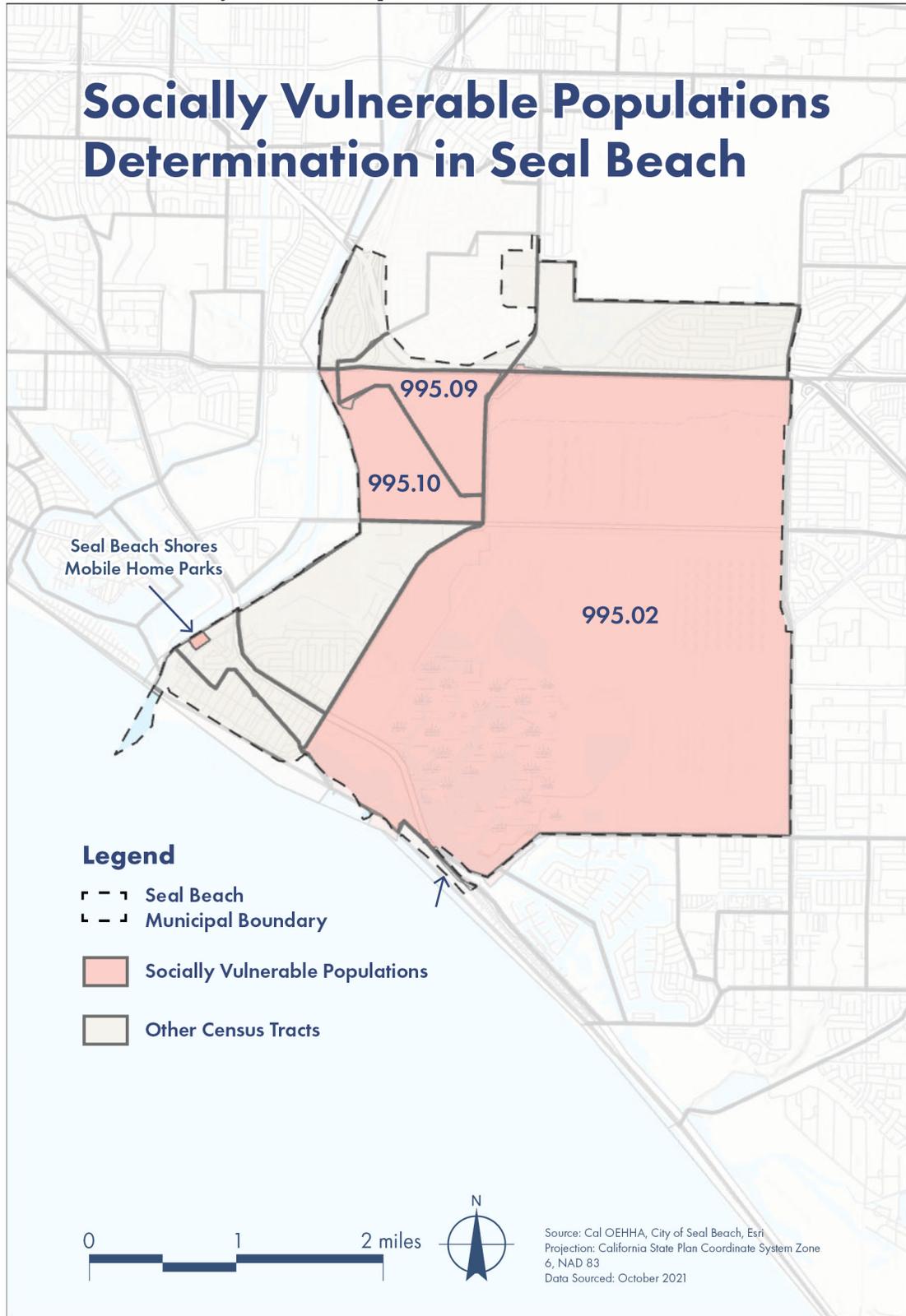
- Census Tracts 995.09 and 995.10 are identified as “Medium-High” by the CDC SVI (Census Tracts). These census tracts are comprised of Leisure World Seal Beach, an age 55+ community with multi-family dwelling units.
- Census Tract 995.02, with a CalEnviroScreen 4.0 Pollution Burden score of 90 other indicators showing high levels of social vulnerability, including the highest concentration of minority populations within the City, low income, and unemployment. It is noted that this is a large census tract with a smaller population (reported approximately 600 individuals), which may skew percentile data reporting at the state and national levels. This census tract is comprised of Naval Weapons Station Seal Beach and housing is restricted to service members and their families.
- Seal Beach Shores Mobile Home Park, located within Census Tract 995.12, as a lower income community within the City. Stakeholder feedback indicated local knowledge of higher incidence of characteristics that contribute social vulnerability.

In addition, CalEnviroScreen 4.0 and CDC data also indicated high prevalence of specific characteristics that contribute to social vulnerability, distributed throughout the community. The characteristics below were reported by stakeholders and members of the public as contributing to social vulnerability within Seal Beach:

- Persons aged 65 or older (seniors)
- Persons under the age of 17 (children)
- Persons with a disability
- Unemployed individuals
- Persons with high pollution burden
- Tourists, visitors and special event attendees

CalEnviroScreen data also indicates high levels of pollution markers distributed throughout Seal Beach. Stakeholders and members of the public attribute these findings due to current and historical land uses such as active military use at Naval Weapons Station and oil refineries, along with the presence of the I-405 freeway. The Environmental Quality Control Board highlighted that Seal Beach often reports high incidence of particulate matter due to sea spray and ocean air. As these findings were not concentrated in a specific census tract, pollution burden and associated impacts were considered for the entirety of the City.

Figure 3-10
Socially Vulnerable Populations Determination in Seal Beach



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**Table 3-14
Socially Vulnerable Populations and Potential Vulnerability**

Socially Vulnerable Populations	Potential Reasons to Vulnerability
Unemployed individuals	<ul style="list-style-type: none"> • Economic instability • Lack of emergency supplies in preparation for disasters • No insurance for housing, vehicles, and/or healthcare • Limited or no transportation • Limited or no healthcare • Housing insecurity and/or safe housing • Lack of financial assistance
Young population under age 17	<ul style="list-style-type: none"> • Reliance on adults for protection, care, and decision-making • Susceptibility to injuries and illnesses • Disruption of education leading to gaps in education and development during recovery from disaster
Elderly populations aged 65 and older	<ul style="list-style-type: none"> • Mobility challenges during evacuation or accessing safe shelter • Overlap between persons aged 65 or older and persons with a disability, such as cognitive impairment, difficulties with independent living or hearing and vision problems
Persons with disabilities	<ul style="list-style-type: none"> • Mobility challenges during evacuation or accessing safe shelter • Communication barriers especially hearing or visual impairments to receive emergency alerts or instructions in a timely manner • Reliance on medical care medications, or assistive devices • Social isolation leading to lack of communication
Persons with high pollution burden	<ul style="list-style-type: none"> • Chronic exposure leading to respiratory and cardiovascular disease • Natural disasters such as wildfire and wildfire smoke exacerbating preexisting health conditions • Weakened immune system due to long term exposure
Tourists and visitors	<ul style="list-style-type: none"> • Unfamiliarity with local hazards • Reliance on temporary or rental housing • Lack of knowledge of local routes and emergency protocols

The City hosts various community events throughout the year (Christmas Parade, Run Seal Beach, Classic Car Show, etc.) that cause an influx of people in the area. This sudden influx of residents, visitors, and tourists would put additional strain local resources during a hazard event, potentially overwhelming healthcare facilities, emergency responders, and shelters, which can hinder response efforts and exacerbate the disaster’s impact on both residents and visitors. Additionally, the 2028 Olympic Games will be hosted in various locations across southern California, creating magnified risk to the City of Seal Beach in the event of a disaster before, during, or after the event. To mitigate these risks, emergency management strategies should include data collection and analysis, public education, resource allocation, collaboration with local businesses and agencies, and regular training or drills. These considerations have been incorporated into the mitigation strategies to reduce risks brought on by tourism.

After understanding data behind the vulnerability determination for census tracts in Seal Beach, the LHMP Project Management team worked to incorporate stakeholders into the LHMP Planning Team that represent or serve socially vulnerable groups, including:

- Golden Rain Foundation/Leisure World (serving various SVPs)
- Seal Beach Lions Club (serving various SVPs)
- Home Instead Senior Care (elderly populations)
- Optum (serving various SVPs)
- It Takes a Village Senior Care (elderly populations)
- Leisure World Information Council (serving various SVPs)

Feedback from these stakeholders and the rest of the LHMP Planning team regarding socially vulnerable populations have been included in each hazard profile ([Section 4](#) through [Section 10](#)) and the mitigation strategy ([Section 11](#)). Specific connections between the risk assessment and relevant mitigation actions are discussed on a hazard-by-hazard basis within [Section 4, Hazards Assessment](#).





4

HAZARDS ASSESSMENT



WHAT'S DIFFERENT ABOUT THE 2025 PLAN?

- The City has identified 9 new hazards as part of the LHMP update.
- Considerations for climate change and Socially Vulnerable Populations (SVPs) have been integrated into each hazard profile.

SECTION 4: HAZARDS ASSESSMENT

4.1 HAZARD IDENTIFICATION AND PRIORITIZATION

4.1.1 HAZARD IDENTIFICATION

The first step in developing the vulnerability and risk assessment is identifying the hazards. The LHMP Planning Team reviewed the previously prepared 2019 City of Seal Beach Hazard Mitigation Plan, hazard mitigation plans from neighboring jurisdictions, and other relevant information to determine the extent of natural and human caused hazards with the potential to affect the City; refer to [Table 2-5, Existing Plans, Studies, Reports, and Other Technical Data/Information](#). A discussion of potential hazards during the first LHMP Planning Team meeting resulted in the identification of the natural hazards that pose a potential risk to the City of Seal Beach. [Table 4-1, City of Seal Beach Hazard Identification](#), summarizes the Planning Team's discussion of each of the natural hazards and indicates those identified for inclusion in the LHMP.

**Table 4-1
Seal Beach Hazard Identification**

List of Hazards	Identified in Previous LHMP	Include in Updated LHMP	Discussion Summary
Avalanche	No	No	Not applicable. The conditions for avalanche are not present in Seal Beach
Civil Disturbance	No	Yes	Civil unrest events may occur in the City and therefore are included.
Climate Change	Yes	Yes	Climate change is not profiled as a distinct hazard, but rather a phenomenon that could exacerbate hazards. Climate change will be considered as a factor for relevant identified hazards.
Coastal Erosion	Yes	Yes	The City is located on the coast in Orange County and therefore may be a risk to the City.
Coastal Storms	Yes	Yes	The City is located on the coast in Orange County and commonly experiences coastal storms.
Cyberattacks	No	Yes	Cyberattacks have affected the City in recent history and have therefore been included.
Dam Reservoir Failure	Yes	Yes	The City is susceptible to inundation caused by dam failure of the Santiago Creek Dam and Whittier Narrows Dam and Reservoir.
Disease/Pest Management	No	Yes	Vector-borne and infectious disease has the potential to impact the planning area. Vector-borne and infectious diseases are profiled along with pandemic under human-caused hazards.
Drought	Yes	Yes	Drought is a potential threat to Seal Beach and has historically impacted the planning area.
Expansive Soils	No	No	Soils in the planning area are predominately composed of silty loam soils with some impervious soils indicating minimal risk of expansive soils to the City.
Extreme Heat	Yes	Yes	Extreme heat has the potential to impact Seal Beach. Extreme heat is profiled under extreme weather hazards.
Flood and Coastal Flooding	Yes	Yes	Flooding is a potential threat to Seal Beach and has historically impacted the planning area.
Hailstorm	No	No	The LHMP Planning Team determined that hailstorms do not pose a significant

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List of Hazards	Identified in Previous LHMP	Include in Updated LHMP	Discussion Summary
			risk to the planning area based upon limited previous occurrences.
Human-Caused Hazards	Yes	Yes	Human-caused hazards are a potential threat to Seal Beach and have historically impacted the planning area.
Hurricane	No	No	The LHMP Planning Team determined that this hazard does not pose a significant risk to the planning area due to limited previous occurrences.
Land Subsidence	No	No	The LHMP Planning Team determined that this hazard does not pose a significant risk to the planning area due to limited previous occurrences.
Landslide	No	Yes	Landslide are potential threats to Seal Beach and may impact the planning area.
Lightning	No	No	The LHMP Planning Team determined that this hazard does not pose a significant risk to the planning area due to limited previous occurrences.
Pandemic	No	Yes	Pandemic is a potential threat and has historically impacted Seal Beach. Pandemic has been profiled under human-caused hazards.
Sea Level Rise	Yes	Yes	Seal Beach has low-lying coastal areas that are susceptible to sea level rise and coastal erosion.
Seismic Hazards	Yes	Yes	Seal Beach is located in a seismically active area and seismic hazards including fault rupture, ground shaking, and liquefaction pose a risk to the planning area.
Severe Weather Hazards	No	Yes	Severe weather including extreme heat, heavy rains, Santa Ana winds, and power outages pose a risk to the planning area. These hazards have been profiled together under extreme weather hazards for organizational purposes.
Terrorism	No	Yes	Terrorist attacks pose a potential threat to the City and have therefore been included.
Tornado	Yes	Yes	Although tornadoes are rare in Seal Beach, this hazard does pose a potential threat to the City.
Tsunami	Yes	Yes	The City is located on the coast and faces potential vulnerability to the tsunami hazard.

List of Hazards	Identified in Previous LHMP	Include in Updated LHMP	Discussion Summary
Volcano	No	No	Not applicable. There are no active volcanoes that pose a threat to Seal Beach.
Wildfire	Yes	Yes	Wildfire is a potential threat to Seal Beach and has been included as a potential threat to the planning area.
Windstorm	Yes	Yes	Strong winds and windstorms are potential hazards within Seal Beach. Strong winds such as Santa Ana Winds have been detailed under the extreme weather hazards profile.

4.1.2 HAZARD PRIORITIZATION

The LHMP Planning Team used a spreadsheet-based tool to prioritize the identified hazards by assigning each hazard a ranking based on probability of occurrence and magnitude of potential impact. These rankings were assigned based on a group discussion, knowledge of past occurrences, and familiarity with the City's vulnerabilities. Four criteria were used to establish the hazard priorities to be addressed in the LHMP:

- Probability (likelihood of occurrence)
- Location (size of potentially affected area)
- Maximum Probable Extent (intensity of damage)
- Secondary impacts (severity of impacts to community)

A value from one to four was assigned for each criterion, where one is the lowest and four is the highest. The four criteria were then weighted based on the LHMP Planning Team's opinion of each criterion's importance. To enhance collaboration and discussion regarding hazard rankings, the LHMP Planning Team participated in a live survey through Mentimeter, allowing each LHMP Planning Team member to individually report initial thoughts on probability, location, maximum probable extent, and secondary impacts. Rankings were assigned individually based on knowledge of past occurrences and familiarity with City vulnerabilities. The survey was integrated into the LHMP Planning Team Meeting #1 PowerPoint presentation, and all attendees filled out the survey questions. Results were averaged to provide a group score per hazard, utilizing the weighted value (recommended by FEMA and confirmed by the LHMP Planning Team) based on the importance of the criterion; refer to [Table 4-2, Hazard Ranking Methodology](#).

The hazard rankings were multiplied by weighted factors to obtain a score for each criterion. A higher weight was given to the criterion considered more important or significant. For example, the probability of hazard occurrence received a higher weight than the potential secondary impacts. The scores for location, maximum probable extent (anticipated damage), and secondary impacts for each hazard were added together to determine the total impact score. The total impact score was then multiplied by the overall probability score to determine the final score. The final scores were used to determine the prioritization of each hazard based on the following FEMA recommended scale:

- Low Threat: 0 to 12;
- Medium Threat: 12.1 to 42; and
- High Threat: 42.1 to 64.

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**Table 4-2
Hazard Ranking Methodology**

Probability, Location, and Maximum Probable Extent and Secondary Impacts			
<i>Probability (2.0): Estimate likelihood of occurrence from historical data.</i>			
Probability			Score
Unlikely – less than 1% probability in next 100 years or has a recurrence interval of greater than every 100 years			1
Somewhat Likely – between 1% and 10% probability in next year or has a recurrence interval of 11 to 100 years			2
Likely – between 10% and 100% probability in next year or has a recurrence interval of 10 years or less			3
Highly Likely – near 100% probability in next year or happens every year			4
<i>Location (0.8): Size of geographical area of community affected by the hazard.</i>			
Affected Area			Score
Isolated			1
Small			2
Medium			3
Large			4
<i>Primary Impact (0.7): Anticipated damage to a typical facility/structure in the community.</i>			
Impact			Score
Negligible – less than 10% damage			1
Limited – between 10% and 25% damage			2
Critical – between 25% and 50% damage			3
Catastrophic – more than 50% damage			4
<i>Secondary Impacts (0.5): Estimated secondary impacts to the community at large.</i>			
Impact			Score
Negligible – no loss of function, downtime, and/or evacuations			1
Limited – minimal loss of function, downtime, and/or evacuations			2
Moderate – some loss of function, downtime, and/or evacuations			3
High – major loss of function, downtime, and/or evacuations			4
Total Score = Probability x Impact, where:			
Probability = (Probability Score x Importance)			
Impact = (Affected Area + Primary Impact + Secondary Impacts), where:			
Affected Area = Affected Area Score x Importance			
Primary Impact = Primary Impact Score x Importance			
Secondary Impacts = Secondary Impacts Score x Importance			
Hazard Planning Consideration			
Score Range		Value	Count
0.0	20.0	Low	0
20.1	42.0	Medium	10
42.1	64.0	High	9

The probability of each hazard is determined by assigning a level, from unlikely to highly likely, based on the likelihood of occurrence from historical data. The total impact value includes the affected area, primary impact, and secondary impact levels of each hazard. Each level's score is reflected in the matrix. The total score for each hazard is the probability score multiplied by its

importance factor times the sum of the impact level scores multiplied by their importance factors. Based on this total score, the hazards are separated into three categories based on the hazard level they pose to the communities: High, Medium, and Low.

The results from the LHMP Planning Team Meeting #1 survey were compiled and presented during LHMP Planning Team Meeting #2 for further evaluation and discussion. Table 4-3, Hazard Rankings, identifies the final scores and the hazard planning consideration (threat level) for each hazard based on additional discussion with the LHMP Planning Team and the prioritization process described above.

The LHMP Project Management Team decided to identify nine hazards (coastal flood, coastal storms, dam/reservoir failure, drought, extreme heat, seismic hazards, flood hazards, heavy rains, and Santa Ana Winds and tornadoes) as a high hazard planning consideration based on conversations with the LHMP Planning Team.

Many hazards identified by the LHMP Planning Team are recognized to be interconnected or interrelated. Where appropriate, the hazard profiles (presented below) may include references to other hazard profiles (such as including extreme heat within the Extreme Weather Hazards category). As part of the hazard identification and prioritization process, the LHMP Planning Team determined that some hazards could be combined for clarity purposes within a larger hazard category.

Some hazards were expanded or renamed to reflect conditions more accurately for the City of Seal Beach. Thus, for example, the Extreme Weather Hazards profile includes drought, extreme heat, heavy rain, Santa Ana Winds and tornadoes and Public Safety Power Shutoff (PSPS). It is noted that PSPS is not a direct hazard, but a secondary impact from other natural disasters (primarily Santa Ana Winds, but potentially extreme heat and heavy rains as well). The Human-Caused Hazards profile includes hazardous materials spill, terrorism/cyberattacks, civil disturbance/civil unrest, and pandemic. The Seismic Hazards profile includes fault rupture/ground motion and liquefaction.

**Table 4-3
Hazard Rankings**

Hazard Type	Probability	Impact			Total Score	Hazard Planning Consideration
		Location	Primary Impact	Secondary Impacts		
Civil Unrest/Civil Disturbance	2	2	2	3	18.0	Medium
Coastal Flood	4	2	4	2	43.2	High
Coastal Storms	4	2	4	2	43.2	High
Dam/Reservoir Failure	4	4	2	2	44.8	High
Drought	4	4	2	2	44.8	High
Extreme Heat	4	4	3	3	54.4	High
Seismic Hazards	4	4	4	4	64.0	High
Flood Hazards	4	4	2	2	44.8	High
Hazardous Materials Spill	2	3	3	3	24.0	Medium
Heavy Rains	4	4	3	3	54.4	High
Pandemic	2	3	2	3	21.2	Medium
Public Safety Power Shutoff (PSPS)	3	3	2	3	36.0	Medium
Santa Ana Winds and Tornadoes	4	4	3	3	54.4	High
Sea-Level Rise and Coastal Erosion	4	2	2	2	32.0	Medium
Terrorism/Cyberattack*	3	3	3	3	36.0	Medium
Tsunami	3	2	3	3	31.0	Medium
Wildfire and Urban Fire/Wildfire Smoke	3	2	2	2	24.0	Medium

*Terrorism and Cyberattacks were originally considered as separate hazards for the purposes of this LHMP. However, after additional stakeholder coordination and discussions, these hazards were grouped together to reduce plan redundancy.

The following hazards are discussed within the 2025 LHMP, below:

- Coastal and Flood Hazards
 - Flood Hazards
 - Coastal Storms

- Coastal Flood
- Sea-Level Rise and Coastal Erosion
- Tsunami
- Dam/Reservoir Failure
- Extreme Weather Hazards
 - Drought
 - Extreme Heat
 - Heavy Rains
 - Santa Ana Winds and Tornadoes
 - Public Safety Power Shutoff (PSPS)
- Landslide
- Seismic Hazards
 - Fault Rupture/Ground Motion
 - Liquefaction
- Wildfire and Urban Fire Hazards
 - Wildfire and Urban Fire
 - Wildfire Smoke
- Human-Caused Hazards
 - Hazardous Materials Spill
 - Terrorism/Cyberattacks
 - Civil Disturbance/Civil Unrest
 - Pandemic

4.2 CLIMATE CHANGE CONSIDERATIONS

Climate change has the potential to exacerbate many of the existing hazards in the City. As such, the LHMP Team decided climate change would be included under each applicable hazard profile with a discussion about how each hazard would intersect or become more significant with impacts of climate change. Discussion and analysis related to climate change are discussed as a subsection under each hazard profile included below.

4.3 VULNERABILITY/RISK ASSESSMENT

Vulnerability describes how exposed or susceptible an asset is to damage and depends on a number of variables including the asset's construction, condition, contents, and economic value of functions. A vulnerability analysis predicts the extent of injury/damage on the built environment that may result from a hazard event of a given intensity in a specific area.

The vulnerability assessment considers risks to critical facilities listed in [Section 3.0, *Community Profile*](#), and to residential and non-residential buildings throughout Seal Beach. Critical facilities serve an important function in the operations of the municipal government and in serving the community. Critical facilities include essential public buildings, police and fire stations, schools, transportation infrastructure, and essential public utility assets. Many facilities may also be vital to evacuations, serve as assembly points or temporary structures, or provide a supportive role in preparing for and recovering from hazard events. While the City owns and maintains most of the listed critical facilities, there are also critical facilities owned by other public agencies or

jurisdictions. Direct and indirect impacts were considered as part of the vulnerability assessment as impacts to some facilities may have indirect impacts on other facilities or populations.

The vulnerability/risk assessment below quantifies, to the extent feasible using the best available data, City assets at risk to hazards and estimates potential losses. This section focuses on the profiled hazards and risks specific to the City of Seal Beach.

Each hazard profile in the following section includes a Vulnerability and Risk Assessment section that presents the results using the methodology described below. Replacement and content values for the facilities in each the hazard areas are tallied in each vulnerability table to estimate the total potential losses for each facility.

4.3.1 METHODOLOGY

For each hazard profiled in [Section 5](#) to [Section 10](#), a vulnerability/risk assessment is included within the section. The vulnerability/risk assessment gives equal weight to all hazards, regardless of the identified probability. The specific hazard and associated probability are considered as part of the mitigation prioritization, discussed in [Section 11.0, *Mitigation Strategy*](#). This assessment considers the physical threats to critical facilities. It should be noted that actual losses will depend on the type, location, magnitude, and extent of the actual hazard event.

This assessment considers the physical threat to the critical facilities, as well as the physical threat to residential and non-residential structures.

Socioeconomic impacts are generally discussed as some hazards have the potential to impact the City in ways beyond physical damages. To confirm at-risk community populations, a detailed parcel analysis investigated the intersection of each mapped natural hazard with development and population vulnerability. The critical facilities listed in [Section 3.0, *Community Profile*](#), were mapped in GIS and overlaid with mapped hazard areas (those hazards that have a specific or defined geographic area) to determine which assets are located in each hazard area.

Using the comprehensive parcel database from the City of Seal Beach, parcels with residential and non-residential structures were identified within each mapped natural hazard zone. For residential assets, the number of units is reported per hazard zone. Single family homes are assumed to be one unit. The number of residential units then informs an estimate of residents within each hazard zone. The estimate was generated using the 1.90 persons per household identified by the American Community Survey (ACS) 2023 dataset. For non-residential assets, the total structure square footage was calculated.

Hazard areas and critical facility overlays were conducted for: dam reservoir failure, flood, landslide, sea level rise, seismic hazards (fault rupture/ground motion, liquefaction), and tsunamis. It should be noted that the parcel analysis is based on the best available data and is intended for planning purposes only. The City of Seal Beach provided parcel data via shapefile in November 2024. Michael Baker International did not manipulate the data and used the data as it was provided to estimate hazard vulnerabilities. As such, the parcel analysis serves as an estimate of potential losses based on this data snapshot and may not reflect actual or current conditions within the City at the time of LHMP approval.

Maps were not prepared for the following hazards: coastal storms, coastal flood, human-caused hazards (hazardous materials spill, terrorism/cyberattacks, civil disturbance/civil unrest, pandemic), extreme weather hazards (drought, extreme heat, heavy rains, Santa Ana Winds and Tornadoes, Public Safety Power Shutoff (PSPS), and wildfire and urban fire (wildfire and urban fire, wildfire smoke). These hazards are not geographically defined and/or have the potential to affect the entire City. The wildfire/wildfire smoke hazard was not mapped due to the City not being identified within a wildfire hazard area. For the purposes of this LHMP and vulnerability assessment, it is assumed that coastal erosion, human-caused hazards, extreme weather hazards, and wildfire/wildfire smoke could impact the entirety of the planning area, including all critical facilities.

Replacement and content values for the facilities, the number of residents and residential and non-residential structures in each hazard area are provided where possible, to estimate the potential losses based on the method described above. Estimations were prepared using replacement values identified in the HAZUS 6.1 Inventory Technical Manual (2024), where appropriate and related land use categories are listed. Some critical facilities have unavailable replacement cost values due to ownership status or unique characteristics that make replacement estimates infeasible.

4.4 SUMMARY OF FEDERALLY DECLARED DISASTERS AFFECTING THE PLANNING AREA

As required by the recently updated FEMA policy guidelines, a summary of federally declared disasters specifically affecting the planning area within the last five years is included below as Table 4-4. Specific effects are also outlined in the hazard profiles, previous occurrences sections (where applicable) within [Section 5](#) through [Section 10](#).

Table 4-4
Summary of Federally Declared Disasters Affecting the Planning Area

Declaration Date	Disaster Number	Incident Subcategory	Incident Description	Incident Period	Effect on Planning Area
April 3, 2023	DR-4699-CA	California Severe Winter Storms, Tornadoes, Flooding, Landslides, and Mudslides	Severe Winter Storms, Tornadoes, Flooding, Landslides, and Mudslides	February 21, 2023 – July 10, 2023	Seal Beach experienced heavy rain during this disaster in February 2023. Impacts primarily included localized flooding in low-lying areas near the coast and in College Park East.
April 13, 2024	DR-4769-CA	California Severe Winter Storms, Tornadoes,	Severe Winter Storms, Tornadoes,	January 31, 2024 –	Seal Beach experienced heavy rain during this disaster in February

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Declaration Date	Disaster Number	Incident Subcategory	Incident Description	Incident Period	Effect on Planning Area
		Flooding, Landslides, and Mudslides	Flooding, Landslides, and Mudslides	February 9, 2024	2024. Impacts primarily included localized flooding in low-lying areas near the coast and in College Park East.
March 13, 2020	DR-3428-CA	Biological	COVID-19	January 20, 2020 – May 11, 2023	The COVID-19 pandemic, caused by the SARS-CoV-2 virus, began in December 2019 and rapidly spread worldwide, leading to significant health, social, and economic disruptions. As of 2024, Orange County has confirmed over 550,000 cases and nearly 7,000 deaths due to COVID-19.
March 22, 2020	DR-4482-CA	Biological	COVID-19	January 20, 2020 – May 11, 2023	See DR-3428

4.5 SUMMARY OF VULNERABILITY

Table 4-5, *Risk Assessment Summary Table*, shows a summary of critical facilities that intersect with hazard areas in the City. Those facilities that intersect with a hazard area are indicated with a “Yes” in red text. Facilities that do not fall within the hazard area are designated with an “No” in green text. Risks that were determined using quantitative data include dam reservoir failure, flood, landslide, sea level rise, seismic hazards (fault rupture/ground motion, liquefaction), and tsunamis. Risks such as coastal erosion, human-caused hazards, extreme weather hazards, and wildfire/wildfire smoke are equal throughout the community. Risks such as coastal storms and coastal flooding were determined using the 2 feet sea-level rise assuming coastal flooding would reach 2 feet.

**Table 4-5
Risk Assessment Summary Table**

No.	Facility Name	Coastal Flooding and Coastal Storms	Dam/Reservoir Failure	Flood	Extreme Weather	Landslide	2 Ft Sea-Level Rise and Coastal Erosion	6 Ft Sea-Level Rise and Coastal Erosion	Seismic Hazards Ground Motion	Seismic Hazards Liquefaction	Tsunami	Urban Fires/Wildfire Smoke	Wildfire
1	3101 ½ N Gate Rd - Potable water reservoir, well and pump station.	No	Yes	No	Yes	No	No	No	Yes	Yes	No	Yes	No
2	2901 Edinger Ave - Sewer lift pump station	No	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No
3	601 Gardner - Potable water reservoir and pump station	No	No	No	Yes	Yes	No	No	Yes	No	No	Yes	No
4	Sewer lift pump station - 800 Ocean Ave	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No
5	Potable water well - 2700 North Gate Rd	No	No	No	Yes	No	No	No	Yes	Yes	No	Yes	No
6	Potable water well - 3333 Bolsa Chica Rd	No	No	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	No
7	Potable water well - 4307 Lampson Ave	No	No	No	Yes	No	No	No	Yes	Yes	No	Yes	No
8	Sewer lift pump station - 200 Seal Beach Blvd	No	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No
9	Sewer lift pump station - 1776 ½ Adolfo Lopez Dr	No	No	No	Yes	Yes	No	No	Yes	No	No	Yes	No
10	Sewer lift pump station - 2701 Seal Beach Blvd	No	Yes	No	Yes	No	No	Yes	Yes	Yes	No	Yes	No
11	Stormwater pump station - 43 ½ Riversea Rd	No	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No
12	Seal Beach Police Department	No	No	No	Yes	No	No	No	Yes	No	No	Yes	No
13	OCFA Fire Station 44	No	No	No	Yes	No	No	No	Yes	No	Yes	Yes	No
14	OCFA Fire Station 48	No	Yes	No	Yes	No	No	No	Yes	Yes	No	Yes	No
15	Seal Beach Marine Safety Headquarters	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No
16*	OC-35 Import Waterline Turnout	No	No	Yes	Yes	No	No	No	Yes	Yes	No	Yes	No

No.	Facility Name	Coastal Flooding and Coastal Storms	Dam/Reservoir Failure	Flood	Extreme Weather	Landslide	2 Ft Sea-Level Rise and Coastal Erosion	6 Ft Sea-Level Rise and Coastal Erosion	Seismic Hazards Ground Motion	Seismic Hazards Liquefaction	Tsunami	Urban Fires/Wildfire Smoke	Wildfire
17	Sewer lift station - 1st St	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No
18	Stormwater Pump Station - 202 Seal Beach Blvd (County owned)	No	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No
19	Bridge to Sunset Aquatic Park (not City-owned)	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No
20	OC San Regional Wastewater Collections Station (not City-owned)	No	Yes	No	Yes	No	No	Yes	Yes	Yes	No	Yes	No
21	Leisure World Water Well (inactive)	No	Yes	No	Yes	No	No	No	Yes	Yes	No	Yes	No
22	OC San Wastewater Station - (3112 Yellowtail, Rossmoor)	No	Yes	No	Yes	No	No	Yes	Yes	Yes	No	Yes	No
23	San Gabriel River Bike Trail Entry Point	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
24	Los Cerritos Wetlands Restoration (not City-owned)	No	Yes	No	Yes	No	No	Yes	Yes	Yes	No	Yes	No
25	Hellman Oil Field (not City-owned)	No	No	No	Yes	No	No	Yes	Yes	Yes	No	Yes	No
26	Stormwater Pump Station (County owned)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No
27	Bridge 53C1998 – San Gabriel River (Local)	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No
28	Bridge 55C0041L – Los Alamitos Channel (Local)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No
29	Bridge 55C0041R – Los Alamitos Channel (Local)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No
30	Bridge 55C0042L - Federal Storm Channel (Local)	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No
31	Bridge 55C0042R - Federal Storm Channel	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No

No.	Facility Name	Coastal Flooding and Coastal Storms	Dam/Reservoir Failure	Flood	Extreme Weather	Landslide	2 Ft Sea-Level Rise and Coastal Erosion	6 Ft Sea-Level Rise and Coastal Erosion	Seismic Hazards Ground Motion	Seismic Hazards Liquefaction	Tsunami	Urban Fires/Wildfire Smoke	Wildfire
32	(Local) Bridge 55C0075 - Westminster Channel	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No
33	(Local) Bridge 55C0104 - Federal Storm Channel	No	Yes	No	Yes	No	No	Yes	Yes	Yes	No	Yes	No
34	(Local) Bridge 55C0105M - Pedestrian Walkway	No	No	No	Yes	No	No	No	Yes	No	No	Yes	No
35	(Local) Bridge 55C0108 - Bolsa Chica Channel	No	No	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	No
36	(Local) Bridge 55C0160 - Bolsa Chica Channel	No	No	Yes	Yes	No	No	No	Yes	Yes	No	Yes	No
37	(State) Bridge 53 0060 - San Gabriel River	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
38	(State) Bridge 53 0302L - San Gabriel River	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No
39	(State) Bridge 53 0302R - San Gabriel River	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No
40	(State) Bridge 53 1185 - San Gabriel River	No	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No
41	(State) Bridge 53 1737H - San Gabriel River	No	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No
42	(State) Bridge 55 0010 - Anaheim Bay	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
43	(State) Bridge 55 0065 - Kitt Highway, US Navy RR	No	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No
44	(State) Bridge 55 0310 - Los Alamitos Channel	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No
45	(State) Bridge 55 0334 - Bolsa Chica Ditch	No	No	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	No
46	(State) Bridge 55 0347H -	No	Yes	Yes	Yes	No	No	No	Yes	Yes	No	Yes	No

No.	Facility Name	Coastal Flooding and Coastal Storms	Dam/Reservoir Failure	Flood	Extreme Weather	Landslide	2 Ft Sea-Level Rise and Coastal Erosion	6 Ft Sea-Level Rise and Coastal Erosion	Seismic Hazards Ground Motion	Seismic Hazards Liquefaction	Tsunami	Urban Fires/Wildfire Smoke	Wildfire
47	Service Rd (State) Bridge 55 0412L – Interstate 405 (State)	No	Yes	No	Yes	No	No	No	Yes	Yes	No	Yes	No
48	Bridge 55 0412R – Interstate 405 (State)	No	Yes	No	Yes	No	No	No	Yes	Yes	No	Yes	No
49	Bridge 55 0413F – Rte 405, 605, CONN, RIV (State)	No	Yes	No	Yes	No	No	No	Yes	Yes	No	Yes	No
50	Bridge 55 0415 – E22 - N405 Connector Ramp (State)	No	Yes	No	Yes	No	No	No	Yes	Yes	No	Yes	No
51	Bridge 55 0426G – S605 - S405 Connector (State)	No	Yes	No	Yes	Yes	No	No	Yes	Yes	No	Yes	No
52	Bridge 55 0428G – State Route 22 (State)	No	Yes	No	Yes	No	No	No	Yes	Yes	No	Yes	No
53	Bridge 55 0441 – Los Alamitos Channel (State)	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	No
54	Bridge 55 0471H – Los Alamitos Channel (State)	No	Yes	Yes	Yes	No	No	No	Yes	Yes	No	Yes	No
55	Bridge 55 1100G – Interstate 405 (State)	No	No	No	Yes	Yes	No	No	Yes	Yes	No	Yes	No
56	Leisure World Clubhouse 1	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No
57	Leisure World Clubhouse 2	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No
58	Leisure World Clubhouse 3	No	Yes	No	Yes	No	No	Yes	Yes	Yes	No	Yes	No
59	Leisure World Clubhouse 4	No	Yes	No	Yes	No	No	Yes	Yes	Yes	No	Yes	No
60	Leisure World Clubhouse 5	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No
61	Leisure World Clubhouse 6	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No
62	Leisure World Healthcare Center	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No
63	Mary Wilson Library	No	No	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No
64	McGaugh School	No	No	No	Yes	No	No	No	Yes	No	Yes	Yes	No
65	North Seal Beach Community Center	No	Yes	No	Yes	No	No	No	Yes	Yes	No	Yes	No

No.	Facility Name	Coastal Flooding and Coastal Storms	Dam/Reservoir Failure	Flood	Extreme Weather	Landslide	2 Ft Sea-Level Rise and Coastal Erosion	6 Ft Sea-Level Rise and Coastal Erosion	Seismic Hazards Ground Motion	Seismic Hazards Liquefaction	Tsunami	Urban Fires/ Wildfire Smoke	Wildfire
66	Seal Beach Senior Center	No	No	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No
67	Seal Beach Tennis Center	No	No	No	Yes	No	No	No	Yes	Yes	No	Yes	No
68	City Hall	No	No	No	Yes	No	No	No	Yes	No	Yes	Yes	No
69	Naval Weapons Station Seal Beach	No	No	No	Yes	No	No	No	Yes	No	No	Yes	No
70	Police Substation	No	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No
71	Seal Beach Ocean Pier	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No
72	Almond Park	No	No	No	Yes	No	No	No	Yes	Yes	No	Yes	No
73	Arbor Park	No	No	No	Yes	No	No	No	Yes	Yes	No	Yes	No
74	Aster Park	No	No	No	Yes	No	No	No	Yes	Yes	No	Yes	No
75	Bluebell Park	No	No	No	Yes	No	No	No	Yes	Yes	No	Yes	No
76	Corsair Park	No	Yes	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No
77	Electric Avenue Greenbelt	No	No	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No
78	Edison Park	No	Yes	No	Yes	No	No	Yes	Yes	Yes	No	Yes	No
79	Eisenhower Park	No	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No
80	Gum Grove Park	No	No	No	Yes	No	No	No	Yes	No	No	Yes	No
81	Heather Park	No	No	No	Yes	No	No	No	Yes	Yes	No	Yes	No
82	Marina Park + Community Center	No	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No
83	Schooner Park	No	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No
84	Zoeter Field	No	No	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No
85	Beach Maintenance yard	No	No	No	Yes	No	No	No	Yes	Yes	Yes	Yes	No
86	City Maintenance Yard	No	No	No	Yes	Yes	No	No	Yes	No	No	Yes	No

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5

COASTAL AND FLOODING HAZARD ASSESSMENT



SECTION 5: COASTAL AND FLOODING HAZARDS ASSESSMENT

5.1 FLOOD HAZARDS

5.1.1 DESCRIPTION

Flooding occurs when a waterway, either a natural one or an artificial drainage channel, receives more water than it is capable of conveying, causing the water level in the waterway to rise. Depending on how long these conditions last and the amount of water the waterway receives in proportion to its capacity, the rising water level may eventually overtop the waterway's banks or any other boundaries to the drainage area, resulting in flooding in the surrounding area.

Floods often occur during heavy precipitation events, when the amount of rainwater exceeds the capacity of storm drains or flood control channels. Floods can also happen when infrastructure such as levees, dams, or culverts fail, or when a section of drainage infrastructure fails, and water cannot be drained from an area fast enough. These failures can be linked to precipitation events (e.g., when water erodes away a levee, allowing water to escape and flood nearby areas), or can be a consequence of other emergency situations (e.g., a dam collapsing due to an earthquake).

FEMA defines flood or flooding as a general and temporary condition of partial or complete inundation of normally dry land areas from:

- The overflow of inland or tidal waters;
- The unusual and rapid accumulation or runoff of surface waters from any source; or,
- Mudslides which are proximately caused by flooding and are akin to a river of liquid and flowing mud on the surfaces of normally dry land areas, as when earth is carried by a current of water and deposited along the path of the current.
- Collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

Floods can be caused by a number of factors, including:

- Weather and climate patterns (e.g., El Niño, La Niña, Pineapple Express, Atmospheric River, etc.)
 - El Niño and La Niña are complex weather patterns resulting from variations in ocean temperatures in the equatorial Pacific. Warmer or colder than average ocean temperatures in one part of the world can influence weather around the globe. El Niño and La Niña episodes typically last 9 to 12 months, but some prolonged events may last for years.¹
 - Pineapple Express is a name given to an atmospheric river on the West Coast. It is a channel in the atmosphere that moves vast amounts of moisture and can result in massive rain showers.
- Hydrologic features such as reservoirs, ponds, lakes, rivers, etc., can have a large impact on the amount of flooding.
- The absorption capacity of the ground depends on the composition of soil and bedrock of the area. Less absorbent soil conditions in addition to lack of proper storm infrastructure can result in flooding.
- Type and density of vegetation is related to moisture absorption affecting the flow of water.
- Patterns of land use/urbanization relates to the pervious and impervious nature of the ground.
- Expected level, age, and condition of flood management infrastructure can impact flooding conditions.
- Large-scale wildfires dramatically alter the terrain and ground conditions. Vegetation absorbs rainfall, reducing runoff. However, wildfires leave the ground charred, barren, and unable to properly absorb water, creating conditions ripe for flash flooding and debris flow. Flood risk remains significantly higher until vegetation is restored – up to five years after a wildfire.^{2 3}

The City of Seal Beach is prone to three types of flooding riverine, localized, and coastal flooding:

- Riverine: Riverine flooding occurs when streams and rivers exceed the capacity of their natural or constructed channels to accommodate water flow and water overflows the banks spilling out into adjacent low-lying, dry land.⁴ According to the FEMA National Risk Index, the City of Seal Beach has a very high risk of riverine flooding.⁵

¹ NOAA, *What are El Nino and La Nina?*, <https://oceanservice.noaa.gov/facts/ninonina.html>, updated June 16, 2024, accessed July 1, 2024.

² FEMA, *Flood Risk Increases After Fires Are Out – Buy Flood Insurance Now*, <https://www.fema.gov/fact-sheet/4562/flood-risk-increases-after-fires-are-out-buy-flood-insurance-now>, published October 21, 2020, accessed December 26, 2024.

³ FEMA, *Glossary: Flood*, <https://www.fema.gov/glossary/flood#:~:text=A%20general%20and%20temporary%20condition,inland%20or%20tidal%20waters%3B%20or>, updated July 7, 2020, accessed December 24, 2024.

⁴ FEMA, *Riverine Flooding*, <https://hazards.fema.gov/nri/riverineflooding#:~:text=Riverine%20Flooding%20is%20when%20streams,low%20lying%2C%20dry%20land>, accessed December 26, 2024.

⁵ Ibid.

- Localized: Localized flooding is the result from storms and run off that overload the drainageways and flows into streets and low lying-areas.⁶ This type of flooding can block streets, and low-lying areas while flooding homes and businesses such as the lower parts of the floors and basements. Localized flooding tends to recur small impacts accumulated over time which can become major problems in the future.
- Coastal: Coastal flooding occurs when low-lying and dry land is submerged by seawater and often occurs as a result of high or rising tides or storm surges.⁷ The FEMA National Risk Index indicates that a relatively very low coastal flooding risk in the City of Seal Beach.⁸ For more detailed information on coastal flooding, refer to Section 5.3, Coastal Flood.

Floods can cause extensive damage and pose health risks. The force of a flood is sufficient to carry away large objects and damage structures, causing considerable damage to buildings and infrastructure. In severe instances, floodwaters themselves can destroy structures or move them off their foundation. Floods can saturate and weaken soil, potentially making structures built on them more susceptible to damage or collapse. Flooding can also affect water quality, as large volumes of water can transport contaminants into water bodies and overload storm/wastewater systems. Additionally, large increases in water volume can cause water body erosion and loss of aquatic habitat. Flooding can also cause economic loss to people and government due to the destruction of property and/or infrastructure. Flood events may be particularly destructive when they create conditions conducive to geologic hazards including landslides or debris flows.

Shallow flooding, a type of localized flooding, can also pose health problems to the community.⁹ This includes:

- Triggering the growth of mold and mildew in buildings which aggravate allergies and asthma;
- An influx of snakes and rodents moving into closer contact with people;
- Movement of gasoline, pesticides, fuel oils, chemicals and other substances can be washed into buildings and soaking into soils;
- Breeding of vectors in standing still water which can transmit encephalitis and West Nile Virus; and,
- Straining individuals and families with the stress of dealing with flood impacts.

Floods can also cause severe damage to trees. Flooding can damage trees through oxygen deprivation where flooded soils limit the oxygen supply to tree roots. Flooding can also alter soil pH and structure, affecting nutrient availability and causing leaf chlorosis, leaf drop, and reduced shoot growth. The force of floodwater can physically damage trees by breaking branches, stripping bark, or even uprooting causing them to fall. Flood-stressed trees are also more vulnerable to diseases and pests and may promote fungal infections.

⁶ Reducing Damage from Localized Flooding: A Guide for Communities, *Chapter 2: Localized Flooding*, FEMA511 ch2.indd, <https://www.fema.gov/pdf/fima/FEMA511-complete.pdf>, accessed December 26, 2024.

⁷ FEMA, *Coastal Flooding National Risk Index*, <https://hazards.fema.gov/nri/coastal-flooding>, accessed December 26, 2024.

⁸ FEMA, *Coastal Flooding National Risk Index*, <https://hazards.fema.gov/nri/map>, accessed December 26, 2024.

⁹ Ibid.

5.1.2 LOCATION/GEOGRAPHIC EXTENT

Flood zones within the City are predominantly situated in known and mapped drainage areas. Areas in the City classified within the 1.0% annual chance flood hazard zone include portions of the Surfside area, portions of the Naval Weapons Station area, portions of the Seal Beach National Wildlife Refuge, portions of the Old Ranch Golf Course (including the nearby shopping area along Seal Beach Blvd.), docks of Sunset Aquatic Park, and the Los Alamitos Retarding Basin. Much of the City has reduced risk flooding due to levees in place from the San Gabriel River; refer to [Figure 5-1, Flood Hazard Zones](#). As the City of Seal Beach is relatively flat, the City is susceptible to ponding, a type of flooding that refers to water collecting in a low-lying area.

The extent or magnitude of flooding is measured by percentage and annual chance floods. Flooding areas are classified as 1 in 100 (one percent) or high risk, and 1 in 500 (0.2 percent) or moderate risk of flooding. Areas having a chance of less than 0.2 percent are classified as low-risk areas. Floods are measured by stream gages that are installed in bodies of water near populated areas (see [Table 5-1, Flood Zones Definitions](#)). They are installed and operated by the United States Geological Survey (USGS) and continuously monitor water levels.

5.1.3 PREVIOUS OCCURRENCES

The College Park East neighborhood in Seal Beach does not have adequate drainage systems and infrastructure sufficient to convey stormwater flows. Flooding in Seal Beach tends to be localized, with the City experiencing coastal flooding as well (see [Section 5.3, Coastal Flood](#) for more flood events related to coastal flooding). The City's proactive preventative maintenance efforts also help to protect City drainage systems in mitigating localized flooding on surface streets. These measures ensure that stormwater is efficiently managed, reducing the risk of flood-related disruptions, and maintaining the safety and accessibility of public areas. Previous occurrences of the flood hazard within the planning area have been listed below:

No federally declared disasters related to flood events have impacted the planning area within the last five years; refer to [Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area](#).

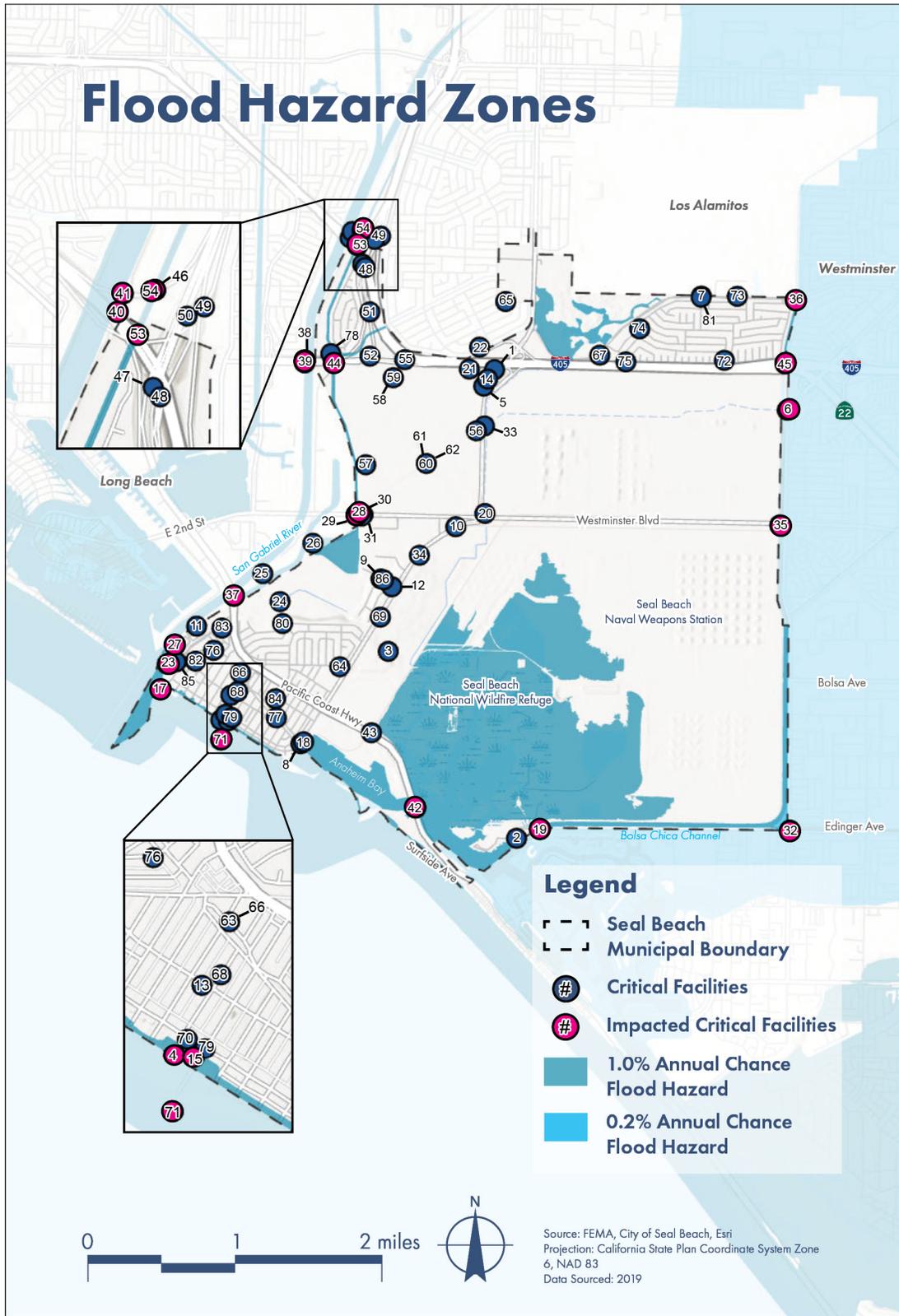
**Table 5-1
Flood Zones Definitions**

Zone	Risk
Floodplain – 100-year flood zone (A, AE, AH, AO, VE)	1% annual flood risk
Floodway – 100-year flood zone (AE) 500-year flood zone	1% annual flood risk 0.2% annual flood risk
Area with reduced flood risk due to levee	Reduced flood risk

Source: FEMA, *FEMA Flood Maps and Zones Explained*, <https://www.fema.gov/blog/fema-flood-maps-and-zones-explained>, accessed August 23, 2023.

Figure 5-1
Flood Hazard Zones

Michael Baker International, Inc.



**Table 5-2
Flood Events in the City of Seal Beach from 2018 – 2024**

Date	Description
December 2021	The County of Orange, including the City of Seal Beach, issued flash flood warnings. ¹⁰
September 2022	The parking lot of the Beach House restaurant was flooded with six inches of water. ¹¹
January 2024	Ocean breached the Seal Beach winter sand berm leaving gouges in the berm. ¹²
February 2024	The City faced significant flooding, prompting street closures and disruptions to local businesses and residences. No injuries were reported, and no vehicles were affected a tree that fell during the storm. ¹³

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5.1.4 PROBABILITY OF FUTURE OCCURRENCES

FEMA defines flood zones based on the probability of occurrence, expressed in a percentage of the change of a flood of a specific extent occurring in any given year. For areas located within the 100-year flood zone, there is a 1 percent chance in a given year that this area will be inundated by flood waters. For moderate flood hazard areas located within the 500-year flood zone, this probability decreases to 0.2 percent. For minimal flood hazard areas, they are located outside of the 0.2 percent annual chance flood.

Given the location of the planning area and based on previous flood events, there is a highly likely probability of a flood event significantly affecting the City of Seal Beach. A highly likely probability means there is a nearly 100 percent probability in the next year or happens every year. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that flood events will likely affect the planning area in the future and therefore felt “highly likely” best defined probability for this specific hazard. The LHMP planning team assigned a high hazard planning consideration to the hazards and impacts associated with flood events based upon a somewhat likely probability and expected impacts of future events.

5.1.5 CLIMATE CHANGE

Climate change is likely to have a direct effect on flooding. According to research conducted by the University of California, Los Angeles, California will experience extremely wet and extremely dry seasons by the end of the century. It is predicted that “over the next 40 years, the State will be 300

¹⁰ Patch, *Flash Flood Watch, Rain, Mountain Snow Kick Off Seal Beach New Year Eve Weekend*, <https://patch.com/california/losalamos/rain-mountain-snow-kick-seal-beach-new-years-eve-weekend>, published December 30, 2021, accessed December 26, 2024.

¹¹ CBS, *New restaurant, Beach House, in Seal Beach flooded as storm approaches Orange County*, <https://www.cbsnews.com/losangeles/news/new-restaurant-beach-house-in-seal-beach-flooded-as-storm-approaches-orange-county/>, published September 9, 2022, accessed December 26, 2024.

¹² Sun News, *Waves overwhelm sand berm and flood First Street lot*, <https://www.sunnews.org/waves-overwhelm-sand-berm-and-flood-first-street-lot/>, published January 4, 2024, accessed December 26, 2024.

¹³ CBS, *Seal Beach businesses, residents cope with aftermath of flooding*, <https://www.cbsnews.com/losangeles/news/orange-county-sees-rain-during-storm/>, updated on February 2, 2024, accessed December 26, 2024.

to 400 percent more likely to have a prolonged storm sequence as severe as the one that caused the legendary California flood more than 150 years ago.”¹⁴

This research team confirmed the recent findings from a New York Times article titled “The Coming California Megastorm,” predicting a future superstorm exacerbated by climate change. A warmer climate can carry atmospheric rivers in rapid succession to California, testing the capacity of dams and flood control infrastructure. The risk of a month-long megastorm as modeled and visualized by this article has a one in 50 chance of occurring annually. If global temperatures continue to climb, the likelihood of such a storm could increase to one in 30.¹⁵ Thus, flood considerations should continue to remain a mitigation priority into the future. Coastal cities will flood more often and more severely. Research from Princeton and Rutgers Universities found that major coastal flooding, which is expected to occur once every 100 years, will inundate coastal cities an average of 40 times more often by 2050.¹⁶

5.2 COASTAL STORMS

5.2.1 DESCRIPTION

Coastal storms are intense weather systems that occur along coastlines, characterized by strong winds, heavy rainfall, and significant wave action.¹⁷ These types of storms differ from other weather systems in that coastal storms specifically impact coastlines including a combination of high winds, heavy rainfall, and storm surges. Coastal storms can impact critical systems, stormwater infrastructure, emergency facilities, and roadways.¹⁸ This can also trigger a Public Safety Power Shutoff (PSPS) event, leaving many residents and commercial buildings without power.

Storm surges are an abnormal water level rise generated by a storm over and above the predicted astronomical tide.¹⁹ Storm surges are sensitive to even the slightest changes in storm intensity, forward speed, size (radius of maximum winds), angle of approach to the coast, and the shape and characteristic of the coastline.²⁰ Storm tide is the water level rise due to the combination of storm surge and the astronomical tide. This rise in water level can cause extreme flooding in coastal areas, particularly when storm surge coincides with normal high tide, resulting in storm tides reaching up to 2 feet or more in some cases. Storm surges can travel up rivers and canals, reaching well inland from the coastline.

¹⁴ UCLA 18Newsroom, *Study forecasts a severe climate future for California*, <https://newsroom.ucla.edu/releases/california-extreme-climate-future-ucla-study>, accessed July 12, 2023.

¹⁵ New York Times, *The Coming California Megastorm*, <https://www.nytimes.com/interactive/2022/08/12/climate/california-rain-storm.html>, published August 12, 2022, accessed July 2, 2024.

¹⁶ Inside Climate News, *U.S. Coastal Cities Will Flood More Often and More Severely, Study Warns*, https://insideclimatenews.org/news/07062017/coastal-flooding-extreme-sea-level-rise-forecast/?gad_source, published June 7, 2017, accessed July 3, 2024.

¹⁷ Fiveable, *Coastal storms*, <https://library.fiveable.me/key-terms/introduction-climate-science/coastal-storms>, accessed December 30, 2024.

¹⁸ NOAA, *Coastal Storms*, <https://coast.noaa.gov/digitalcoast/topics/coastal-storms.html>, accessed December 31, 2024.

¹⁹ NOAA, *National Hurricane Center and Central Pacific Hurricane Center*, <https://www.nhc.noaa.gov/surge/#:~:text=struck%20the%20area,What%20is%20Storm%20Surge?,to%20the%20overall%20water%20level,> accessed December 30, 2024.

²⁰ Ibid.

Storm surges are primarily caused by strong onshore winds of a hurricane or tropical storm. The wind circulation around the eye of a hurricane causes a vertical circulation in the ocean. While in deep water, there is no indication of storm surge because there is nothing to interfere with this circulation. However, once the storm reaches shallower waters near the coast, the vertical circulation is disrupted by the ocean bottom, prohibiting the water from moving downward. Thus, the water begins to move upward and inland, resulting in storm surge. Stronger winds will produce a higher storm surge. A faster storm will produce a higher surge at the immediate coastline, while a slower storm will produce a surge that penetrates farther inland.²¹

5.2.2 LOCATION/EXTENT

The City of Seal Beach has 1.5 miles of coastline extending from 1st Street to Surfside. The coastal zone of the City includes portions of Old Town, the Seal Beach Wildlife Refuge, Seal Beach Pier, Surfside Colony, and parks along the coastline. Coastal storms carry the potential to affect the entire coastline of Seal Beach and may extend into inland areas of the City depending on the extent of the storm. Infrastructure affected by coastal storms tends to be the Seal Beach Municipal Pier, but all coastal areas contain infrastructure that is at risk of future coastal storm damage.

5.2.3 PREVIOUS OCCURRENCES

Coastal storm events have historically impacted the City of Seal Beach, with a major storm event affecting the City in 1997. Seal Beach has also experienced large waves due to coastal storms in recent history. Recent urban coastal storm events affecting the City in the last five years have been summarized below, along with a major event in 1997:

- September 1997 – Hurricane Nora produced 20-foot waves causing tidal flooding in the City. This is one of the tallest ocean waves recorded in Seal Beach history.²²
- January 2023 – 18-foot waves pummeled the Seal Beach pier prompting temporary closure. Part of the boat ramp used by oil platform workers was damaged.²³
- December 2024 – 12-foot waves prompted flooding warning to the coast of Seal Beach.²⁴

No federally declared disasters related to coastal storm events have impacted the planning area within the last five years; refer to Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area.

5.2.4 PROBABILITY OF FUTURE OCCURRENCES

Given the location of the planning area and based on previous storm events, there is a highly likely probability of a coastal storm event significantly affecting the City of Seal Beach. A highly likely probability means there is a near 100 percent probability of occurrence in the next year or a recurrence interval of every year. While the LHMP Planning Team acknowledges this reoccurrence

²¹ Ibid.

²² OC Register, *Hurricane Hillary: Here's what Southern California news looked like last time a tropical storm made landfall in 1939*, <https://www.ocreger.com/2023/08/19/lets-take-the-look-at-the-last-time-a-tropical-storm-made-landfall-here-in-1939/>, published August 19, 2023, accessed December 31, 2024.

²³ East Bay Times, *18-foot waves pummel piers, chunk out sand and flood parking lots along Southern California coast*, <https://www.eastbaytimes.com/2023/01/08/big-waves-pummel-piers-chunk-out-sand-and-flood-parking-lots-along-southern-california-coast/>, updated January 8, 2023, accessed December 26, 2024.

²⁴ Patch, *12-Foot Waves Prompt Flood Warning To Seal Beach Coast*, <https://patch.com/california/losalamitos/12-foot-waves-prompt-flood-warning-seal-beach-coast>, published December 23, 2024, accessed December 27, 2024.

interval does not bear out historically, the team felt strongly that coastal storms will likely affect the planning area in the future and therefore felt “highly likely” best defined probability for this specific hazard. The LHMP planning team assigned a high hazard planning consideration to the hazards and impacts associated with coastal storm events.

5.2.5 CLIMATE CHANGE

Climate change is likely to have a direct effect on coastal storms and coastal flooding. According to research conducted by the University of California, Los Angeles, California will experience extremely wet and extremely dry seasons by the end of the century. It is predicted that “over the next 40 years, the State will be 300 to 400 percent more likely to have a prolonged storm sequence as severe as the one that caused the legendary California flood more than 150 years ago.”²⁵

5.3 COASTAL FLOOD

5.3.1 DESCRIPTION

A significant effect of coastal storms involves coastal flooding. Coastal flooding occurs when intense offshore systems or storm surges push seawater inland, submerging low-lying and normally dry land above the normal tide level.²⁶ The FEMA National Risk Index indicates a relatively very low coastal flooding risk in the City of Seal Beach.²⁷

Every year, the City of Seal Beach installs a winter sand berm in October through mid-November, which is then taken down during Spring Break. The berm extends from the pier to approximately Dolphin Avenue.²⁸

5.3.2 LOCATION/EXTENT

Coastal flood zones within the City primarily include the Surfside area, portions of the Naval Weapons Station, and Old Town. Much of the City has reduced risk of flooding due to levees in place from the San Gabriel River, and Seal Beach constructs sand berms along the coast annually to act as barriers to protect against high tides and storm surges.²⁹ As the City is relatively flat, coastal areas are especially susceptible to ponding, a type of flooding that refers to a type of flooding as a result of water collecting in low-lying areas. The City of Seal Beach has a high risk of coastal flooding along its coastal boundary, with an even higher risk in the northern coastal area of the City.³⁰

²⁵ UCLA Newsroom, *Study forecasts a severe climate future for California*, <https://newsroom.ucla.edu/releases/california-extreme-climate-future-ucla-study>, accessed July 12, 2023.

²⁶ FEMA, *Coastal Flooding National Risk Index*, <https://hazards.fema.gov/nri/coastal-flooding>, accessed December 26, 2024.

²⁷ FEMA, *Coastal Flooding National Risk Index*, <https://hazards.fema.gov/nri/map>, accessed December 26, 2024.

²⁸ City of Seal Beach Press Release, *The City of Seal Beach Announces 2024 Winter Sand Berm Construction*, <https://www.sealbeachca.gov/Portals/0/Documents/Public%20Works/Press%20Release%20-%202024%20Berm%20Construction.pdf>, published October 4, 2024, accessed January 7, 2025.

²⁹ Sun News, *Seal Beach planning for sea level rise with vulnerability assessment*, <https://www.sunnews.org/seal-beach-planning-for-sea-level-rise-with-vulnerability-assessment/>, published July 26, 2019, accessed December 31, 2024.

³⁰ NOAA, *Coastal Flood Exposure Mapper, Coastal Flood Hazard Composite*, <https://coast.noaa.gov/floodexposure/#-13091016,3947681,16z>, accessed July 3, 2024.

The extent or magnitude of flooding is measured by percentage and annual probability of flooding. Flooding areas are classified as 1 in 100 (one percent) or high risk, and 1 in 500 (0.2 percent) or moderate risk of flooding. Areas having a probability of less than 0.2 percent are classified as low-risk areas. Floods are measured by stream gages that are installed in bodies of water near populated areas. They are installed and operated by the United States Geological Survey (USGS) and continuously monitor water levels.

**Table 5-3
Flood Zones Definitions**

Zone	Risk
Floodplain – 100-year flood zone (A, AE, AH, AO, VE)	1% annual flood risk
Floodway – 100-year flood zone (AE)	1% annual flood risk
500-year flood zone	0.2% annual flood risk
Area with reduced flood risk due to levee	Reduced flood risk

Source: FEMA, *FEMA Flood Maps and Zones Explained*, <https://www.fema.gov/blog/fema-flood-maps-and-zones-explained>, accessed January 14, 2025.

5.3.3 PREVIOUS OCCURRENCES

Coastal flood events have also historically impacted Seal Beach and have yielded impacts to City assets in recent history. Recent urban coastal flood events affecting the City in the last five years have been summarized below:

- December 2023 – High surf flooded the City’s restaurant parking for the second time in less than a year.³¹
- May 2023 – High tides flooded parking lots and neighborhood streets in Seal Beach. One car nearly submerged in water.³²

No federally declared disasters related to coastal flood events have impacted the planning area within the last five years; refer to Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area.

5.3.4 PROBABILITY OF FUTURE OCCURRENCES

FEMA defines flood zones based on the probability of occurrence, expressed in a percentage of the change of a flood of a specific extent occurring in any given year. For areas located within the 100-year flood zone, there is a 1 percent chance in a given year that this area will be inundated by flood waters. For moderate flood hazard areas located within the 500-year flood zone, this probability decreases to 0.2 percent. For minimal flood hazard areas, they are located outside of the 0.2 percent annual chance flood zone.

Given the location of the planning area and based on previous coastal flood events, there is a highly likely probability of a coastal flood event significantly affecting the City of Seal Beach. A highly likely probability means there is a near 100 percent probability in the next year or happens every

³¹ ABC 7, *Weather*, <https://abc7.com/high-surf-warning-seal-beach-orange-county-flooding-risk/14248347/>, published December 30, 2023, accessed December 26, 2024.

³² CBS News, *High tides flood streets and parking lots in seal beach*, <https://www.cbsnews.com/losangeles/news/high-tides-floods-streets-and-parking-lots-in-seal-beach/>, updated May 18, 2023, accessed December 31, 2024.

year. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that coastal flood events will likely affect the planning area in the future and therefore felt “highly likely” best defined probability for this specific hazard. The LHMP planning team assigned a high hazard planning consideration to the hazards and impacts associated with coastal flooding based upon a highly likely probability and expected impacts of future events.

5.3.5 CLIMATE CHANGE

Coastal cities such as Seal Beach are expected to flood more often and more severely. Research from Princeton and Rutgers Universities found that major coastal flooding, which is expected to occur once every 100 years, will inundate coastal cities an average of 40 times more often by 2050.³³

5.4 SEA-LEVEL RISE AND COASTAL EROSION

5.4.1 DESCRIPTION

Sea-Level Rise

Sea level rise is the increase in the level of the world’s oceans. This phenomenon is primarily driven by multiple factors. The first factor is thermal expansion where the water can warm due to global warming and expand.^{34,35} Warmer water occupies more space than cooler water, contributing to sea level rise. The accelerated melting of glaciers and ice sheets also contribute to rising sea levels as global temperatures increase. This meltwater flows into the oceans adding to the overall volume of seawater. Additionally, changes in surface and deep ocean circulation and storm surges can cause sea-level rise (see [Figure 5-2, *What Cause The Sea Level To Change?*](#)).

Due to the effects of increased temperatures, sea-level rise is expected to increase storm frequency. This can result in wave energy moving further inshore, eroding coastal areas of communities. Sea level rise can often cause flooding in low-lying areas, which can damage infrastructure, homes, and ecosystems (see [Section 5.1, *Flood*](#)). This phenomenon can also cause saltwater to intrude into freshwater sources, affecting drinking water supplies and agriculture.³⁶

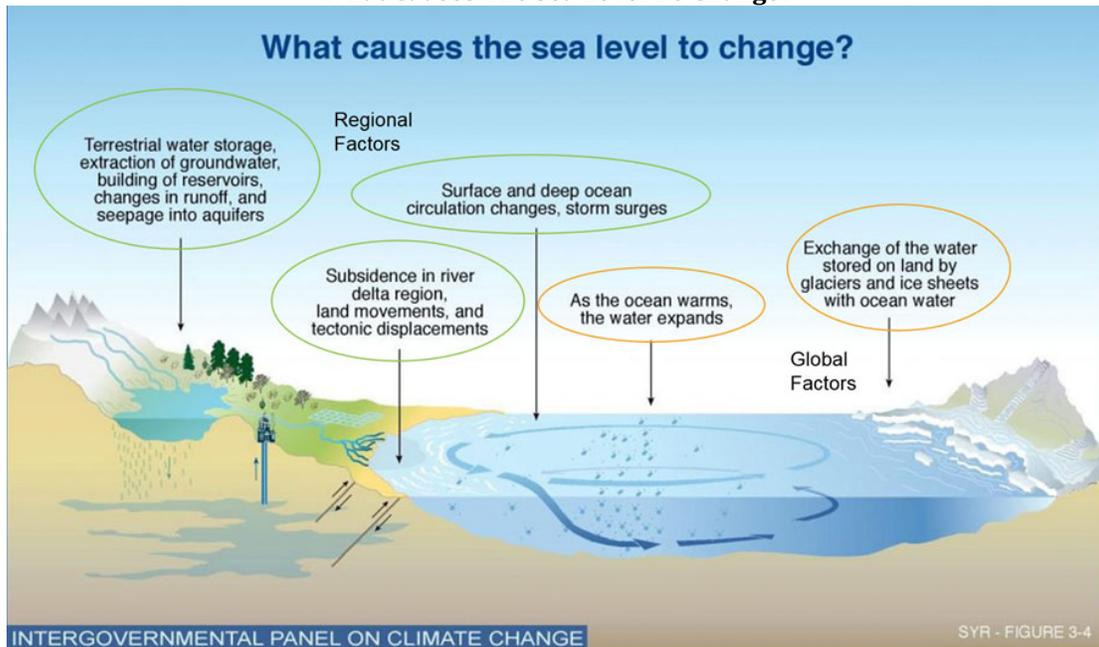
³³ Inside Climate News, *U.S. Coastal Cities Will Flood More Often and More Severely, Study Warns*, https://insideclimatenews.org/news/07062017/coastal-flooding-extreme-sea-level-rise-forecast/?gad_source, published June 7, 2017, accessed July 3, 2024.

³⁴ National Geographic, *Sea Level Rise*, <https://education.nationalgeographic.org/resource/sea-level-rise/>, accessed January 7, 2025.

³⁵ European Commission, *Rising sea levels due to climate change found to escalate the rate of erosion of rocky shorelines*, https://environment.ec.europa.eu/news/rising-sea-levels-due-climate-change-found-escalate-rate-erosion-rocky-shorelines-2023-03-29_en, published March 29, 2023, accessed January 7, 2025.

³⁶ United Nations, *What is sea level rise and why does it matter to our future?*, <https://news.un.org/en/story/2024/08/1153596>, published August 26, 2024, accessed January 14, 2025.

Figure 5-2
What Causes The Sea Level To Change?



Michael Baker International, Inc.

Moffatt & Nichol, *City of Seal Beach Sea Level Rise Vulnerability Assessment*, published July 2019, accessed January 14, 2025.

Coastal Erosion

Coastal erosion is the process by which local sea level rise, strong wave action, and coastal flooding wear down or carry away rocks, soil, and/or sands along the coast.³⁷ During the winter season in California, beaches typically erode, thereby allowing waves to reach further inland and inundate the bottoms of coastal cliffs and beaches. Coastal failure can also occur as result of heightened precipitation, particularly during El Niño events where wave actions can be high. Rainfall may be the ultimate trigger for slope failure, even during times with little to no wave action as rocks and soil are heavily saturated.³⁸

Coastal or shoreline erosion will be the most significant hazard impacting coastal resources due to “coastal squeeze.”³⁹ Coastal squeeze is the process by which sea level dependent physical, cultural, or biological areas are pushed landward with sea level rise but are prevented from natural landward movement due to a protected or non-erodible structure. The City currently experiences coastal squeeze as sea level rises.

There are several strategies to reduce coastal erosion due to sea-level rise either through gray or green techniques (refer to [Figure 5-3, Coastal Erosion Mitigation Strategies](#)). Grey techniques are referred to as shoreline “hardening,” where structures such as seawalls, revetements, groins (medium-sized artificial structure built perpendicular to the shoreline), riprap, and levees are

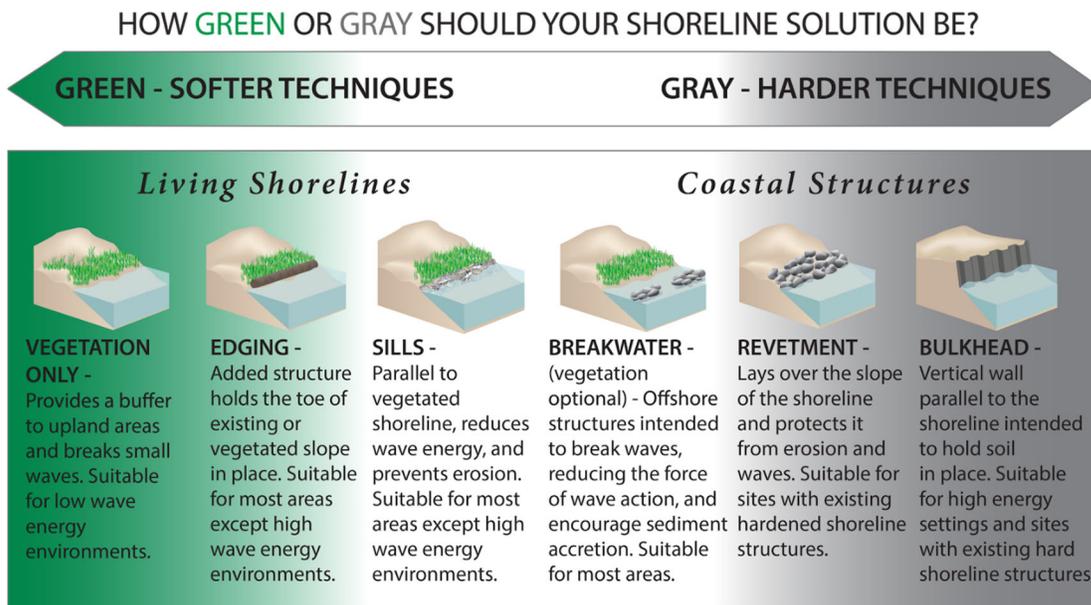
³⁷ U.S. Climate Resilience Toolkit, *Coastal Erosion*, <https://toolkit.climate.gov/topics/coastal-flood-risk/coastal-erosion>, modified April 2021, accessed January 7, 2025.

³⁸ *Ibid.*

³⁹ Moffatt & Nichol, *City of San Clemente Sea Level Rise Vulnerability*, published October 2019, accessed January 14, 2025.

placed to reduce eroding coastal areas.⁴⁰ Seawalls and riprap may lock potential beach sand in place on cliffs, removing an important source of natural sand replenishment.⁴¹ Green techniques use living shorelines, which consist of plants or other natural elements often in combination with harder shoreline structures, to stabilize estuarine coasts, bays, and tributaries.⁴² Living shorelines improve water quality, provide fisheries habitat, increase biodiversity, and promote recreation. Coastal erosion strategies can also incorporate components of both gray and green techniques to comprehensively protect shorelines.

**Figure 5-3
Coastal Erosion Mitigation Strategies**



Source: NOAA, *Guidance for Considering the Use of Living Shorelines*, https://www.habitatblueprint.noaa.gov/wp-content/uploads/2018/01/NOAA-Guidance-for-Considering-the-Use-of-Living-Shorelines_2015.pdf, published 2015, accessed January 14, 2025.

5.4.2 LOCATION/EXTENT

According to the *Sea Level Rise Vulnerability Assessment* prepared by Moffat and Nichol in 2019, the City of Seal of Beach has three distinct regions where the combined effects of sea level rise and coastal and fluvial storms could result in flooding of the community. The three areas are listed below and are shown in Figure 5-4, Coastal Setting within the City of Seal Beach.

1) Seal Beach – Open Coast: This coastal reach between the San Gabriel River and Anaheim Bay jetties (East and West Jetty) encompasses West Beach, the Seal Beach Municipal Pier, and East Beach. This is the center of beach-related activity in Seal Beach due to the accessibility and proximity to Main Street, residential development and visitor serving amenities. This area is

⁴⁰ U.S. Climate Resilience Toolkit, *Coastal Erosion*, <https://toolkit.climate.gov/topics/coastal-flood-risk/coastal-erosion>, updated April 2021, accessed January 7, 2025.

⁴¹ Surfrider Foundation San Diego County, *The True Cost of Armoring the Beach*, <https://sandiego.surfrider.org/news/the-true-cost-of-armoring-the-beach>, published July 6, 2020, accessed January 7, 2025.

⁴² Ibid.

currently exposed to coastal erosion, flooding, and wave runup (the maximum vertical height that waves reach as they travel up the slope of a beach, revetment, or coastal structure) during extreme events. Sea level rise has the potential to increase the severity of these hazards, impacting the recreational beach areas, amenities, and residential development.

2) Surfside Community – Open Coast: The Surfside Community, south of Anaheim Bay, is also exposed to the open coast and associated process of coastal erosion, wave runup and flooding during extreme events. Located downcoast of complete littoral barrier formed by the Anaheim Bay jetties, this segment of shoreline is particularly vulnerable to erosion and dependent on regular nourishment from the United States Army Corps of Engineers (USACE) to maintain a sandy beach in front of residential development.

3) Inland Low-Lying Areas: Inland low-lying areas of Seal Beach are also susceptible to potential flooding from sea level rise in combination with high tides and fluvial events from sources such as the San Gabriel River, Los Cerritos Wetlands and Anaheim Bay. The low-lying areas include portions of the Electric Avenue corridor and commercial development adjacent to Westminster Boulevard and Leisure World.⁴³

Additionally, Moffatt & Nichol looked at three different sea level rise scenarios in the report: 1.6 ft, 3.3 ft, 4.9 ft, and 6.6 ft. Their findings showed that approximately 3 feet of inundation may occur from 2060 to 2100+, and 6 feet of inundation may occur in 2090 to 2100+ (See [Figure 5-5, Sea Level Rise Timeline](#)). The geographic extent from sea-level rise at 2 ft would potentially impact the City, primarily at the Seal Beach National Wildlife Refuge, Anaheim Bay, and coastal areas of the City as shown in [Figure 5-6, 2 Feet Sea Level Rise Hazard Zones](#). However, the geographic extent of sea-level rise at 6 ft would potentially impact much of the City, spanning from the southern boundaries of the City to Interstate 405 as shown in [Figure 5-7, 6 Feet Sea Level Rise Hazard Zones](#).

⁴³ Moffat & Nichol, *City of Seal Beach Sea Level Rise Vulnerability Assessment*, https://www.sealbeachca.gov/Portals/0/Documents/SealBeach_VA_7.12.19_Draft01.pdf?ver=2019-07-15-124445-557, July 2019, accessed January 6, 2025.

Figure 5-4
Coastal Setting within the City of Seal Beach



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Moffatt & Nichol, *City of Seal Beach Sea Level Rise Vulnerability Assessment*, published July 2019, https://www.sealbeachca.gov/Portals/0/Documents/SealBeach_VA_7.12.19_Draft01.pdf?ver=2019-07-15-124445-557 accessed January 6, 2025.

Figure 5-5
Sea-Level Rise Timeline

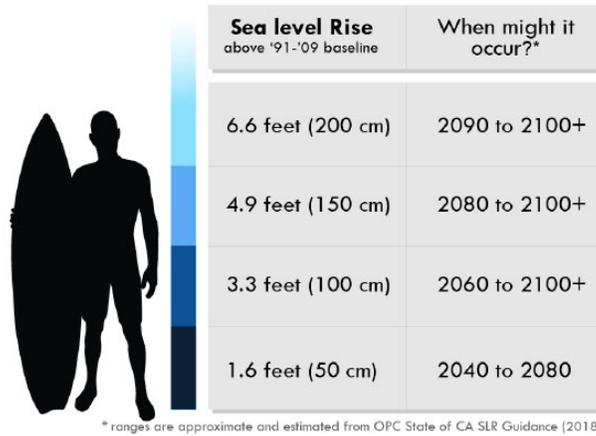
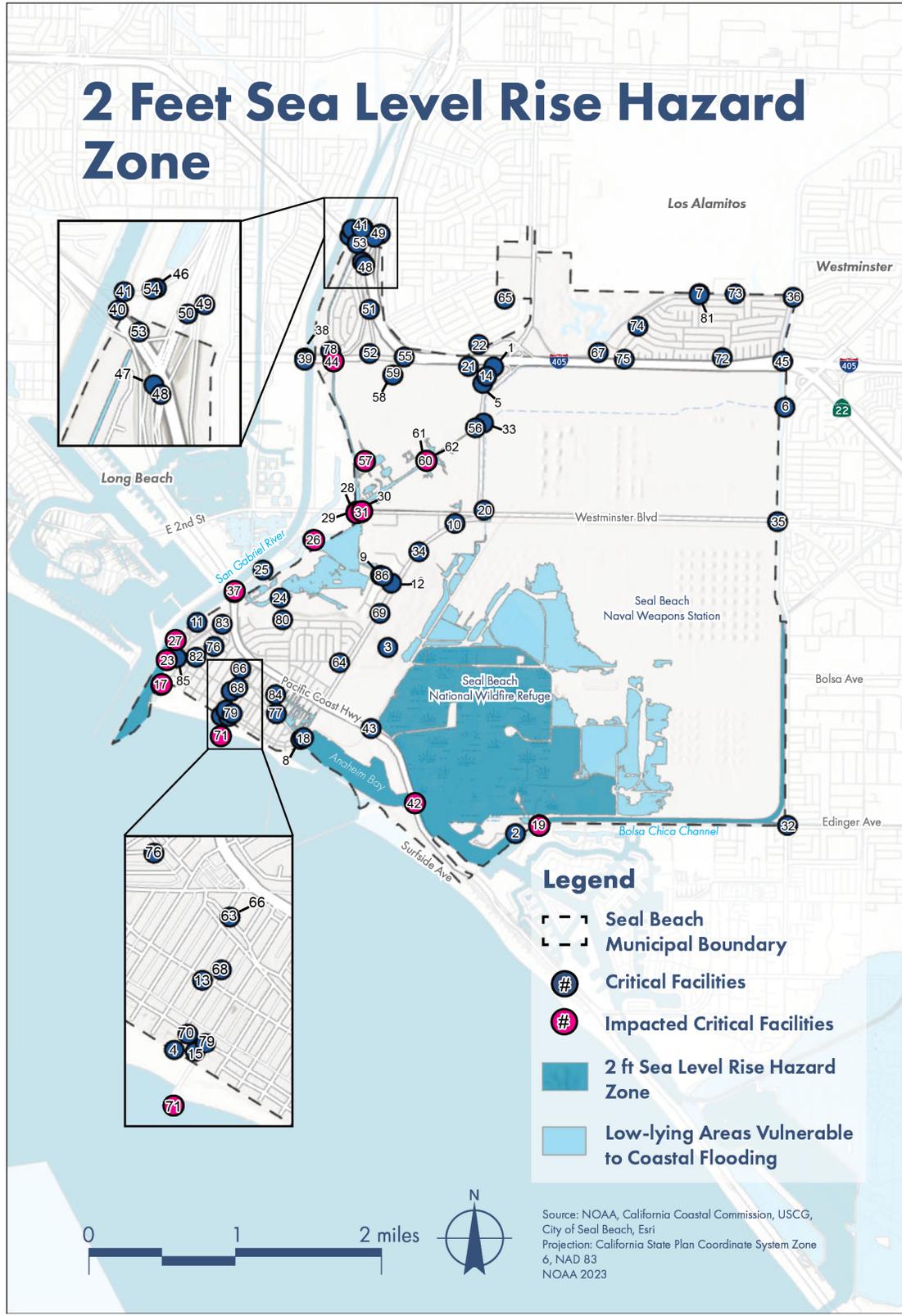
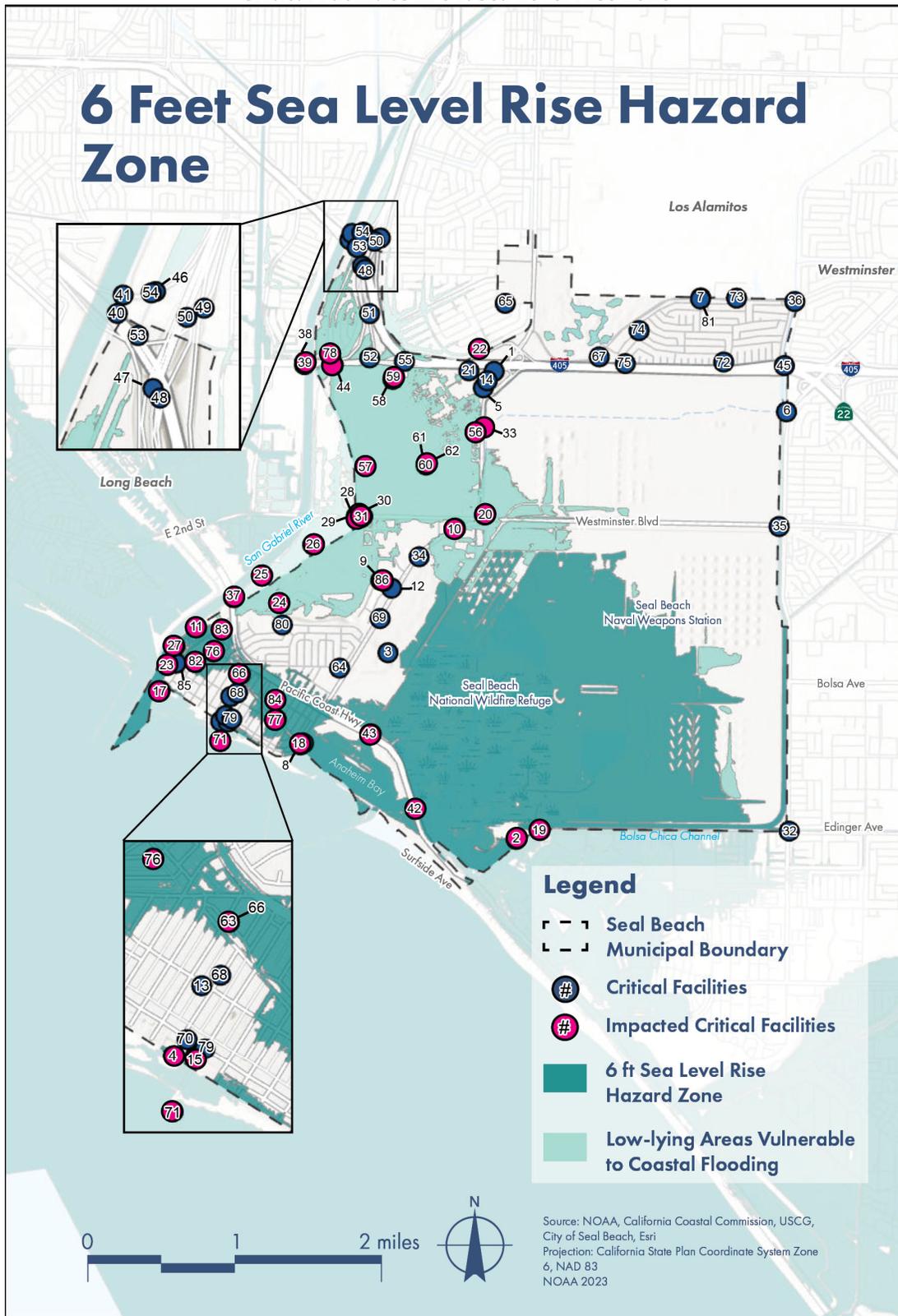


Figure 5-6
Critical Facilities in 2 ft Sea Level Rise Zone



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Figure 5-7
Critical Facilities in 6 ft Sea Level Rise Zone



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5.4.3 PREVIOUS OCCURRENCES

According to the City's Sea Level Rise Vulnerability Assessment, coastal erosion in the City dates back to the 1950s.⁴⁴ In 1959, the concrete sheet pile groin along the Seal Beach Municipal Pier was initially constructed to offset effects of wave amplification and prevent undue loss of beach area east of the Pier. In 1964, the United States Army Corps of Engineers began regular beach nourishment cycles at Surfside-Sunset Beach as mitigation for the downcoast shoreline impacts of the Anaheim Bay Jetties and to provide a feeder for the 13 miles of downdrift shoreline. Over 17 million cubic yards have been placed since 1964. Past sand nourishment events at the City have been sporadic and generally supplied by dredge materials from nearby projects, offshore sources or inland sources on an opportunistic basis. Placement of nourished material typically occurs along the east beach to widen the berm and provide a buffer for the winter dike. Recent nourishments have occurred at a frequency of approximately once every 5-7 years as sand is placed immediately downcast of the eastern Anaheim Bay jetty.

No federally declared disasters related to sea-level rise and coastal erosion events have impacted the planning area within the last five years; refer to Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area.

5.4.4 PROBABILITY OF FUTURE OCCURRENCES

Concrete sheet pile groin along the Seal Beach Municipal Pier was initially constructed in 1959 to offset wave amplification and prevent undue loss of each area east of the Pier. Without the concrete sheet pile groin along the Seal Beach Municipal Pier, it is estimated that erosion rates in the area would increase by approximately 50 percent.

Based on previous occurrences and observed risk, there is a likely probability of future coastal impacts in the future. The LHMP planning team assigned a likely probability of a coastal erosion occurring in the future, meaning there is a 10 to 100 percent probability in the next year or a recurrence interval of 10 years or less. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that coastal erosion will likely affect the planning area in the future and therefore felt "likely" best defined probability for this specific hazard. The LHMP planning team assigned a medium hazard planning consideration to the hazards and impacts associated with coastal erosion based on a likely probability and likely expected impacts of future events. Throughout the planning area, much of the coastal areas are susceptible to coastal erosion and have already experienced impacts and loss.

5.4.5 CLIMATE CHANGE

Coastal counties produce more than \$9.5 trillion in goods and service each year and support more than 58 million jobs in fishing, tourism, real estate, defense, and other industries.⁴⁵ Coastal communities can face permanent inundation and flooding threats from climate change effects such as sea level rise, intense rains, high tide flooding, and severe storms.⁴⁶ Climate change can cause

⁴⁴ Moffatt & Nichol, *City of Seal Beach Sea Level Rise Vulnerability Assessment*, https://www.sealbeachca.gov/Portals/0/Documents/SealBeach_VA_7.12.19_Draft01.pdf?ver=2019-07-15-124445-557, published July 2019, accessed March 5, 2025.

⁴⁵ Environmental Protection Agency, *Climate Change Impacts on Coasts*, <https://www.epa.gov/climateimpacts/climate-change-impacts-coasts>, updated on November 16, 2023, accessed January 7, 2025.

⁴⁶ Ibid.

coastal land losses to occur by turning dry land into wetlands or open water.⁴⁷ In addition, a higher increase in sea-level rise may also increase residential displacement along Seal Beach coastal communities, as well as impacting infrastructure and services in the planning area.

5.5 TSUNAMI

5.5.1 DESCRIPTION

A tsunami is a wave or series of waves generated by a large and sudden upward movement of the ocean floor or other natural disturbances. Usually, tsunamis occur because of an earthquake below or near the ocean floor. Volcanic eruptions, landslides, and in rare instances meteorites may also trigger tsunamis. The sudden and forceful displacement of the ocean floor creates waves that radiate outward in all directions away from their source, sometimes crossing entire ocean basins.⁴⁸ In the open ocean, a tsunami travels 500 to 600 miles per hour but is only a few feet in height and may be undetectable by ships. Once the wave nears the shore, the shallow depth pushes against the motion of the wave, causing it to decelerate and increase in height.⁴⁹ *Figure 5-8, How a Tsunami Works*, illustrates the factors that lead to the formation of a tsunami wave.

Tsunamis typically rush ashore in multiple waves like fast-rising tide with powerful currents. When the tsunami makes landfall, the wave can violently disperse inland, causing immense damage and risk of injury or death. These waves often travel much further inland than normal waves. Most tsunami damage is caused by these strong currents and floating debris.⁵⁰

Tsunamis are generally unpredictable, and the only warning sign is often the earthquake that triggers it. However, the initial earthquake may occur far away and be imperceptible to people on land. The trough of the tsunami is the low point beneath the crest of the wave. This trough often reaches shore first and produces a vacuum effect, which pulls coastal water seaward and exposes the harbor and sea floors. This is one of the few warning signs or indicators that the wave crest and full force of the tsunami will soon hit the coast.⁵¹

Tsunamis may last for hours, and additional waves may continue to impact coastlines. This leads to the destruction or damage of structures, disruption of transportation, power, and communications, and more.⁵² Damages often depend on the size and nature of the earthquake or other tsunami catalysts, as well as the location. Earthquakes and corresponding tsunamis that occur further away are less impactful than those that occur close to the coast. Tsunami damage may range from minor to devastating, with the worst tsunamis resulting in severe structural and property damage, and substantial loss of life.

⁴⁷ Ibid.

⁴⁸ FEMA, *Understanding Tsunamis*, <https://www.fema.gov/fact-sheet/understanding-tsunamis>, accessed December 27, 2024.

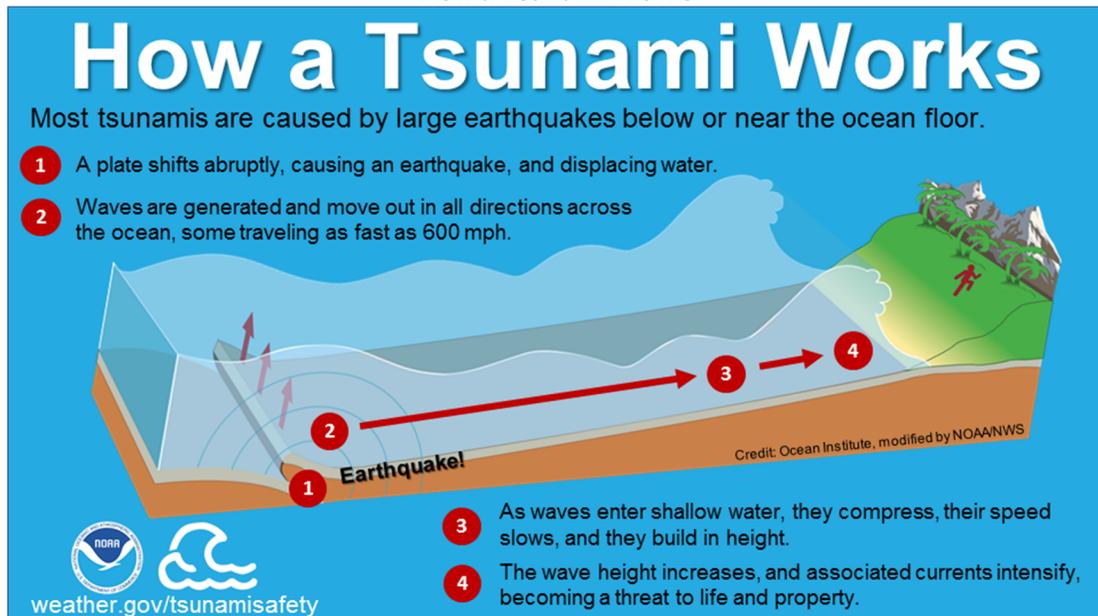
⁴⁹ National Oceanic and Atmospheric Administration, *Tsunami Propagation*, <https://www.noaa.gov/jetstream/tsunamis/tsunami-propagation>, accessed December 27, 2024.

⁵⁰ United States Geological Survey, *Tsunamis and Tsunami Hazards*, <https://www.usgs.gov/special-topics/water-science-school/science/tsunamis-and-tsunami-hazards>, accessed December 27, 2024.

⁵¹ FEMA, *Understanding Tsunamis*, <https://www.fema.gov/fact-sheet/understanding-tsunamis>, accessed December 27, 2024.

⁵² FEMA, *Understanding Tsunamis*, <https://www.fema.gov/fact-sheet/understanding-tsunamis>, accessed December 27, 2024.

Figure 5-8
How a Tsunami Works



Michael Baker International, Inc.

Source: National Weather Service, *Tsunami Preparedness*, <https://www.weather.gov/wrn/fall2018-tsunami-sm>, accessed December 27, 2024.

Approximately 80% of tsunamis occur within the Pacific Ocean’s “Ring of Fire,” a geologically active area where tectonic shifts make volcanoes and earthquakes common.⁵³ The Ring of Fire surrounds the Pacific tectonic plate along the east coast of Asia and along the west coast of North and South America. All coastlines are potentially vulnerable to tsunamis that occur in the Pacific, including the southern California coastline that includes the City of Seal Beach.⁵⁴

5.5.2 LOCATION/EXTENT

The entire 42-mile coastline of Orange County faces vulnerability to the tsunami hazard, which includes coastal communities in the City of Seal Beach. These communities are densely populated, making evacuation efforts a challenge in the event of an emergency. Other factors impacting evacuation include the time of day, the time of year, road conditions, tourist population, and sporting and social events. Tsunami hazard events are rare for southern California, as the state’s coastline is protected by the region’s ocean floor geography and the presence of the Channel Islands, which help to reduce the coastline’s vulnerability to tsunamis.⁵⁵ Tsunamis impacting the planning area are considered unlikely to be large walls of waves, but rather choppy waters resulting in unsafe swimming and boating conditions, and coastal flooding.

⁵³ National Geographic, *Tsunamis*, <https://www.nationalgeographic.com/environment/article/tsunamis#:~:text=Most%20tsunamis%E2%80%93about%2080%20percent,underwater%20landslides%20or%20volcanic%20eruptions.>, accessed December 27, 2024.

⁵⁴ United States Geological Survey, *Tsunamis and Tsunami Hazards*, <https://www.usgs.gov/special-topics/water-science-school/science/tsunamis-and-tsunami-hazards>, accessed December 27, 2024.

⁵⁵ Tsunami.org, *What Causes a Tsunami?*, <https://tsunami.org/what-causes-a-tsunami/>, accessed December 27, 2024.

In more extreme scenarios, scientists estimate that if a tsunami hits the Orange County coast, it could generate waves greater than 30 feet high.⁵⁶ An impact of this magnitude could cause loss of life, destroy thousands of homes, greatly affect coastal businesses, and impact tourism. Even if all residents and visitors were safely evacuated, the damage to property in this densely populated, high property value area would still be tremendous.⁵⁷

The City of Seal Beach's proximity to fault lines just off its coastline and running through the City increases the potential of a Local Source Tsunami striking the City's coastline. Historically, Distant-Source Tsunamis, like the one generated in Chile in 1960, have caused significant damage to the California coast. Additionally, there is concern that an earthquake event along the Cascadia subduction zone may have significant impact on southern California, similar to those experienced in Crescent City after the 1964 Alaskan earthquake. With the distance between Cascadia and southern California being about the same as the distance from Alaska to Crescent City, this earthquake scenario poses a threat to the City of Seal Beach.⁵⁸

According to the Federal Emergency Management Agency (FEMA) National Risk Index (NRI) for natural hazards, Orange County and the City of Seal Beach face a relatively low risk of tsunami impacts. The NRI considers a combination of expected annual loss, social vulnerability, and community resilience ratings to determine relative risk for natural hazard such as tsunami, as shown in Figure 5-9, *Tsunami Hazard Zone*.

Tsunami damages are closely tied to the magnitude and severity of these on-shore or off-shore earthquake triggers; refer to Section 8, *Seismic Hazard Assessment*, for the magnitude and severity of earthquakes. In the worst-case scenario, tsunamis may cause severe and widespread structural and property damage and substantial loss of life.

5.5.3 PREVIOUS OCCURRENCES

The City of Seal Beach has been impacted by two tsunami hazard events in recent history. On September 16, 2015, following a magnitude 8.3 earthquake off the coast of Chile, the National Tsunami Warning Center issued a tsunami advisory for coastline areas from Orange County to north of San Luis Obispo. No coastal flooding resulted from this incident, and tsunami wave heights were observed to be just under one foot along the Orange County coastline.⁵⁹

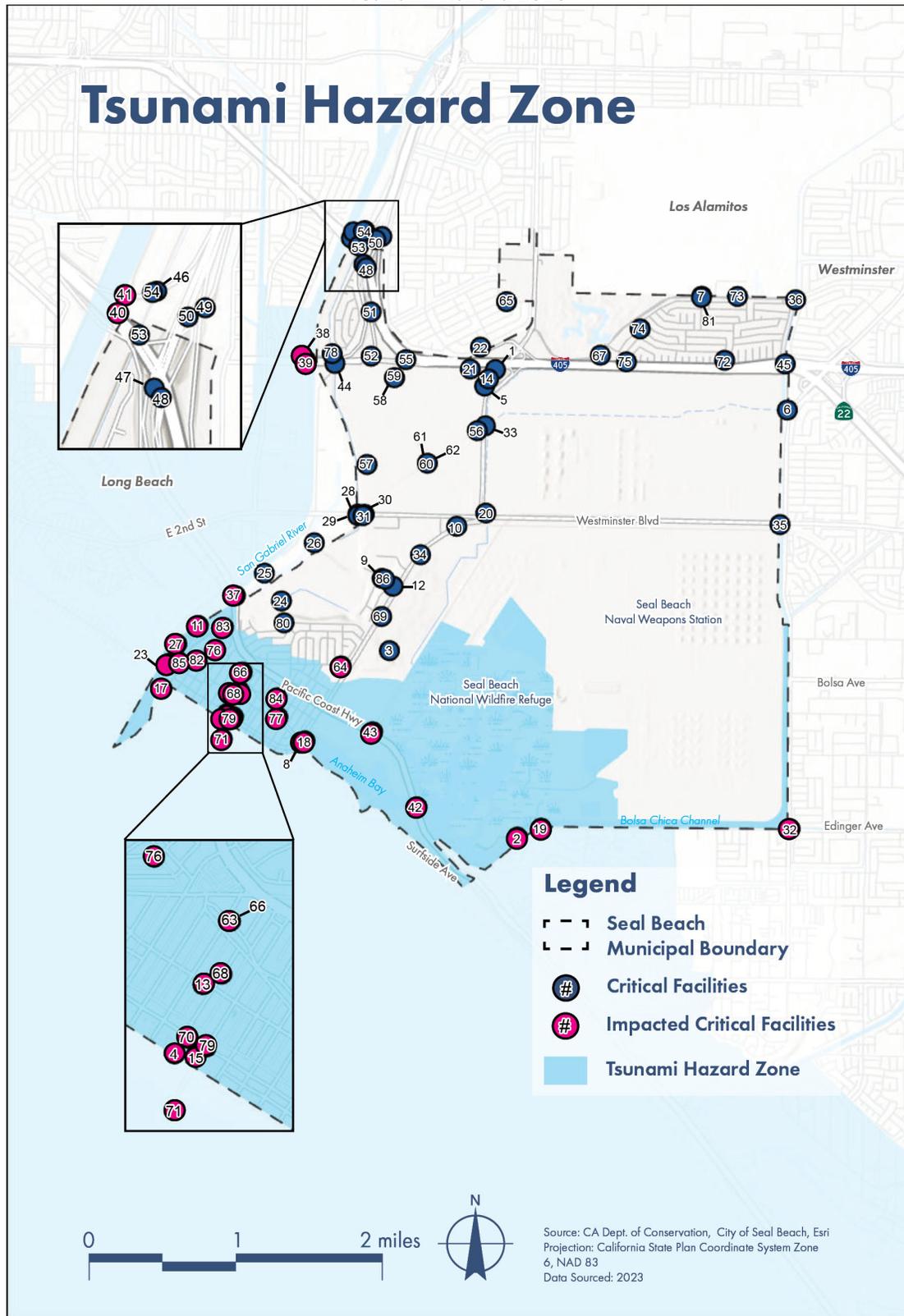
⁵⁶ UNESCO, *Tsunami: The Great Waves*, <https://unesdoc.unesco.org/ark:/48223/pf0000148609>, published 2005, accessed December 27, 2024.

⁵⁷ County of Orange, *2018 Tsunami Annex*, <https://www.san-clemente.org/about-us/advanced-components/document-folder/-folder-34>, accessed December 27, 2024.

⁵⁸ Bourgeois, Michaela, *Cascadia Subduction Zone study reveals area at particular risk for massive quake*, <https://www.koin.com/news/environment/earthquakes/cascadia-subduction-zone-study-earthquake-quake-pacific-northwest-june-2024/>, accessed December 27, 2024.

⁵⁹ NOAA, *Storm Events Database*, https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+Tsunami&beginDate_mm=03&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=03&endDate_dd=31&endDate_yyyy=2024&county=ORANGE%3A59&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statsfips=6%2CCALIFORNIA, accessed December 27, 2024.

Figure 5-9
Tsunami Hazard Zone



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On January 15, 2022, a tsunami advisory was issued for Orange County. Wireless Emergency Alerts and tsunami sirens were activated before the first tsunami wave impacted the coastline. Minor damage was reported along the coast, but no injuries or deaths resulted from this incident.⁶⁰

No federally declared disasters relating to tsunami events have impacted the planning area within the last five years; refer to [Table 4-4, *Summary of Federally Declared Disasters Affecting the Planning Area*](#).

5.5.4 PROBABILITY OF FUTURE OCCURRENCES

Earthquakes and tsunamis will continue to occur throughout the Pacific Ocean. Significant tsunami impacts to Seal Beach are rare, and a tsunami is not generally expected to impact the coastline near the planning area. Despite this, the coastal areas of Seal Beach could be susceptible to smaller earthquakes and tsunamis generated from nearby faults and volcanic activity.

It is difficult to predict the recurrence and magnitude of tsunamis. Given the location of the planning area, the amount of low-lying coastal features throughout the City, and the previous history of tsunami occurrence in the Pacific Ocean, it has been determined that the probability of tsunami impacting the planning area in the future is considered likely. A likely probability means a probability of between 10 and 100 percent in the next year or has a recurrence interval of 10 years or less. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that tsunami events will likely affect the planning area in the future and therefore felt “likely” best defined probability for this specific hazard. The LHMP planning team assigned a medium hazard planning consideration to the hazards and impacts associated with tsunamis based upon a likely probability and limited expected impacts of future events.

5.5.5 CLIMATE CHANGE

Climate change is not directly tied to the probability of tsunami occurrence. Tsunami triggers including earthquakes, volcanic eruptions, and landslides are not expected to occur more frequently or be more severe due to climate change. However, sea level rise due to climate change may increase the severity of damages due to tsunamis. Increased mean sea levels would potentially cause tsunami waves and surges to travel further inland. Tsunami impacts would therefore be exacerbated by sea level rise and would cause more destruction and potential loss of life. This nexus between climate change and tsunami suggests that mitigation of climate change and sea level rise would indirectly mitigate the severity of tsunami impacts.

5.6 DAM/RESERVOIR FAILURE

5.6.1 DESCRIPTION

A dam is an artificial barrier preventing the flow of water or a barrier built across a watercourse for impounding water. Dam failure is the uncontrolled release of impounded water from behind a dam. Flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, and terrorism can all cause dam infrastructure to fail. Dam failure causes downstream flooding of varying velocities that can result in loss of life and property. Reservoirs

⁶⁰ Ibid

are defined as an artificial lake, pond, impoundment, or tank, used to store water (both potable and non-potable). Reservoirs can be created on the surface by constructing dams to store water. Additionally, tank reservoirs can be constructed to store water above ground, on the surface, or below ground. Reservoir failure is the uncontrolled release of impounded water from a reservoir.

Dam or reservoir failures are most likely to happen for the following reasons:⁶¹

- Overtopping, caused by water spilling over the top of the dam, usually a precursor of dam failure because of inadequate spillway design, debris blockage of spillways, or settlement of the dam crest;
- Foundation defects, including settlement or slope stability;
- Cracking caused by natural settling of a dam or seismic movements;
- Inadequate maintenance and upkeep; and/or
- Piping, when seepage through a dam is not properly filtered, soil particles continue to progress and form sinkholes in the dam.

Because dam failure can have severe consequences, FEMA and Cal OES require all dam owners to develop an Emergency Action Plan (EAP) for warning, evacuation, and post-flood actions. In the event of a major dam failure, mutual aid from all levels of government would be required for an extended period. Recovery efforts would include the removal of debris, clearing roadways, demolishing unsafe structures, assistance in reestablishing public services, and providing continued care for the affected population. There are two dam inundation zones within the City of Seal Beach: The Santiago Creek Dam and the Whittier Narrows Dam and Reservoir.

The Santiago Creek Dam is jointly owned by the Irvine Ranch Water District and the Serrano Water District. The Irvine Ranch Water District recently implemented the Dam Safety Program, which uses a Risk-Informed Decision-Making process to identify and reduce dam risk.⁶²

Dams in Orange County are regulated by the Department of Water Resources, Division of Safety of Dams (DSOD). DSOD ensures dam safety by:⁶³

- Reviewing and approving dam enlargements, repairs, alterations, and removals, and ensuring that the dam appurtenant structures are designed to meet minimum requirements;
- Performing independent analyses to understand dam and appurtenant structures performance (including structural, hydrologic, hydraulic, and geotechnical evaluations);
- Overseeing construction to ensure work is performed in accordance with approved plans/specifications;
- Inspecting each dam on an annual basis to ensure safety and performance standards; and
- Periodically reviewing the stability of dams/major appurtenances, as well as new findings regarding earthquake hazards and hydrologic estimates in California.

⁶¹ Association of State Dam Safety Officials, *Dam Failures and Incidents*, <https://damsafety.org/dam-failures>, accessed December 24, 2024.

⁶² Irvine Ranch Water District, *Dam Safety Program*, https://www.irwd.com/images/pdf/construction/DSP_Guidelines_-_July_2023.pdf, accessed December 31, 2024.

⁶³ California Department of Water Resources, *Division of Safety of Dams*, <https://water.ca.gov/Programs/All-Programs/Division-of-Safety-of-Dams>, accessed December 31, 2024.

The DSOD is responsible for assigning each jurisdictional dam a downstream hazard classification. This classification is based only on potential downstream impacts to life and property, should the dam fail when operating with a full reservoir. This hazard status is not related to the condition of the dam or the likelihood of the dam failing in either the short- or long-term. Additionally, dams in southern California usually do not operate at full capacity at all times of the year, and thus hazard risks and classifications are a worst-case scenario assessment. The DSOD definitions for downstream hazards are borrowed from the Federal Guidelines for Inundation Mapping of Flood Risks Associated with Dam Incidents and Failures, and are outlined in Table 5-4, *DSOD Downstream Hazard Potential Classification Levels*.

**Table 5-4
DSOD Downstream Hazard Potential Classification Levels**

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

Source: California Department of Water Resources, Division of Safety of Dams, *Definitions of Downstream Hazard and Condition Assessment*, <https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/All-Programs/Division-of-Safety-of-Dams/Files/Publications/Division-of-Safety-of-Dams-Definitions-for-Downstream-Hazard-and-Condition-Assessment.pdf>, published September 2021, accessed July 5, 2024.

DSOD inspects dams once annually and provides a condition assessment. This condition assessment is a more accurate tool to evaluate infrastructure risk. DSOD uses the National Inventory of Dams (NID) condition rating definitions, with additional criteria, as a guideline in assigning condition assessments. This rating system is outlined in Table 5-5, *DSOD Condition Assessment Rating Levels*.

**Table 5-5
DSOD Condition Assessment Rating Levels**

Rating	National Inventory of Dams Definitions	California DSOD Additional Criteria
Satisfactory	No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions (static, hydrologic, seismic) in accordance with the applicable regulatory criteria or tolerable risk guidelines.	None
Fair	No existing dam safety deficiencies are recognized for normal loading conditions.	Dam has a long-standing deficiency that is not being

Rating	National Inventory of Dams Definitions	California DSOD Additional Criteria
	Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action.	addressed in a timely manner. Dam is not certified, and its safety is under evaluation. Dam is restricted and operation of the reservoir at the lower level does not mitigate the deficiency.
Poor	A dam safety deficiency is recognized for loading conditions that may realistically occur. Remedial action is necessary. A poor rating may also be used when uncertainties exist as to critical analysis parameters that identify a potential dam safety deficiency. Further investigations and studies are necessary.	Dam has multiple deficiencies or a significant deficiency that requires extensive remedial work.
Unsatisfactory	A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.	None
Not Rated	The dam has not been inspected, is not under State jurisdiction, or has been inspected but, for whatever reason, has not been rated.	None

Source: California Department of Water Resources, Division of Safety of Dams, *Definitions of Downstream Hazard and Condition Assessment*, <https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/All-Programs/Division-of-Safety-of-Dams/Files/Publications/Division-of-Safety-of-Dams-Definitions-for-Downstream-Hazard-and-Condition-Assessment.pdf>, published September 2021, accessed July 9, 2024.

Dam or reservoir failure within highly urbanized areas like the City can be catastrophic and result in property damage, destruction, and loss of life. Reservoirs in Orange County are regularly inspected and monitored to ensure structural integrity and safety; thus, most issues are identified early and immediately rectified to prevent dam failure. Dam failures can also increase in magnitude and severity when coupled with other natural disasters. Earthquakes or heavy rains can threaten the structural integrity of dam/reservoir infrastructure and create challenging conditions for emergency response.

For dams owned and operated by the United States Army Corps of Engineers (USACE) the Dam Safety Action Classification System (DSAC) is used based on their inspections to determine the probability of failure and potential safety, economic and environmental risks. This rating system is outlined in [Table 5-6, USACE Dam Safety Action Classification System](#).

**Table 5-6
USACE Dam Safety Action Classification System**

Dam Safety Action Class	Safety Characteristics	Description
DSAC I (Urgent and Compelling)	Unsafe; Critically near failure or extreme high risk	Dams where progression toward failure is confirmed to be taking place under normal operations, and the dam is almost certain to fail under normal operations within a time frame from immediately to within a few years without intervention; or the combination of life or economic consequences with probability of failure is extremely high.
DSAC II (High Urgency)	Unsafe or Potentially Unsafe; Failure initiation foreseen or very high risk	Dams where failure could begin during normal operations or be initiated as the consequence of an event. The likelihood of failure from one of these occurrences, prior to remediation, is too high to assure public safety; or the combination of life or economic consequences with probability of failure is very high.
DSAC III (Moderate Urgency)	Conditionally Unsafe; Significantly inadequate or moderate to high risk	Dams that have issues where the dam is significantly inadequate, or the combination of life, economic or environmental consequences with probability of failure is moderate to high.
DSAC IV (Low Urgency)	Marginally Safe; Inadequate with low risk	Dams are inadequate with low risk such that the combination of life, economic or environmental consequences with a probability of failure is low, and the dam may not meet all essential USACE engineering guidelines.
DSAC V (Normal)	Adequately Safe; Residual risk considered tolerable	Dams considered adequately safe, meeting all essential agency guidelines, and the residual risk is considered tolerable.

Source: USACE, *Dam Safety Program*, <https://www.usace.army.mil/Missions/Civil-Works/Dam-Safety-Program/Program-Activities/>, updated December 16, 2021, accessed March 5, 2025.

The City of Seal Beach can also be impacted with flooding if levees near the City fail. Levees are embankments or raised structures built along rivers, lakes, or other bodies of water to prevent flooding. The U.S. Army Corps of Engineers (USACE) Los Angeles District is responsible for inspection of the levees to identify any deficiencies that could be hazardous. Levees are built by piling soil, sand, or rocks on a cleared, level surface. There are four different types of levees:

- Earthen levees: primarily made from compacted soil and are the most prevalent type. They are used extensively along rivers and flood control channels.
- Concrete Levees: Often found in urban areas, these levees are reinforced with concrete to provide additional strength and durability.
- Rock Levees: Constructed with large rocks or riprap, these are used in areas with high erosion potential.

- Floodwalls: Vertical structures made from concrete or steel, often used in conjunction with levees to provide additional protection in densely populated areas.

5.6.2 LOCATION/EXTENT

The geographic extent from dam or reservoir failure is dependent on the type of infrastructure and amount of water stored at the time of the hazard incident. There are no dams located within the planning area; however, the Whittier Narrows Dam and Reservoir and Santiago Creek Dam have inundation zones that would potentially impact the City of Seal Beach. Additional information on the Whittier Narrows Dam and Reservoir and Santiago Creek Dam is listed in [Table 5-7, *Upstream Dams and Reservoirs affecting the City of Seal Beach*](#). Refer to [Figure 5-10, *Dam Inundation Map*](#) for an illustration of inundation extent within the City.

Levees are primarily located along the San Gabriel River adjacent to the City. The 20.54-mile San Gabriel River 1 (SGR1) Levee System is located in Los Angeles and Orange counties. SGR1 Levee System is made up of an earthen levee embankment and a trapezoidal channel. The riverward slope of the channel is covered with riprap, grouted stone, or reinforced concrete. The SGR1 Levee System protects residential, commercial, industrial, and civic improvements from flooding.⁶⁴ Levees along the San Gabriel River near the City of Seal Beach reduce risk of flooding for the western portion of the City including Old Ranch, Rossmoor Center, College Park West, Leisure World, Marina Hill, Hellman Ranch, Boeing Facility, Old Town and Bridgeport.

Table 5-7
Upstream Dams and Reservoirs Affecting the City of Seal Beach

Dam Name	Dam Owner	Location	Hazard Classification	Type	Size	DSOD Rating
Santiago Creek Dam	Serrano Water District and Irvine Ranch Water District	Inundation zone within the City	Extremely High	Earthen Embankment	38,000 acre-feet	Poor
Whittier Narrows Dam and Reservoir	U.S. Army Corps of Engineers	Inundation zone within the City	DSAC I	Earth	66,702.0 acre-feet	N/A*

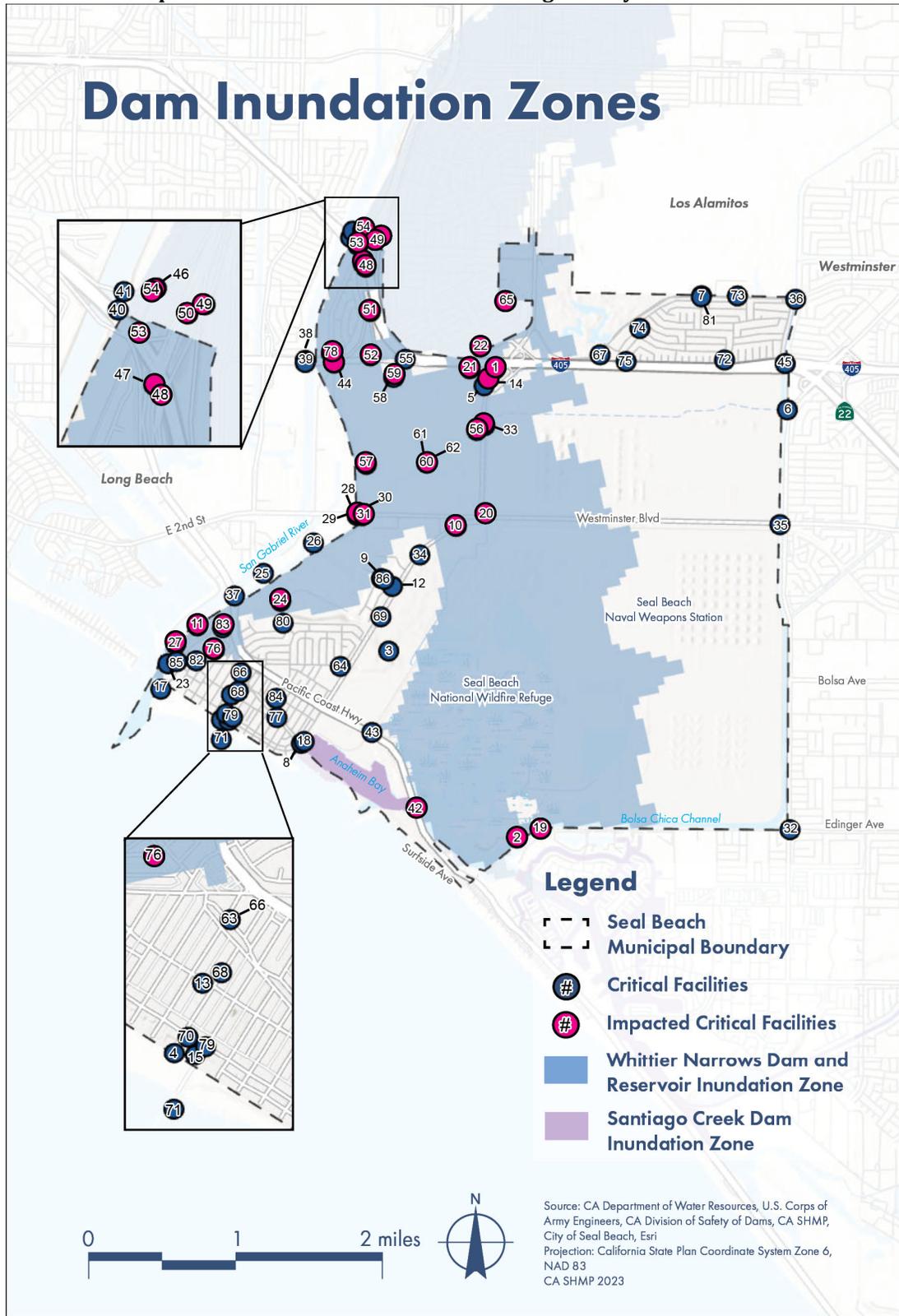
*DSOD does not assign rankings for any dams owned/operated by USACE.

Sources: US Army Corps of Engineers, Dam Safety Mega Projects, <https://www.spl.usace.army.mil/Missions/Mega-Projects/Dam-Safety-Mega-Projects/>, accessed March 5, 2025; California Department of Water Resources, Division of Safety of Dams, *Dams within Jurisdiction of the State of California*, <https://resources.ca.gov/-/media/DWR-Website/Web-Pages/Programs/All-Programs/Division-of-Safety-of-Dams/Files/Publications/DAMS-WITHIN-JURISDICTION-OF-THE-STATE-OF-CALIFORNIA-LISTED-ALPHABETICALLY-BY-COUNTY-SEPTEMBER-2023.pdf>, published September 2023, accessed December 31, 2024.

⁶⁴ US Army Corps of Engineers, *San Gabriel River 1 Levee System, Los Angeles County, California, Periodic Inspection Report No. 2 Generalized Executive Summary*, https://www.spl.usace.army.mil/Portals/17/docs/LeveeSafetyProgram/San_Gabriel_River_1_Levee_System_PI_Report_No_2_ES_U_20170419.pdf, submitted January 2017, accessed January 2, 2025.

Figure 5-10
Upstream Dams and Reservoirs Affecting the City of Seal Beach

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The Whittier Narrows Dam and Reservoir has a larger potential impact zone on the planning area if dam failure occurs at maximum capacity. This Reservoir is located in Los Angeles County, approximately 22 miles north of the City of Seal Beach. This Dam and Reservoir's spillway has a DSAC of 1, representing an extremely high incremental risk due to the potential for significant loss of life and economic damages should failure of the dam occur.⁶⁵ The San Gabriel River and Rio Hondo both flow into the Reservoir, bringing flows collected from a 554 square mile drainage reservoir.⁶⁶ Construction of this dam was completed in October 1957 and is continuously monitored to ensure safety measures are maintained. The USACE recently published the Whittier Narrows Dam Flood Control Project Dam Safety Modification Study Final Environmental Impact Statement as of May 2019 to summarize and compare environmental impacts of dam risk management plans.⁶⁷ As a reservoir with an extremely high downstream hazard potential classification, the magnitude and extent of a failure would potentially be considerable.

The Santiago Creek Dam, also known as the Santiago Dam, is located on unincorporated land in Orange County, approximately 4 miles upstream from the City of Orange and north of the City of Irvine.⁶⁸ The dam's spillway is not considered a critical appurtenant structure (CAS) by DSOD but was included in DSOD's 2017 list of spillways for re-evaluation. The drainage area upstream of the dam is 63.2 square miles. The Santiago Creek Dam forms the Irvine Lake which is filled by natural runoff during the rainy season.

The downstream hazard classification for the dam is extremely high and would potentially impact Anaheim Bay which acts as a deep-water Navy harbor at the bay entrance and Pacific Coast Highway. The Santiago Creek Dam was constructed between 1929 and 1931. As a reservoir with an extremely high downstream hazard potential classification, the magnitude and extent of a failure would potentially be considerable. This could lead to impacted evacuation efforts and transportation or water service disruptions during and after a dam or reservoir failure event.

In the event of an incident at Santiago Creek Dam, any field level response will coordinate with the Unified Command which includes Orange County Sheriff's Department, Orange County Fire Authority, and representatives from IRWD and SWD, in addition to all agencies of downstream jurisdictions including Seal Beach. Actions would be carried out by the Seal Beach Police Department and Orange County Fire Authority. Responsibilities may include:

- Advising threatened populations of the emergency and informing them of safety measures to be implemented
- Dissemination of accurate and timely emergency public information and warning to the public
- Evacuation and rescue operations

⁶⁵ US Army Corps of Engineers, Los Angeles District Website, Dam Safety Mega Projects, <https://www.spl.usace.army.mil/Missions/Mega-Projects/Dam-Safety-Mega-Projects/>, accessed March 5, 2025.

⁶⁶ US Army Corps of Engineers, Los Angeles District Website, *Whittier Narrows Dam*, <https://www.spl.usace.army.mil/Missions/Asset-Management/Whittier-Narrows-Dam/>, accessed February 27, 2025.

⁶⁷ US Army Corps of Engineers, Los Angeles County Drainage Area, Whittier Narrows Dam Flood Control Project Dam Safety Modification Study Final Environmental Impact Statement, published May 2019, accessed March 5, 2025.

⁶⁸ Dam of the World, *Santiago Creek Dam Quick Facts*, <https://damsoftheworld.com/usa/california/santiago-creek-dam/>, accessed December 31, 2024.

- Establish evacuation routes and road closures
- Facilitate return of evacuate individuals
- Access and perimeter control
- Public health operations
- Restoration of vital services and utilities.

5.6.3 PREVIOUS OCCURRENCES

There have been no previous occurrences of dam or reservoir failure within the planning area. However, major dam failures and recent crises in California include the Baldwin Hills Dam failure and the Oroville Dam Crisis. On December 14, 1963, the Baldwin Hills Dam, located in the City of Los Angeles, suffered a catastrophic failure and flooded the surrounding residential areas. The sudden release resulted in five deaths and approximately \$11 million in property damage.⁶⁹ The incident triggered the State of California to update and implement dam safety standards, regulations, and inspection schedule. In the past 50 years, there have been few incidents in California as a result of these regulations.

The most recent major dam incident in California was the Oroville Dam Crisis in 2017.⁷⁰ Erosion at the Oroville Dam emergency spillway threatened the structural integrity of the main weir and gate. Over 188,000 people were evacuated from downstream areas; however, emergency repairs ultimately prevented dam failure. The crisis served as a reminder of the ongoing risk presented by dams and initiated additional inundation mapping and emergency preparedness planning for California dams.

Additionally, there are no previous occurrences involving levee failure in the City. However, in 2017, the USACE identified several levees in the Los Angeles County area, including parts of the San Gabriel River levee system, that required maintenance and upgrades to ensure their reliability. One notable instance of levee failures in history includes the events that occurred during Hurricane Katrina in 2005. The levee system in New Orleans failed in more than 50 locations leading to catastrophic flooding that submerged 80 percent of the City.⁷¹ It is estimated that more than 1,500 people lost their lives due to Hurricane Katrina. Millions became homeless and some 400,000 residents left the City of New Orleans permanently.⁷²

No federally declared disasters related to dam failure events have impacted the planning area within the last five years; refer to Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area.

⁶⁹ Lessons Learned From Dam Incidents and Failures, *Case Study: Baldwin Hills Dam (California, 1963)*, <https://damfailures.org/case-study/baldwin-hills-dam/>, published 2024, accessed January 2, 2025.

⁷⁰ Vox, *The crisis at Oroville Dam*, explained, <https://www.vox.com/science-and-health/2017/2/13/14598042/oroville-dam-flood-evacuation>, published February 15, 2017, accessed January 2, 2025.

⁷¹ History, *How Levee Failures Made Hurricane Katrina a Bigger Disaster*, <https://www.history.com/news/hurricane-katrina-levee-failures>, published August 27, 2020, accessed January 2, 2025.

⁷² Ibid.

5.6.4 PROBABILITY OF FUTURE OCCURRENCES

The Irvine Ranch Water District provides emergency preparedness capabilities for a potential failure of the Santiago Creek Dam in coordination with the Orange County Sheriff's Department (OCSD) and Orange County Fire Authority (OCFA). The USACE has been working on updating the Whittier Dam with the completion year for the Whittier Narrows Dam Project projected for 2031.⁷³ Despite best planning efforts however, dam or reservoir failure resulting in flooding within the community could occur due to severe seismic activity. While the probability of future occurrences remains low, an incident has the potential to be destructive due to the urbanized nature of the City and the proximity to extremely high hazard dams and reservoirs.

Given that the Santiago Creek Dam has a DSOD rating of "poor" and Whittier Narrows Dam and Reservoir has hazard classification of DSAC I, the LHMP planning team determined that the probability of dam/reservoir failure impacting the planning area in the future is considered highly likely. A highly likely probability means a nearly 100 percent probability in the next year, or it happens every year. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that dam failure events will likely affect the planning area in the future and therefore felt "highly likely" best defined probability for this specific hazard. The LHMP planning team assigned a high hazard planning consideration to the hazards and impacts associated with dam reservoir failure based upon a highly likely probability and limited expected impacts of future events.

5.6.5 CLIMATE CHANGE CONSIDERATIONS

Climate change could indirectly increase the likelihood of dam/reservoir infrastructure and levee failure. Increased severe storm events and flooding incidents could increase strain on dam/reservoir infrastructure, including those dams near the City. This is evidenced by the 2017 Oroville Dam Crisis triggered by an unusually high influx of water from snowmelt and repetitive rain events.⁷⁴ These inputs overwhelmed soil storage, leading to extreme runoff and resulting in erosion. Incidents such as this could increase "wear and tear" and require additional maintenance and infrastructure improvements to protect dam integrity and function. Severe storm events and increased temperatures resulting in rapid snowmelt both threaten to overwhelm dams/reservoirs. Severe storm events could also oversaturate soils and compromise dam infrastructure.

5.7 VULNERABILITY ASSESSMENT

5.7.1 MAPPED HAZARDS VULNERABILITY ASSESSMENT

To identify populations at risk for mapped coastal and flooding hazards, hazard data layers were overlaid and compared with City parcel data in Geographic Information Systems, ArcGIS. If a hazard layer either completely or partially overlapped with a parcel in the data layer, then the entire parcel is conservatively considered vulnerable in this analysis. In many instances, the hazard zone intersected with only small portions of individual properties. However, to provide a

⁷³ Pico Rivera, Whittier Narrows Dam Update, <https://www.pico-rivera.org/whittier-narrows-dam-update/>, published March 27, 2023, accessed March 5, 2025.

⁷⁴ UC San Diego, Scripps Institute of Oceanography, *Researchers Identify Factor Behind 2017 Oroville Dam Spillways Incident*, <https://scripps.ucsd.edu/news/researchers-identify-factor-behind-2017-oroville-dam-spillways-incident>, published July 22, 2020, accessed January 2, 2025.

detailed understanding of risk and vulnerability as part of this hazard mitigation plan, these parcels (including all residential and non-residential development on the parcel, regardless of location) are considered vulnerable.

Flood

Flood would potentially impact certain portions of the City of Seal Beach. Transportation is the primary asset type within the flood hazard zone; however, other types of critical facilities have also been identified as vulnerable. Critical facilities located within the flood hazard zone primarily include those that serve as safety and security, food, transportation, water systems, and communication community lifelines. In total, there are 26 vulnerable critical facilities located within the City's flood hazard zone. Critical facilities located within the City's identified flood hazard zone have been listed in [Table 5-8, Critical Facilities in Flood Hazard Zone](#).

Approximately 399 residential units are located within the flood hazard zone. The number of vulnerable residential units multiplied by the average of 1.9 persons per household for Seal Beach indicates that approximately 758 people reside in the flood hazard zone. Additionally, approximately 283,803.38 square feet of non-residential structures are located within the flood hazard area. Refer to [Table 5-9, Populations at Risk in Flood Hazard Zone](#) for a summary of vulnerable residents, residential units, and non-residential buildings.

Table 5-8
Critical Facilities in Flood Hazard Zone

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
4	Sewer lift pump station - 800 Ocean Ave	Water Systems	Water Systems	\$1,050,000
6	Potable water well - 3333 Bolsa Chica Rd	Water Systems	Water Systems	\$400,000
15	Seal Beach Marine Safety Headquarters	Government Services	Safety and Security, Communications	\$3,129,060
16*	OC-35 Import Waterline Turnout	Transportation	Transportation	Not Available
17	Sewer lift station - 1st St	Water Systems	Water Systems	\$1,050,000
19	Bridge to Sunset Aquatic Park (not City-owned)	Transportation	Transportation	Not Available
23	San Gabriel River Bike Trail Entry Point	Transportation	Transportation	Not Available
26	Stormwater Pump Station (County owned)	Water Systems	Water Systems	Not Available
27	Bridge 53C1998 - San Gabriel River (Local)	Transportation	Transportation	\$16,324,000
28	Bridge 55C0041L - Los Alamitos Channel (Local)	Transportation	Transportation	\$1,574,100
29	Bridge 55C0041R - Los Alamitos Channel (Local)	Transportation	Transportation	\$1,574,100

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
32	Bridge 55C0075 - Westminster Channel (Local)	Transportation	Transportation	\$5,281,980
35	Bridge 55C0108 - Bolsa Chica Channel (Local)	Transportation	Transportation	\$5,888,300
36	Bridge 55C0160 - Bolsa Chica Channel (Local)	Transportation	Transportation	\$2,157,100
37	Bridge 53 0060 - San Gabriel River (State)	Transportation	Transportation	\$18,073,000
38	Bridge 53 0302L - San Gabriel River (State)	Transportation	Transportation	\$9,969,300
39	Bridge 53 0302R - San Gabriel River (State)	Transportation	Transportation	\$9,969,300
40	Bridge 53 1185 - San Gabriel River (State)	Transportation	Transportation	\$35,563,000
41	Bridge 53 1737H - San Gabriel River (State)	Transportation	Transportation	\$7,287,500
42	Bridge 55 0010 - Anaheim Bay (State)	Transportation	Transportation	\$16,637,800
44	Bridge 55 0310 - Los Alamitos Channel (State)	Transportation	Transportation	\$9,328,000
45	Bridge 55 0334 - Bolsa Chica Ditch (State)	Transportation	Transportation	\$67,045,000
46	Bridge 55 0347H - Service Rd (State)	Transportation	Transportation	\$378,950
53	Bridge 55 0441 - Los Alamitos Channel (State)	Transportation	Transportation	\$15,158,000
54	Bridge 55 0471H - Los Alamitos Channel (State)	Transportation	Transportation	\$1,107,700
71	Seal Beach Ocean Pier	Seal Beach Ocean Pier	Public Park	Not Available

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**Table 5-9
Populations at Risk for Flooding**

Residents at Risk	Residential Units at Risk	Non-Residential Area at Risk (sq. ft.)
758	399	283,803.38

Other areas vulnerable to flooding include Anaheim Bay, Seal Beach National Wildlife Refuge, the Naval Weapons Station, and beach areas. Flooding could directly impact and cause secondary impacts along the coast of the City. Incidents of severe flooding could also impact the planning area, leading to the displacement of residents and the destruction of homes and businesses. The economic impact would include significant losses in property value, tourism, and local businesses.

Overall, the potential social, economic, and environmental consequences of flooding in the City could be far-reaching and may require investment in mitigation and adaptation strategies.

Sea-Level Rise and Coastal Erosion

Sea-level rise and coastal erosion may primarily impact those that serve as safety and security, food, hydration, shelter, and health and medical community lifelines. In total, there are 17 vulnerable critical facilities located within the City’s 2 ft sea level rise hazard zone and 43 critical facilities within the City’s 6 ft sea level rise hazard zone. Transportation, safety and security, water systems, and communications are the primary asset types within the sea level rise hazard zones. However, other types of critical facilities have been identified as vulnerable. Critical facilities located within the City’s identified sea level rise hazard zones have been listed in Table 5-10, Critical Facilities in Sea level Rise Zone and Potential Coastal Erosion Zones.

There are 1,729 units located within the 2 ft sea level rise zone and 13,015 residential units located in the 6 ft sea level rise hazard zone. The number of vulnerable residential units multiplied by the average of 1.90 persons per household for Seal Beach indicates that there are 3,285.1 individuals residing within the 2 ft sea level rise hazard zone and 13,015 people reside in the 6 ft sea level rise hazard zone. Additionally, approximately 461,128.7 square feet of non-residential structures are located within the 2 ft sea level rise zone and 4,226,960.9 residential units located in the 6 ft sea level rise zone. Refer to Table 5-11, Populations at Risk in Flood Hazard Zone for a summary of vulnerable residents, residential units, and non-residential buildings.

**Table 5-10
Critical Facilities in Sea Level Rise, Coastal Erosion and Coastal Storms Hazard Zone**

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
<i>2 ft Sea Level Rise Zone</i>				
17	Sewer lift station - 1st St	Water Systems	Water Systems	\$1,050,000
19	Bridge to Sunset Aquatic Park (not City-owned)	Transportation	Transportation	Not Available
23	San Gabriel River Bike Trail Entry Point	Transportation	Transportation	Not Available
26	Stormwater Pump Station (County owned)	Water Systems	Water Systems	Not Available
27	Bridge 53C1998 - San Gabriel River (Local)	Transportation	Transportation	\$16,324,000
28	Bridge 55C0041L - Los Alamitos Channel (Local)	Transportation	Transportation	\$1,574,100
29	Bridge 55C0041R - Los Alamitos Channel (Local)	Transportation	Transportation	\$1,574,100

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
30	Bridge 55C0042L - Federal Storm Channel (Local)	Transportation	Transportation	\$1,690,700
31	Bridge 55C0042R - Federal Storm Channel (Local)	Transportation	Transportation	\$1,906,410
37	Bridge 53 0060 - San Gabriel River (State)	Transportation	Transportation	\$18,073,000
42	Bridge 55 0010 - Anaheim Bay (State)	Transportation	Transportation	\$16,673,800
44	Bridge 55 0310 - Los Alamitos Channel (State)	Transportation	Transportation	\$9,328,000
57	Leisure World Clubhouse 2	Community Facility	Safety and Security	Not Available
60	Leisure World Clubhouse 5	Community Facility	Safety and Security	Not Available
61	Leisure World Clubhouse 6	Community Facility	Safety and Security	Not Available
62	Leisure World Healthcare Center	Community Facility	Safety and Security	\$3,000,695
71	Seal Beach Ocean Pier	Public Park	Safety and Security	Not Available
<i>6 ft Sea level Rise Zone</i>				
2	2901 Edinger Ave - Sewer lift pump station	Water Systems	Water Systems	\$1,050,000
4	Sewer lift pump station - 800 Ocean Ave	Water Systems	Water Systems	\$1,050,000
8	Sewer lift pump station - 200 Seal Beach Blvd	Water Systems	Water Systems	\$1,050,000
10	Sewer lift pump station - 2701 Seal Beach Blvd	Water Systems	Water Systems	\$1,050,000
11	43 ½ Riversea Rd - Stormwater pump station	Water Systems	Water Systems	\$1,050,000
15	Seal Beach Marine Safety Headquarters	Government Services	Safety and Security, Communications	\$3,129,060
17	Sewer lift station - 1st St	Water Systems	Water Systems	\$1,050,000
18	Stormwater Pump Station (County owned) - 202 Seal Beach Blvd	Water Systems	Water Systems	Not Available
19	Bridge to Sunset Aquatic Park (not City-owned)	Transportation	Transportation	Not Available

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
20	OC San Regional Wastewater Collections Station (not City-owned)	Water Systems	Water Systems	Not Available
22	OC San Wastewater Station - (3112 Yellowtail, Rossmoor)	Water Systems	Water Systems	Not Available
23	San Gabriel River Bike Trail Entry Point	Transportation	Transportation	Not Available
24	Los Cerritos Wetlands Restoration (not City-owned)	Wetlands	Safety and security	Not Available
25	Hellman Oil Field (not City-owned)	Oil Field	Hazardous Materials	Not Available
26	Stormwater Pump Station (County owned)	Water Systems	Water Systems	Not Available
27	Bridge 53C1998 - San Gabriel River (Local)	Transportation	Transportation	\$16,324,000
28	Bridge 55C0041L - Los Alamitos Channel (Local)	Transportation	Transportation	\$1,574,100
29	Bridge 55C0041R - Los Alamitos Channel (Local)	Transportation	Transportation	\$1,574,100
30	Bridge 55C0042L - Federal Storm Channel (Local)	Transportation	Transportation	\$1,690,700
31	Bridge 55C0042R - Federal Storm Channel (Local)	Transportation	Transportation	\$1,906,410
33	Bridge 55C0104 - Federal Storm Channel (Local)	Transportation	Transportation	\$4,185,940
37	Bridge 53 0060 - San Gabriel River (State)	Transportation	Transportation	\$18,073,000
38	Bridge 53 0302L - San Gabriel River (State)	Transportation	Transportation	\$9,969,300
39	Bridge 53 0302R - San Gabriel River (State)	Transportation	Transportation	\$9,969,300
42	Bridge 55 0010 - Anaheim Bay (State)	Transportation	Transportation	\$16,673,800

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
43	Bridge 55 0065 - Kitt Highway, US Navy RR (State)	Transportation	Transportation	\$6,879,400
44	Bridge 55 0310 - Los Alamitos Channel (State)	Transportation	Transportation	\$9,328,000
56	Leisure World Clubhouse 1	Community Facility	Safety and Security	Not Available
57	Leisure World Clubhouse 2	Community Facility	Safety and Security	Not Available
58	Leisure World Clubhouse 3	Community Facility	Safety and Security	Not Available
59	Leisure World Clubhouse 4	Community Facility	Safety and Security	Not Available
60	Leisure World Clubhouse 5	Community Facility	Safety and Security	Not Available
61	Leisure World Clubhouse 6	Community Facility	Safety and Security	Not Available
62	Leisure World Healthcare Center	Healthcare Facility	Health and Medical	\$3,000,695
63	Mary Wilson Library	Community Facility	Safety and Security, Communications	\$3,271,290
66	Seal Beach Senior Center	Community Facility	Safety and Security; Food, Water, Shelter	\$436,931
71	Seal Beach Ocean Pier	Public Park	Safety and Security	Not Available
76	Corsair Park	Public Park	Safety and Security	\$150,000
77	Electric Avenue Greenbelt	Public Park	Safety and Security	\$3,950,000
78	Edison Park	Public Park	Safety and Security	\$5,000,000
82	Marina Park + Community Center	Public Park	Safety and Security	\$500,000
83	Schooner Park	Public Park	Safety and Security	\$950,000
84	Zoeter Field	Public Park	Safety and Security	\$750,000

Table 5-11

Populations at Risk for Sea Level Rise, Coastal Erosion, and Coastal Storms

Residents at Risk	Residential Units at Risk	Non-Residential Area at Risk (sq. ft.)
<i>2 ft Sea Level Rise Zone</i>		
3,285.1	1,729	461,128.723
<i>6 ft Sea Level Rise Zone</i>		
13,015	6,850	4,226,960.947

Tsunami

Critical facilities located within the tsunami hazard zone primarily include those that serve as safety and security, water systems, transportation, and hazardous materials community lifelines. In total, there are 32 vulnerable critical facilities located within the City's tsunami hazard zone.

Transportation and safety and security are the primary asset types within the tsunami hazard zone, however other types of critical facilities have also been identified as vulnerable. Critical facilities located within the City's identified tsunami hazard zone have been listed in [Table 5-12, Critical Facilities in Tsunami Hazard Zone](#).

Approximately 3,577 residential units are located within the tsunami hazard zone. The number of vulnerable residential units multiplied by the average of 1.90 persons per household for Seal Beach indicates that approximately 6,797 people reside in the tsunami hazard zone. Additionally, approximately 2,388,630.4 square feet of non-residential structures are located within the tsunami hazard area. Refer to [Table 5-13, Populations at Risk for Tsunami](#) for a summary of vulnerable residents, residential units, and non-residential buildings.

Table 5-12
Critical Facilities in Tsunami Hazard Zone

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
2	2901 Edinger Ave - Sewer lift pump station	Water Systems	Water Systems	\$1,050,000
4	Sewer lift pump station - 800 Ocean Ave	Water Systems	Water Systems	\$1,050,000
8	Sewer lift pump station - 200 Seal Beach Blvd	Water Systems	Water Systems	\$1,050,000
11	43 ½ Riversea Rd - Stormwater pump station	Water Systems	Water Systems	\$1,050,000
13	OCFA Fire Station 44	Government Services	Safety and Security, Communications	\$1,630,720
15	Seal Beach Marine Safety Headquarters	Government Services	Safety and Security, Communications	\$3,129,060
17	Sewer lift station - 1st St	Water Systems	Water Systems	\$1,050,000
18	Stormwater Pump Station (County owned) - 202 Seal Beach Blvd	Water Systems	Water Systems	Not Available
19	Bridge to Sunset Aquatic Park (not City-owned)	Transportation	Transportation	Not Available
23	San Gabriel River Bike Trail Entry Point	Transportation	Transportation	Not Available
27	Bridge 53C1998 - San Gabriel River (Local)	Transportation	Transportation	\$16,324,000

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
32	Bridge 55C0075 - Westminster Channel (Local)	Transportation	Transportation	\$5,281,980
37	Bridge 53 0060 - San Gabriel River (State)	Transportation	Transportation	\$18,073,000
38	Bridge 53 0302L - San Gabriel River (State)	Transportation	Transportation	\$9,969,300
39	Bridge 53 0302R - San Gabriel River (State)	Transportation	Transportation	\$9,969,300
40	Bridge 53 1185 - San Gabriel River (State)	Transportation	Transportation	\$35,563,000
41	Bridge 53 1737H - San Gabriel River (State)	Transportation	Transportation	\$7,287,500
42	Bridge 55 0010 - Anaheim Bay (State)	Transportation	Transportation	\$16,673,800
43	Bridge 55 0065 - Kitt Highway, US Navy RR (State)	Transportation	Transportation	\$6,879,400
63	Mary Wilson Library	Community Facility	Safety and Security, Communications; Food Water, Shelter	\$3,271,290
64	McGaugh School	Community Facility	Safety and Security; Communications; Food, Water, Shelter	\$3,771,540
66	Seal Beach Senior Center	Seal Beach Senior Center	Community Facility	\$436,931
68	City Hall	City Hall	Government Building	\$5,120,280
70	Police substation	Police Substation	Municipal Services	Not Available
71	Seal Beach Ocean Pier	Public Park	Safety and Security	Not Available
76	Corsair Park	Corsair Park	Public Park	\$150,000
77	Electric Avenue Greenbelt	Electric Avenue Greenbelt	Public Park	\$3,950,000
79	Eisenhower Park	Eisenhower Park	Public Park	\$700,000
82	Marina Park + Community Center	Community Facility	Safety and Security	\$500,000

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
83	Schooner Park	Public Park	Safety and Security	\$950,000
84	Zoeter Field	Public Park	Safety and Security	\$750,000
85	Beach Maintenance yard	Government Building	Hazardous Materials	\$4,064,100

**Table 5-13
Populations at Risk for Tsunami**

Residents at Risk	Residential Units at Risk	Non-Residential Area at Risk (sq. ft.)
6,797	3,577	2,388,630.4

Dam

Critical facilities located within the dam failure zones primarily include those that serve as safety and security, transportation, food, hydration, and shelter, and health and medical community lifelines. In total, there are 38 vulnerable critical facilities located within the City’s dam failure hazard zones. Transportation and safety and security community lifelines are the primary asset types within the dam failure hazard zones; however, other types of critical facilities have also been identified as vulnerable. Critical facilities located within the City’s identified dam failure hazard zones have been listed in [Table 5-14, Critical Facilities in Dam Failure Hazard Zones](#).

Approximately 7,389 residential units are located within the dam failure hazard zone. The number of vulnerable residential units multiplied by the average of 1.90 persons per household for Seal Beach indicates that approximately 14,039 people reside in the dam failure hazard zones. Additionally, approximately 4,333,474.50 square feet of non-residential structures are located within the dam failure hazard zones. Refer to [Table 5-15, Populations at Risk for Dam Reservoir Failure](#) for a summary of vulnerable residents, residential units, and non-residential buildings.

**Table 5-14
Critical Facilities in Dam Failure Hazard Zones**

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
1	3101 ½ N Gate Rd - Potable water reservoir, well and pump station.	Water Systems	Water Systems	\$2,425,000
2	2901 Edinger Ave - Sewer lift pump station	Water Systems	Water Systems	\$1,050,000
10	Sewer lift pump station - 2701 Seal Beach Blvd	Water Systems	Water Systems	\$1,050,000
11	43 ½ Riversea Rd - Stormwater pump station	Water Systems	Water Systems	\$1,050,000

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
14	OCFA Fire Station 48	Government Services	Safety and Security, Communications	\$1,630,720
19	Bridge to Sunset Aquatic Park (not City-owned)	Transportation	Transportation	Not Available
20	OC San Regional Wastewater Collections Station (not City-owned)	Water Systems	Water Systems	Not Available
21	Leisure World Water Well (inactive)	Water Systems	Water Systems	Not Available
22	OC San Wastewater Station - (3112 Yellowtail, Rossmoor)	Water Systems	Water Systems	Not Available
24	Los Cerritos Wetlands Restoration (not City-owned)	Wetlands	Safety and security	Not Available
27	Bridge 53C1998 - San Gabriel River (Local)	Transportation	Transportation	\$16,324,000
28	Bridge 55C0041L - Los Alamitos Channel (Local)	Transportation	Transportation	\$1,574,100
29	Bridge 55C0041R - Los Alamitos Channel (Local)	Transportation	Transportation	\$1,574,100
30	Bridge 55C0042L - Federal Storm Channel (Local)	Transportation	Transportation	\$1,690,700
31	Bridge 55C0042R - Federal Storm Channel (Local)	Transportation	Transportation	\$1,906,410
33	Bridge 55C0104 - Federal Storm Channel (Local)	Transportation	Transportation	\$4,185,940
42	Bridge 55 0010 - Anaheim Bay (State)	Transportation	Transportation	\$16,673,800
44	Bridge 55 0310 - Los Alamitos Channel (State)	Transportation	Transportation	\$9,328,000
46	Bridge 55 0347H - Service Rd (State)	Transportation	Transportation	\$378,950
47	Bridge 55 0412L - Interstate 405 (State)	Transportation	Transportation	\$19,822,000
48	Bridge 55 0412R - Interstate 405 (State)	Transportation	Transportation	\$11,660,000

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Map ID	Name	Asset Type	Community Lifeline	Replacement Value
49	Bridge 55 0413F - Rte 405, 605, CONN, RIV (State)	Transportation	Transportation	\$44,891,000
50	Bridge 55 0415 - E22 - N405 Connector Ramp (State)	Transportation	Transportation	\$131,175,000
51	Bridge 55 0426G - S605 - S405 Connector (State)	Transportation	Transportation	\$12,458,710
52	Bridge 55 0428G - State Route 22 (State)	Transportation	Transportation	\$26,818,000
53	Bridge 55 0441 - Los Alamitos Channel (State)	Transportation	Transportation	\$15,158,000
54	Bridge 55 0471H - Los Alamitos Channel (State)	Transportation	Transportation	\$1,107,700
56	Leisure World Clubhouse 1	Community Facility	Safety and Security	Not Available
57	Leisure World Clubhouse 2	Community Facility	Safety and Security	Not Available
58	Leisure World Clubhouse 3	Community Facility	Safety and Security	Not Available
59	Leisure World Clubhouse 4	Community Facility	Safety and Security	Not Available
60	Leisure World Clubhouse 5	Community Facility	Safety and Security	Not Available
61	Leisure World Clubhouse 6	Community Facility	Safety and Security	Not Available
62	Leisure World Healthcare Center	Community Facility	Safety and Security	\$3,000,695
65	North Seal Beach Community Center	Community Facility	Safety and Security; Food, Water, Shelter	\$995,610
76	Corsair Park	Public Park	Safety and Security	\$150,000
78	Edison Park	Public Park	Safety and Security	\$5,000,000
83	Schooner Park	Public Park	Safety and Security	\$950,000

**Table 5-15
Populations at Risk for Dam/Reservoir Failure**

Residents at Risk	Residential Units at Risk	Non-Residential Area at Risk (sq. ft.)
14,039	7,389	4,333,474.50

5.7.2 NON-MAPPED HAZARD VULNERABILITY ASSESSMENT

Coastal Storms

Although this hazard is not mapped, the LHMP planning team chose the 2 ft sea-level rise flooding scenario as the City's coastal storm hazard zone to evaluate which critical facilities are vulnerable to coastal storms. This hazard may primarily impact those that serve as safety and security, food, hydration, shelter, and health and medical community lifelines. In total, there are 17 vulnerable critical facilities located within the City's coastal storm zone. Transportation, safety and security, water systems, and communications are the primary asset types within the sea level rise hazard zones. However, other types of critical facilities have been identified as vulnerable. Critical facilities located within the City's identified coastal storm hazard zones have been listed in [Table 5-10](#).

There are 1,729 units located within the 2 ft sea level rise zone while the number of vulnerable residential units multiplied by the average of 1.90 persons per household for Seal Beach indicates that no known persons reside in the 2 ft sea level rise zone. Approximately 461,128.7 square feet of non-residential structures are located within the 2 ft sea level rise zone. Refer to [Table 5-11](#) for a summary of vulnerable residents, residential units, and non-residential buildings.

Coastal Flood

Similarly, although coastal flooding is not mapped, the LHMP planning team chose the 2 ft sea-level rise flooding as the City's coastal flood hazard zone to evaluate which critical facilities are vulnerable to coastal flood. This hazard may primarily impact those that serve as safety and security, food, hydration, shelter, and health and medical community lifelines. In total, there are 5 vulnerable critical facilities located within the City's coastal flood zone. Transportation, safety and security, water systems, and communications are the primary asset types within the 2 ft sea level rise hazard zone. However, other types of critical facilities have been identified as vulnerable. Critical facilities located within the City's identified coastal flood hazard zone have been listed in [Table 5-1, *Critical Facilities in Coastal Flood Hazard Zone \(2 ft Sea Level Rise\)*](#).

There are 1,729 units located within the 2 ft sea level rise zone while the number of vulnerable residential units multiplied by the average of 1.90 persons per household for Seal Beach indicates that no known persons reside in the 2 ft sea level rise zone. Approximately 461,128.7 square feet of non-residential structures are located within the 2 ft sea level rise zone. Refer to [Table 5-19, *Populations at Risk for Coastal Flood Hazard Zone \(2 ft Sea Level Rise\)*](#) for a summary of vulnerable residents, residential units, and non-residential buildings.

5.7.3 CHANGES IN VULNERABILITY FROM PREVIOUS FIVE YEARS

Since the 2019 LHMP, development and land use has not substantially changed in the planning area. In the five years since the approval of the previous LHMP, only one significant housing development was identified in the City's most recent 2021-2029 Housing Element: the construction of approximately thirty single family homes on a former Department of Water and Power (DWP) site at the intersection of Marina Drive and 1st Avenue. Other land use changes since the 2019 LHMP were limited in scope, such as the addition of ADUs, and/or lot line adjustments. As these changes were minor in size and scale, vulnerability is not considered to have significantly changed in the past five years.

As development and land use in the planning area has not substantially changed since the 2019 LHMP, population trends have also remained relatively the same. United States Census Data reports a 2020 population of 25,232 and a 2023 population of 24,868, representing a 1.44 percent population decline. Generally, observed population decline in the planning area is associated with an overall aging population.

5.7.4 CHANGES IN VULNERABILITY FOR FUTURE FIVE YEARS

Looking forward, the City anticipates the majority of population growth would align with the 2021-2029 Housing Element, which proposes to accommodate the City's Regional Housing Needs Allocation of 1,243 units largely at commercial sites which are proposed to be rezoned for mixed use. These areas may be impacted by flooding hazards, especially areas along the coastline areas of the City along with western and northern portions of the City. Based on anticipated growth and development, it is reasonable to assume that vulnerability to coastal and flooding hazards will increase over the 5-year planning period of this LHMP.

5.8 SOCIALLY VULNERABLE POPULATIONS ASSESSMENT

Section 3.7 includes a detailed determination of Socially Vulnerable Populations (SVPs) within the planning area and characteristics that make those populations more vulnerable to hazards. The SVPs include census tracts 995.09, 995.10, 995.02 and the Seal Beach Shores Mobile Home Park. Only census tract 995.10 has areas of vulnerability in the event of a 0.1 percent chance flood. Coastal storms and coastal floods do not have an impact on SVPs using the 2 ft sea level rise flooding model. However, sea level rise and coastal erosion at 6 feet may impact census tracts 995.10, 995.09, 995.02, and the Seal Beach Shores Mobile Home Park. A potential tsunami in a worst-case scenario may impact census tract 995.02 and the Seal Beach Mobile Home Park. Census tracts at risk of dam/reservoir failure in a worst-case scenario include census tracts 995.02, 995.09, 995.10 and Seal Beach Shores Mobile Home Park.

Additionally, SVPs and other high-risk individuals exist throughout the planning area and may be present within coastal and flooding hazard zones despite a census tract's social vulnerability classification. Specific SVPs and high-risk individuals that may be present throughout the planning area and coastal and flooding hazard zones include unemployed individuals, elderly populations aged 65 and older, young populations under age 17, persons with disabilities, persons with high pollution burden, and tourists, seasonal visitors, and homeless populations. The primary concern for SVPs and other high-risk individuals in the City would be evacuation efforts and access to emergency services and supplies, as well as recovery.

Unemployed individuals may be more vulnerable to coastal and flooding hazards as they may be financially limited in resources to prepare for disasters, such as purchasing emergency supplies, securing adequate housing, or evacuating to safer areas with transportation. Additionally, unemployed individuals may have substandard housing or live in flood-prone areas, increasing their risk of exposure to flooding. These populations may not have resources to seek medical care following a coastal and flooding hazard. These social and economic disparities can further hinder their ability to recover, leaving them at greater risk of long-term displacement and financial hardship following a coastal and flooding hazard event.

Young populations under age 17 may be more vulnerable to the impacts of coastal and flooding hazards due to being more susceptible to injuries and illnesses as their bodies are still developing. Younger children may also have limited mobility and awareness to evacuate in time during a disaster and may have a hard time withstanding the force of floodwaters. Younger populations rely heavily on adults for protection, care, and decision-making; thus if parents/guardians/caregivers are affected by a disaster, the child's safety and well-being may be compromised. Additionally, flooding can lead to school closures and displacement, which may disrupt children's education and social development.

Elderly populations aged 65 and older are more vulnerable to coastal and flooding hazard events. Persons aged 65 or older often face several challenges when responding to an emergency, such as mobility challenges, health concerns, social isolation, barriers to transportation, and limited access to information or technology. In addition, there is often overlap between persons aged 65 or older and persons with a disability, as older adults experience increased prevalence of disabilities. This could include cognitive impairment, difficulties with independent living or hearing and vision problems. Lastly, this population may rely on caregivers for their well-being; thus, evacuation may be more difficult if this service is disrupted.

Similarly, persons with disabilities are highly vulnerable to coastal and flooding hazards due to mobility challenges, experiencing difficulty evacuating quickly, or navigating through floodwaters. This population may have more underlying health conditions that can be exacerbated by the stress and demands of a flooding event. This population may face communication barriers as emergency alerts and information may be inaccessible due to limited communication mediums. Coastal and flooding hazards can damage or destroy essential assistive devices such as wheelchairs, hearing aids, communication devices, and other medical technology. Lastly, persons with disabilities may rely on caregiving services, which may be disrupted during a coastal and flooding hazard event, making it much harder to evacuate.

Persons exposed to areas with a high pollution burden are more vulnerable to coastal and flooding hazards due to a variety of factors. Coastal and flooding hazards can further exacerbate populations with high pollution burdens who are already exposed to high pollution levels and have weakened respiratory and cardiovascular systems. Additionally, contaminated floodwaters can further increase their risk of illness. Communities with high pollution often face economic challenges, making it harder to prepare and recover from coastal and flooding hazard events. Lastly, persons dwelling in areas with a high pollution burden may have older, less resilient infrastructure, increasing the likelihood of damage during flooding and ultimately leading to prolonged exposure to hazardous conditions.

Tourists, seasonal visitors, and homeless populations are particularly vulnerable during coastal and flooding hazard events due to their lack of familiarity with the area and lack of established support systems. They may not be aware of evacuation routes or local emergency procedures, making it difficult for them to respond quickly. Additionally, they might not have access to timely information about coastal and flooding hazards and the resources needed to cope with the aftermath. The City hosts multiple community events throughout the year and nearby Huntington Beach and Long Beach are expected to host sizeable events for the upcoming 2028 Olympic Games,

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COASTAL AND FLOODING HAZARDS ASSESSMENT

indicating increased present and future vulnerability. These factors make SVPs throughout Seal Beach especially vulnerable to the impacts of coastal and flooding hazards.

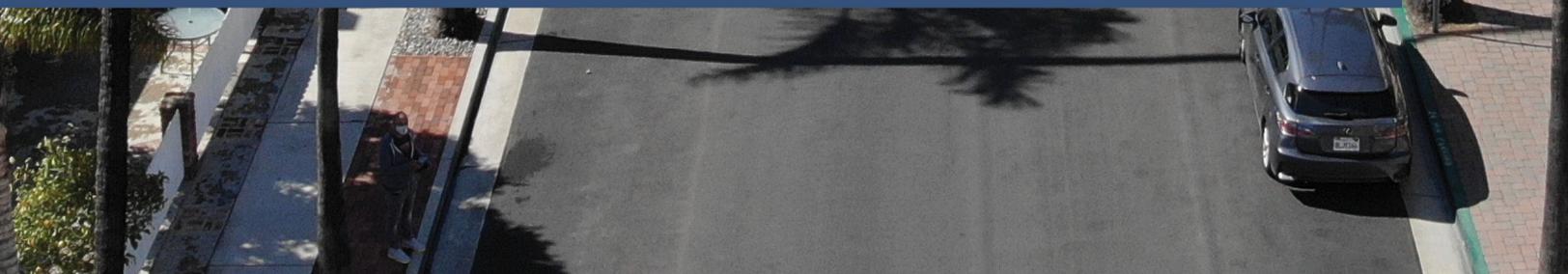
Considerations for SVPs throughout the planning area were incorporated into the mitigation strategy in Section 11, Mitigation Strategy. Specifically, the LHMP Planning Team tailored Mitigation Actions P.1, P.8, 1.8, 5.4, and 5.9 to mitigate hazard impacts to SVPs including issues related to preparedness, evacuation, and access to emergency services.

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6

EXTREME WEATHER HAZARD ASSESSMENT





SECTION 6: EXTREME WEATHER HAZARDS ASSESSMENT

6.1 DROUGHT

6.1.1 DESCRIPTION

Drought is defined as a prolonged period of abnormally low rainfall, leading to a shortage of water. Drought may also be defined by factors other than rainfall, including vegetation conditions, agricultural productivity, soil moisture, water levels in reservoirs, and stream flow. Droughts or water shortages are a gradual phenomenon, often occurring over multiyear periods and increasing with the length of dry conditions. When precipitation is less than normal for a period of time, the flow of streams and rivers declines, water levels in lakes and reservoirs fall, and the depth to water in wells increases. If dry weather persists and water supply problems develop, the dry period can become a drought. The term “drought” can have different meanings depending on how a water deficiency affects day to day activities.

Drought is a complex natural hazard, reflected in the following four common definitions:

- *Agricultural* – Agricultural drought is defined principally in terms of naturally occurring soil moisture deficiencies relative to water demands of plant life, usually arid crops.
- *Hydrological* – Hydrological drought is related to the effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
- *Meteorological* – Meteorological drought is defined solely on the degree of dryness, expressed as a departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
- *Regulatory (or socioeconomic)* – Regulatory drought can occur when the availability of water is reduced due to imposition of regulatory restrictions on the diversion and export of water out of a watershed to another area.

Although climate is a primary contributor to hydrological drought, other factors such as changes in land use (i.e., deforestation), land degradation, and dam construction can affect the hydrological characteristics of a region. Because regions are geographically interconnected by natural systems, drought impacts may extend well beyond the borders of the precipitation-deficient area. Changes in land use upstream may alter hydrologic characteristics such as infiltration and runoff rates, resulting in more variable stream flow and a higher incidence of hydrologic drought downstream. Land use changes can alter water shortage frequencies, even when no change in precipitation occurred.^{1 2}

Droughts cause public health and safety impacts, as well as economic, environmental, and social impacts. Public health and safety impacts are primarily associated with catastrophic wildfire risks and drinking water shortage risks. Examples of other impacts include costs to homeowners due to loss of residential landscaping, degradation of urban environments due to loss of landscaping, agricultural land fallowing and associated job loss, degradation of fishery habitat, and tree mortality with damage to forest ecosystems. Drought conditions can also result in damage to older infrastructure that is located within dry soils with potential to break or crack. Dead or dying vegetation poses a risk to falling and damaging structures and infrastructure systems.

Drought also results in drier brush and an increase in the size and severity of wildfires. Dry brush becomes significantly more flammable and increases the rate of wildfire spread. Extended drought conditions can also create challenges in procuring adequate amounts of water to fight wildfires. Further, water and wastewater infrastructure systems located within areas susceptible to wildfires are at greater risk of being impacted. Damage or failure to water and wastewater infrastructure systems can significantly reduce or even interrupt service to customers. For more on wildfire hazards, refer to Section 9, *Wildfire and Urban Fires*.

6.1.2 LOCATION/EXTENT

Droughts are widespread regional events that affect the entirety of the City of Seal Beach. The geographic extent of drought conditions would extend to every resident within the planning area. Certain areas within the City may experience more severe drought impacts than others.

Drought severity and extent depends on numerous factors including duration, intensity, and geographic extent, as well as regional water supply demands by humans and vegetation. The magnitude of drought is usually measured by time and severity of the hydrologic deficit. The United States Drought Monitor provides weekly data identifying portions of the United States that are experiencing drought. The intensity of drought is categorized as one five classifications: abnormally dry (D0), showing areas that may be going into or are coming out of drought, and four levels of drought: moderate (D1), severe (D2), extreme (D3), and exceptional (D4); refer to Table 6-1, *Drought Severity Classification*.

¹ National Drought Mitigation Center, *Drought Basics*, <https://drought.unl.edu/Education/DroughtBasics.aspx>, accessed December 26, 2024.

² NOAA, *Definition of Drought*, <https://www.ncdc.noaa.gov/monitoring-references/dyk/drought-definition>, accessed December 26, 2024.

**Table 6-1
Drought Severity Classification**

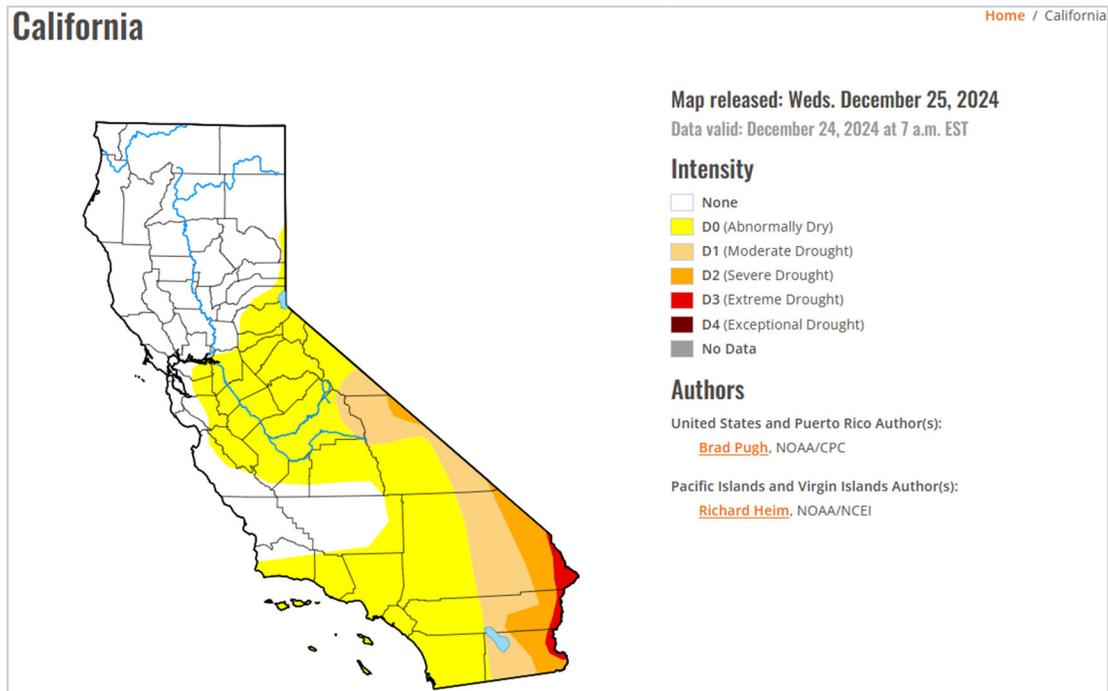
Category	Downstream Hazard Potential Classification	Potential Downstream Impacts to Life and Property
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested.
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed.
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions.
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies.

Source: United States Drought Monitor, *Drought Classification*, <https://droughtmonitor.unl.edu/About/AbouttheData/DroughtClassification.aspx>, accessed December 26, 2024.

Figure 6-1, *Drought Monitor Map*, and Figure 6-2, *Drought Statistics Table*, identifies areas of drought by intensity. As of December 2024, the planning area has been identified as “Abnormally Dry (D0)”, but not subject to drought conditions according to the United States Drought Monitor. The Drought Monitor is not a forecast but looks backward; providing a weekly assessment of drought conditions based on how much precipitation did or did not fall.

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Figure 6-1
Drought Monitor Map



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Figure 6-2
Drought Statistics Table

Week	Date	None	D0-D4	D1-D4	D2-D4	D3-D4	D4	DSCI
Current	2024-12-24	43.49	56.51	16.72	5.70	1.03	0.00	80
Last Week to Current	2024-12-17	43.49	56.51	16.72	5.70	1.03	0.00	80
3 Months Ago to Current	2024-09-24	28.59	71.41	10.67	0.08	0.00	0.00	82
Start of Calendar Year to Current	2023-12-26	96.65	3.35	0.00	0.00	0.00	0.00	3
Start of Water Year to Current	2024-10-01	28.40	71.60	10.67	0.08	0.00	0.00	82
One Year Ago to Current	2023-12-26	96.65	3.35	0.00	0.00	0.00	0.00	3

Source: U.S. Drought Monitor, *California*,
<https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?CA>, accessed December 26, 2024.

6.1.3 PREVIOUS OCCURRENCES

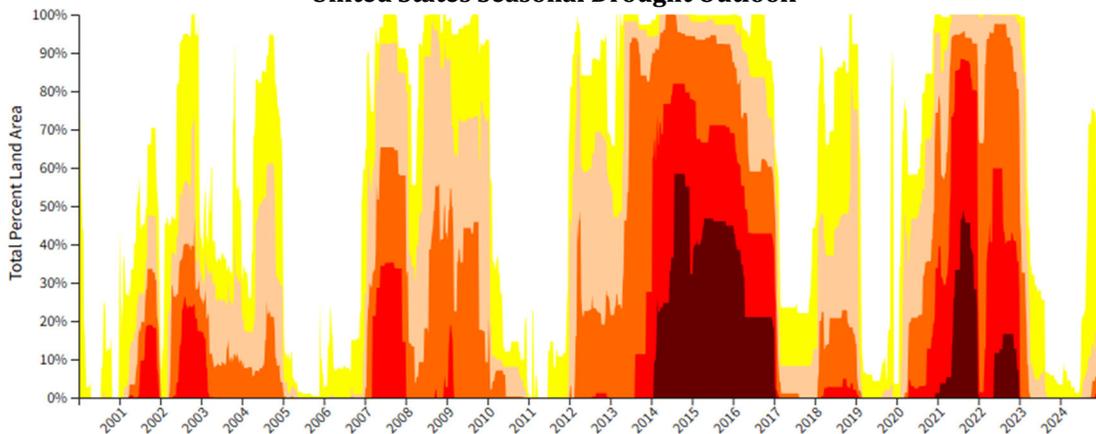
Historically, the City of Seal Beach and County of Orange have faced high susceptibility to the drought hazard. From June 2007 to December 2009, Orange County was classified by the National Drought Monitor as D3: Extreme Drought Conditions before gradually being downgraded to D0: Abnormally Dry conditions in December 2009. A statewide drought declaration was issued by the Governor in June 2008 in response to these conditions.

The most severe drought on record began in 2012 and continued through 2017. On January 17, 2014, the Governor of California declared a State drought emergency, and on April 1, 2015, the Governor announced the first-ever mandatory 25% Statewide water use reduction. As part of this reduction effort, the state proposed a series of actions to help save water, increase enforcement to prevent wasteful water use, streamline the State's drought response, and invest in new

technologies that would make California more drought resilient. At the time of the announcement, the volume of Sierra Nevada snowpack was approximately 14% of normal. By the end of May 2014, all of California was in a condition of “extreme” or “exceptional” drought. At the same time, the volume of the Sierra Nevada snowpack had decreased to less than 10% of normal and water stored in Lake Oroville, the major reservoir for the State Water Project, was at 58% of normal.³ After a series of winter rains, the Governor issued an executive order in April 2017 ending the drought emergency in Southern California, including Orange County.

California saw drought conditions recur during 2020 and 2021. A proclamation of a State of Emergency was made by the Governor of California for Mendocino and Sonoma counties in April of 2021, and the proclamation was expanded during summer 2021 to include the majority of northern and central California.⁴ On October 19, 2021, the State of Emergency was again expanded, this time including Orange County.⁵ After two wet seasons in 2023 and 2024, the State of California no longer suffers from widespread drought and no active National Weather Service drought information statements are active in California.⁶ Figure 6-3, Historical Drought and Rain Cycles in California, shows the historical droughts that have occurred in California from 2000 through the present.

**Figure 6-3
United States Seasonal Drought Outlook**



Source: National Integrated Drought Information System, *California*, <https://www.drought.gov/states/california#historical-conditions>, accessed December 26, 2024.

³ California Department of Water Resources, *California’s Most Significant Droughts: Comparing Historical and Recent Conditions*, <https://cawaterlibrary.net/document/californias-most-significant-droughts-comparing-historical-and-recent-conditions-2/>, February 2015, accessed April 29, 2025.

⁴ Office of Governor Gavin Newsom, *Governor Newsom Expands Drought Emergency to Klamath River, Sacramento-San Joaquin Delta, and Tulare Lake Watershed Counties*, <https://www.gov.ca.gov/2021/05/10/governor-newsom-expands-drought-emergency-to-klamath-river-sacramento-san-joaquin-delta-and-tulare-lake-watershed-counties/>, published May 10, 2021, accessed December 26, 2024.

⁵ Office of Governor Gavin Newsom, *Governor Newsom Expands Drought Emergency Statewide, Urges Californians to Redouble Water Conservation Efforts*, <https://www.gov.ca.gov/2021/10/19/governor-newsom-expands-drought-emergency-statewide-urges-californians-to-redouble-water-conservation-efforts/>, accessed December 26, 2024.

⁶ Drought.gov, *California*, <https://www.drought.gov/states/california#:~:text=There%20are%20no%20active%20National%20Weather%20Service%20drought%20information%20statements%20for%20California,> accessed December 26, 2024.

No federally declared disasters related to drought have impacted the planning area within the last five years; refer to [Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area](#).

6.1.4 PROBABILITY OF FUTURE OCCURRENCES

California weather is classified by a typical dry and wet season. During the wet season, the state relies on heavy precipitation events to constitute the majority of the annual total rainfall, so the absence of any event can significantly impact water availability. Certain atmospheric circulation patterns define California's temperature and precipitation extremes. Examining these patterns, researchers discovered that atmospheric conditions associated with extreme drought have become increasingly common in recent decades.⁷

The United States Seasonal Drought Outlook depicts large-scale trends based on United States Drought Monitor areas (intensities of D1 to D4), as shown in [Figure 6-4, United States Seasonal Drought Outlook](#). The U.S. Seasonal Drought Outlook indicates no drought is likely to affect the City through March 2025.⁸

Impacts of future droughts can be mitigated through water conservation efforts and other waterwise management practices taken by water purveyors. Previous occurrences of drought prompted actions to examine water storage, distribution, management, conservation, and use policies more closely. Water purveyors drafted administrative drought actions and implemented mechanisms allowing for administrative consistency in water conservation and drought regulations.

Based on previous occurrences and climate trends in California, there is a highly likely probability of drought affecting the City in the future, meaning there is a near 100 percent probability that drought may occur in the next year or may happen every year. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that drought events will likely affect the planning area in the future and therefore felt "highly likely" best defined probability for this specific hazard. The LHMP planning team designated a high hazard planning consideration for drought considering the likelihood of future events and historical occurrences.

6.1.5 CLIMATE CHANGE

Climate change is a phenomenon that will likely exacerbate drought hazards. According to the 2023 California State Hazard Mitigation Plan, climate change is expected to affect California's water supply conditions over the long term.⁹ While the City of Seal Beach does not face significant drought vulnerability at this time, the effects of climate change may increase the City's overall

⁷ Stanford News, *California drought patterns becoming more common, Stanford scientists say*, <https://news.stanford.edu/2016/04/01/drought-patterns-change-040116/>, published April 1, 2016, accessed December 26, 2024.

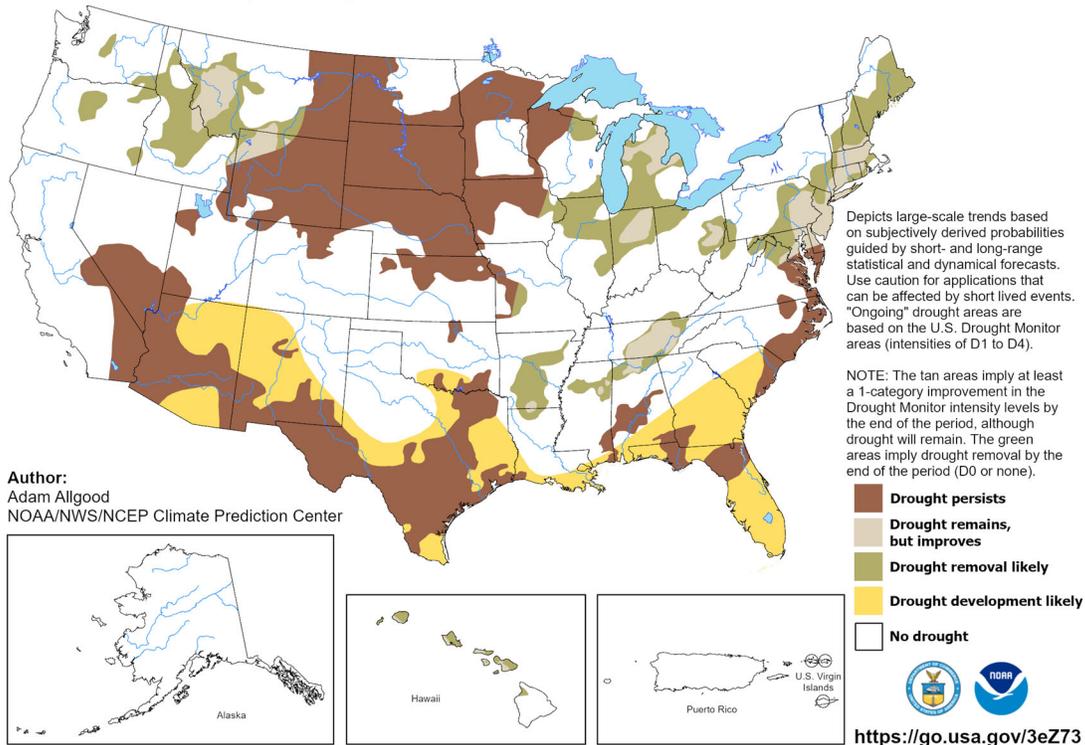
⁸ NWS Climate Prediction Center, *U.S Seasonal Drought Outlook*, https://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php, accessed December 26, 2024.

⁹ Cal OES, *2023 California State Hazard Mitigation Plan*, chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-1_11.10.2023.pdf, accessed December 26, 2024.

vulnerability to the drought hazard through rising temperatures, reduced precipitation, and changes in ocean temperature.

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Figure 6-4
United States Seasonal Drought Outlook
U.S. Seasonal Drought Outlook Valid for December 19, 2024 - March 31, 2025
 Drought Tendency During the Valid Period Released December 19, 2024



Source: National Weather Service Climate Prediction Center, *U.S. Seasonal Drought Outlook*, https://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php, accessed December 26, 2024.

6.2 EXTREME HEAT

6.2.1 DESCRIPTION

Extreme heat conditions refer to temperatures that are significantly higher than average for a particular regional location and time of year. Extreme or excessive heat can be a combination of high heat and high humidity, leading to heat-related illness. The heat index, or the apparent temperature, is what the temperature feels like to the human body when relative humidity and air temperature are both considered. Relative humidity can significantly increase the heat index and contribute to dangerous health conditions.¹⁰ High heat and humidity can cause heat-related illness, including heat cramps, heat exhaustion, and heat stroke.¹¹

¹⁰ National Weather Service, *What is the Heat Index?*, <https://www.weather.gov/ama/heatindex#:~:text=The%20heat%20index%2C%20also%20known,sweat%20to%20cool%20itself%20off.>, accessed December 30, 2024.

¹¹ National Weather Service, *Excessive Heat Conditions*, <https://www.weather.gov/phi/heatcond#Overview>, accessed December 30, 2024.

Extreme heat is location specific and determined based on average temperature for a given location. While there is no universal definition for an extreme heat event, the 2023 California State Hazard Mitigation Plan (SHMP) defines extreme heat as temperatures that hover 10°F or more above the average high temperatures for a region for several days or weeks.¹²

A heat wave is a period of abnormally hot weather generally lasting more than two days.¹³ The threat of extreme heat can be higher in urban areas, where dark-colored roofs and paving materials cause the air temperature to be hotter. The dense concentrations of pavement, buildings, and other surfaces that absorb and retain heat is known as the urban heat island effect.¹⁴

Extreme heat can have a grave effect on the City's urban forestry. This hazard can cause heat stress stunting tree growth, reduced photosynthesis, and increased water loss. Trees can also be more susceptible to pests and disease as trees are in a weakened state due to the heat. As extreme heat can raise soil temperatures, high soil temperature can affect root health and function reducing their ability to absorb water and nutrients.¹⁵

6.2.2 LOCATION/EXTENT

The geographic extent of extreme heat conditions would extend to every resident within the planning area, and extreme heat events typically last for a few days. The National Weather Service (NWS) uses a heat index, or apparent temperature, to help identify extreme heat events and predict extent of potential impacts. The dangers of extreme heat increase with time and exposure, meaning that a prolonged period of extreme heat over just a few days can be particularly dangerous. [Figure 6-5, Heat Index](#), shows the likelihood of heat disorder with prolonged exposure or strenuous activity associated with temperature and relative humidity.

The greatest risks from extreme heat events are health related. Although some heat-related illnesses are often minor and/or temporary such as heat rash, heat cramps, and heat exhaustion, extreme heat can overwhelm the body's ability to maintain a safe internal temperature, causing a person's body temperature to reach dangerous levels. If a person's internal temperature rises to 104 degrees Fahrenheit or above, heatstroke can occur.¹⁶ Heatstroke can cause fainting, seizures, and mental impairment. If left untreated, it may lead to permanent organ damage, coma, or death.

¹² Cal OES, *2023 California State Hazard Mitigation Plan*, https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-1_11.10.2023.pdf, accessed December 30, 2024.

¹³ National Weather Service NOAA, *During a Heat Wave*, <https://www.weather.gov/safety/heat-during>, published 2024, accessed December 30, 2024.

¹⁴ US EPA, *Reduce Urban Heat Island Effect*, <https://www.epa.gov/green-infrastructure/reduce-urban-heat-island-effect#:~:text=%22Urban%20heat%20islands%22%20occur%20when,heat%2Drelated%20illness%20and%20mortality>, accessed December 30, 2024.

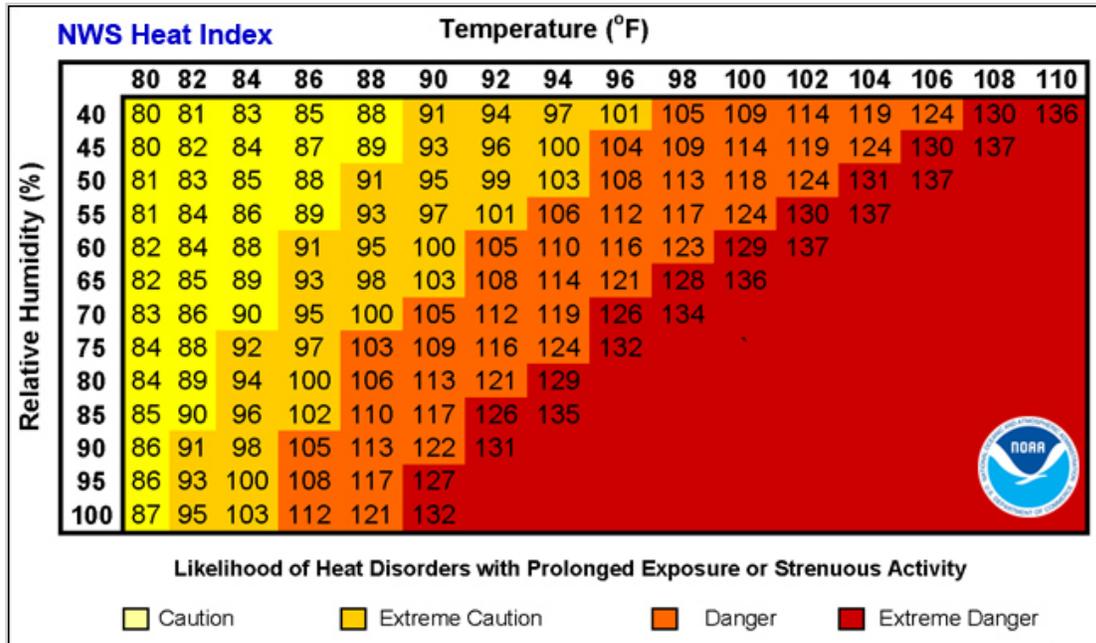
¹⁵ PennState Extension, *Heat Stress in Urban Trees*, <https://extension.psu.edu/heat-stress-in-urban-trees#:~:text=The%20approximate%20thermal%20death%20threshold,F%20to%2085%C2%B0F.>, updated March 7, 2024, accessed January 13, 2025.

¹⁶ Mayo Clinic, *Heat Exhaustion*, <https://www.mayoclinic.org/diseases-conditions/heat-exhaustion/symptoms-causes/syc-20373250>, accessed December 30, 2024.

Extreme heat is unlikely to result in physical damage to structures; however, residents may experience the effects of heat exhaustion or heat stroke. Additionally, the increased use of air conditioning may put stress on the power grid and lead to power outages. The National Weather Service (NWS) provides weather forecasts for jurisdictions out of the San Diego Weather Forecast Office which covers San Diego and Orange Counties. Anticipated extreme heat events would be reported by these weather stations, including specific anticipated duration and severity.

During extreme heat events, the City of Seal Beach opens the local Tennis Center as a public cooling center and may activate additional locations as needed. This facility is accessible to the public and allows service animals.

**Figure 6-5
Heat Index**



Source: National Weather Service, *What is the Heat Index?*, <https://www.weather.gov/ama/heatindex#:~:text=The%20heat%20index%2C%20also%20known,sweat%20to%20cool%20itself%20off>, accessed December 30, 2024.

6.2.3 PREVIOUS OCCURRENCES

Extreme heat events have affected the City of Seal Beach during the summer months in previous years. Table 6-2, *Extreme Heat Events in the City of Seal Beach from 2018 – 2024*, identifies recent hazard events involving extreme heat have affected the planning area:

**Table 6-2
Extreme Heat Events in the City of Seal Beach from 2018 – 2024**

Date	Description
July 2018	Extreme heat and dry conditions across Southern California. ¹⁷

¹⁷ Meteoblue, *Weather Archive Seal Beach*, https://www.meteoblue.com/en/weather/historyclimate/weatherarchive/seal-beach_united-states_5394086, accessed December 30, 2024.

Date	Description
September 2019	Heat, high winds, and low relative humidity affects Southern California. ¹⁸
October 2019	Gusty Santa Ana Winds, hot temperatures, and single-digit relative humidity across Orange County and Southern California.
August 2020	Long duration heat wave affects Orange County.
September 2020	Heat wave affected Los Angeles and Orange County breaking new heat records in cities such as Long Beach.
October 2020	Gusty Santa Ana Winds, high temperatures, and dense fog affected coastal areas of Orange County.
April 2021	A record-breaking heat wave affected Orange County.
June 2021	A long-lasting heat wave swept across Southern California, with isolated thunderstorms producing gusty winds.
August 2021	High temperatures affected the Orange County area from August 1-5, with dense fog affecting coastal communities.
September 2022	Early September heat wave.
July 2023	A long-duration heat event affected Orange County, leading to widespread heat-related incidents reported across the County.
September 2024	Heat wave hits Southern California. ¹⁹

No federally declared disasters related to extreme heat events have impacted the planning area within the last five years; refer to [Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area](#).

6.2.4 PROBABILITY OF FUTURE OCCURRENCES

Seal Beach has historically experienced extreme heat, especially within the past five years. There is highly likely probability of future extreme heat occurrences, meaning a 90 to 100 percent probability of occurrence in the next year or a recurrence interval of less than 1 year. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that extreme heat will likely affect the planning area in the future and therefore felt “highly likely” best defined probability for this specific hazard. The LHMP planning team designated a high hazard planning consideration for extreme heat considering the likelihood for future extreme heat events. Extreme heat events will likely occur with a higher frequency and longer duration as climate change causes increased global temperatures.

6.2.5 CLIMATE CHANGE

Climate change is understood to have a direct impact on temperature. As global temperatures rise, there will be an increased occurrence and prolonged duration of extreme heat events. According to Risk Factor, a hot day in the City of Seal Beach is any day above a “feels like” temperature of

¹⁸ Ibid

¹⁹ ABC7, *Long Beach residents struggle without AC during SoCal heat wave*, <https://abc7.com/post/southern-california-heat-wave-brings-challenges-long-beach-residents-ac/15271186/>, published September 5, 2024, accessed December 30, 2024.

86°F.²⁰ The City of Seal Beach is expected to experience seven hot days this year, and in 30 years the frequency is expected to rise to 22 days above 86°F.

6.3 HEAVY RAINS

6.3.1 DESCRIPTION

Heavy rains refer to events during which the amount of rainfall in a location substantially exceeds normal or typical rainfall conditions. Heavy precipitation is not necessarily an indicator that the total amount of precipitation has increased, rather that precipitation is occurring in more intense events. Changes in precipitation intensity, coupled with changes in the interval between events, can affect overall precipitation totals.²¹ Potential impacts of heavy rains include property damage, soil erosion, and increased flood risk (refer to [Section 5, Coastal and Flooding Hazard Assessment](#)), which in turn contribute to other hazards such as debris flows, flooding, and landslides (refer to [Section 7, Landslide Hazard Assessment](#)). The contribution of heavy rains to other hazards has the potential to cause significant property damage and loss of life within the planning area.

Heavy rains can also contribute to the mortality of an urban forest. This hazard can cause erosion and sediment movement, therefore exposing roots or burying them under excess soil causing the tree stress. Additionally, overly saturated soils prevent the tree from absorbing nutrients properly and root oxygen deprivation.²² Heavy rain can prolong wet conditions in a tree, promoting fungal infections such as root rot and other diseases. These infections can further weaken a tree, making trees more susceptible to other stresses.

6.3.2 LOCATION

An indicator for the extent of a heavy rain season is the Oceanic Niño Index (ONI), used to monitor the El Niño-Southern Oscillation (ENSO). To calculate the ONI, scientists from the National Oceanic and Atmospheric Administration's (NOAA) Climate Prediction Center calculate the average sea surface temperature in the El Niño 3.4 region (area of the east-central equatorial Pacific Ocean) for each month, and then average it with values from the previous and following months. The observed difference from the average temperature in that region, whether warmer or cooler, is the ONI value for that three-month "season". El Niño and La Niña conditions can affect climate conditions in southern California significantly. El Niño causes the Pacific jet stream to move south of the neutral position, often bringing increased precipitation and secondary impacts such as increased flooding. La Niña usually has the opposite effect and causes the Pacific jet stream to move northward. This usually leads to dry and drought-like conditions, along with warmer than normal temperatures during the winter. It is important to note that El Niño and La Niña are only predictors of precipitation in Southern California and may not always result in rainy or dry years.

Typically, municipal drainage infrastructure systems are designed to accommodate heavy rain events. During uncharacteristically heavy storms or rain events (such as those caused by an El

²⁰ Risk Factor, *Does Seal Beach have Heat Risk?*, https://firststreet.org/city/seal-beach-ca/670686_fsid/heat, accessed December 30, 2024.

²¹ US EPA, *Climate Change Indicators: U.S. and Global Heavy Precipitation*, <https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-precipitation>, accessed December 30, 2024.

²² UF ISAF Extension, *We Had Plenty of Rain; Why Are My Trees Dying?*, <https://nwdistrict.ifas.ufl.edu/hort/2013/09/30/we-had-plenty-of-rain-why-are-my-trees-dying/>, published September 30, 2013, accessed January 13, 2025.

Niño weather pattern), these drainage systems may not be sufficient to move stormwater flows and thus, result in flooding (see [Section 5, Coastal and Flooding Hazard Assessment](#)). Severe storms could also cause overtopping of dams or reservoirs or threaten slope stability (see [Section 7, Landslide Hazard Assessment](#)).

The City of Seal Beach typically receives an average rainfall of about 8.82 inches spread over approximately 57.8 days.²³ The wetter seasons last approximately 4.3 months from November 2nd to March 30th.²⁴ The City typically sees the greatest amount of rainfall in February with an average of 5.5 rainy days.²⁵ Incidents of heavy rainfall during storm events have the potential to affect the entirety of the planning area.

6.3.3 PREVIOUS OCCURRENCES

While heavy rains are not common, a few events in recent history have impacted the City. [Table 6-3, Heavy Rain Events in the City of Seal Beach from 2018 – 2024](#), identifies recent hazard events involving heavy rain that have affected the planning area. Additionally, College Park East has restrictive storm drain infrastructure exceeding a 5-year storm event which worsens flooding during heavy rain events. Thus, a subcommittee was formed as a result of the 2023-2024 winter for this area.

Table 6-3
Heavy Rain Events in the City of Seal Beach from 2018 – 2024

Date	Description
January 2019	Heavy rains caused flooding in Seal Beach. ²⁶
July 2021	Monsoon rainstorms Seal Beach with flash flood watches and power outages. ²⁷
December 2021	Winter storm estimated to bring 3 inches of rain to the City. ²⁸
September 2022	Tropical Storm Kay dropped heavy rains over the City. The parking lot of the Beach House restaurant was filled with 6 inches. ²⁹
December 2022	Heaps of debris flowed down San Gabriel River washing up on Seal Beach. ³⁰

²³ Weather Atlas, *Climate and monthly weather forecast Seal Beach, CA*, <https://www.weather-atlas.com/en/california-usa/seal-beach-climate>, updated August 10, 2024, accessed December 30, 2024.

²⁴ Weather Spark, *Climate and Average Weather Year Round in Seal Beach*, <https://weatherspark.com/y/1657/Average-Weather-in-Seal-Beach-California-United-States-Year-Round>, accessed December 30, 2024.

²⁵ Ibid.

²⁶ CBS, *Heavy Rain Causes Major Flooding in Long Beach, Seal Beach*, <https://www.cbsnews.com/losangeles/news/flooding-long-beach-seal-beach/>, published January 16, 2019, accessed January 7, 2025.

²⁷ Patch, *Monsoon Wakes Seal Beach: Flash Flood Watches, Power Outages*, <https://patch.com/california/losalamitos/monsoon-storm-seal-beach-flash-flood-watches-power-outages>, posted July 26, 2021, accessed January 6, 2025.

²⁸ Patch, Seal Beach, *Los Alamitos Residents Prepare for Heavy, Wind & Flooding Tuesday*, published December 13, 2021, accessed January 6, 2025.

²⁹ Los Angeles Daily News, *Kay, morphing from a tropical storm, pulls its punch: just minor flooding in some Southern California spots*, <https://www.dailynews.com/2022/09/10/tropical-storm-kay-brings-minor-flooding-damage-to-southern-california/>, published September 10, 2022, accessed January 6, 2025.

³⁰ The Orange County Register, *Junk litters Seal Beach after big rain washes train down San Gabriel River*, <https://www.ocregister.com/2022/12/13/first-flush-washes-trash-down-the-san-gabriel-river-straight-to-the-ocean/>, updated December 14, 2022, accessed January 6, 2025.

Date	Description
February 2023	A storm brought heavy rain, strong winds, and high surf to the City. ³¹
March 2023	Heavy rains storms cause flooding throughout Orange County region. ³²
August 2023	Tropical Storm Hilary brought significant rainfall to the area, with Seal Beach receiving around 2.92 inches of rain. ³³
February 2024	A heavy rainstorm led to significant flooding in Seal Beach, causing street closures and disruption to local businesses and residences. ³⁴
November 2024	College Park East experienced constant flooding as the area lacks stormwater drainage and expressed concerns for new development in Los Alamitos. ³⁵ As a result of storm conditions during the winters of 2023 and 2024, the Seal Beach Ad Hoc Street and Storm Drain Committee was formed.

Two federally declared disasters related to heavy rain events have impacted the planning area within the last five years:

- DR-4699-CA – Severe Winter Storms, Straight-line Winds, Flooding, Landslides, and Mudslides
- DR-4769-CA – Severe Winter Storms, Tornadoes, Flooding, Landslides, and Mudslides

For additional information on federal disaster declarations impacting the planning area, refer Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area.

6.3.4 PROBABILITY OF FUTURE OCCURRENCES

Based on previous occurrences and the seasonal climate of the area, there is a likely probability of future heavy rain impacts in the future. A likely probability means there is 10 to 100 percent probability in the next year or a recurrence interval of 10 years or less. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that heavy rain events will likely affect the planning area in the future and therefore felt “likely” best defined probability for this specific hazard. The LHMP planning team assigned a high

³¹ City of Seal Beach Press Release, *Heavy Rain, Wind, Surf, and Cold Expected*, <https://www.sealbeachca.gov/Portals/0/Documents/NewsHighlights/City%20of%20Seal%20Beach%20Press%20Release%20-%20Heavy%20Rain,%20Wind,%20Surf,%20and%20Cold%20Expected.pdf>, released February 21, 2023, accessed January 6, 2025.

³² Patch, *How Many Inches of Rain Fell in Seal Beach During Three-Day Storm?*, <https://patch.com/california/losalamitos/how-many-inches-rain-fell-seal-beach-during-three-day-storm>, published March

³³ Patch, *Seal Beach Rainfall Totals from Tropical Storm Hilary: Cleanup Ensues*, <https://patch.com/california/losalamitos/seal-beach-rainfall-totals-tropical-storm-hilary-cleanup-ensues>, published August 21, 2023, accessed January 6, 2025.

³⁴ CBS News, *Seal Beach businesses, residents cope with aftermath of flooding*, <https://www.cbsnews.com/losangeles/news/orange-county-sees-rain-during-storm/>, updated February 2, 2024, accessed January 6, 2025.

³⁵ ABC 7, *Seal Beach residents fear housing development in nearby Los Alamitos will worsen flooding*, <https://abc7.com/post/seal-beach-residents-fear-housing-development-project-nearby-los-alamitos-will-worsen-flooding/15561180/>, published November 21, 2024, accessed June 10, 2025.

hazard planning consideration to the hazards and impacts associated with heavy rain events based upon a likely probability and limited impacts of future events.

6.3.5 CLIMATE CHANGE

Climate change will affect the frequency and intensity of heavy rain events, causing secondary impacts such as flooding. As global temperatures increase, the average amount of moisture in the air will increase. This in turn leads to more severe storms including increased precipitation that ultimately leads to heavy rain events and associated hazards. Climate change is expected to exacerbate the impacts of severe storm-related impacts including incidents of heavy rain in the planning area.

6.4 SANTA ANA WINDS AND TORNADOES

6.4.1 DESCRIPTION

According to the National Weather Service (NWS), Santa Ana Winds occur when air from a region of high pressure over the dry, desert region of the southwestern U.S. flows westward towards low pressure located off the California coast.³⁶ This creates dry winds that flow east to west through the mountain passages in Southern California. These winds are most common during the cooler months of the year, occurring from September through May. Santa Ana winds typically feel warm (or even hot) because as the cool desert air moves down the side of the mountain, it is compressed, which causes the temperature of the air to rise. These strong winds can cause major property damage and increase wildfire risk because of the dryness of the winds and the speed at which they can spread a flame across the landscape.

Severe incidents of Santa Ana Winds may pose a significant risk to life and property by creating conditions that disrupt essential systems such as public utilities, telecommunications, and transportation routes. Destructive impacts to trees, power lines, and utility services also are associated with high winds. Falling trees can occasionally cause fatalities and serious structural damage and fallen power lines could cause widespread power outages and fire.

Tornadoes are rapidly rotating columns of air with circulation reaching the ground; they nearly always start as a funnel cloud and may be accompanied by a loud roaring noise.³⁷ Tornadoes that form over water are called waterspouts. Waterspouts fall into two categories: fair weather waterspouts and tornadic waterspouts. Fair waterspouts usually form along the dark flat base of a line of developing cumulus cloud and are generally formed in light wind conditions, so they only move minimally.³⁸ Tornadic waterspouts are tornadoes that form over water or move from land to water and have the same characteristics as a land tornado.³⁹ Tornadic waterspouts are

³⁶ National Weather Service, *Mountain and Valley Winds*, <https://www.weather.gov/safety/wind-mountain-valley>, accessed December 30, 2024.

³⁷ NOAA, *NOAA's National Service Weather - Glossary*, <https://forecast.weather.gov/glossary.php?word=tornado>, accessed January 6, 2025.

³⁸ Rochester, *Waterspouts defined: Aren't they just tornadoes on water?*, <https://www.rochesterfirst.com/weather/waterspouts-defined-arent-they-just-tornadoes-on-water/>, published October 13, 2024, accessed January 6, 2025.

³⁹ NOAA, *What is a waterspout?*, <https://oceanservice.noaa.gov/facts/waterspout.html>, last updated June 16, 2024, accessed January 6, 2025.

associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Although many trees need wind for strengthening their structure, root development, and seed and pollen dispersal, high winds may cause severe damage to a tree. Strong winds can cause branches and limbs to break or split, especially in trees with brittle wood. This hazard can also uproot trees, causing trees to fall or strip leaves from the canopy, reducing the tree’s ability to photosynthesize. Winds can damage the tree’s vascular system which is responsible for transporting water and nutrients.

6.4.2 LOCATION

Wind events such as the Santa Ana Winds typically impact large areas and can potentially impact any region of the planning area. Depending on the conditions of the wind event, impacts could be widespread or localized. The City of Seal Beach experiences significant seasonal variation in average wind speed, with the windiest parts of the year (November to May) yielding an average wind speed of 6.6 mph.⁴⁰ The windiest month of the year tends to be December, with an average hourly speed of 8.0 miles per hour.⁴¹

During a severe wind event, the Santa Ana Winds can reach a wind speed of up to 115 mph.⁴² Santa Ana Wind events can result in damaged buildings and infrastructure, damaging personal property including vehicles and homes. Downed trees, damaged power lines, and power outages may also affect residents within the City of Seal Beach. Table 6-4, Beaufort Wind Scale, relates wind speed to observed conditions and is used to measure the intensity of wind events up to 74 miles per hour.

**Table 6-4
Beaufort Wind Scale**

Beaufort Scale	Wind Speed	Description
0: Calm	Less than 1 mph	Smoke rises vertically.
1: Light air	1 to 3 mph	Direction shown by smoke drift but not by wind vanes.
2: Light breeze	4 to 7 mph	Wind felt on face; leaves rustle; wind vane moved by wind.
3: Gentle breeze	8 to 12 mph	Leaves and small twigs in constant motion; light flags extended.
4: Moderate breeze	13 to 18 mph	Raises dust and loose paper; small branches moved.
5: Fresh breeze	19 to 24 mph	Small trees in leaf begin to sway; crested wavelets form on inland waters.
6: Strong breeze	25 to 31 mph	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.

⁴⁰ Weather Spark, *Climate and Average Weather Year Round In Seal Beach*, <https://weatherspark.com/y/1657/Average-Weather-in-Seal-Beach-California-United-States-Year-Round>, accessed December 30, 2024.

⁴¹ Ibid.

⁴² Rancho Santiago Community College District, *Section IV-F – Severe Weather/Santa Ana Winds*, <https://www.rscdd.edu/Departments/Risk-Management/Documents/Risk%20Management/IV-F%20Windstorms.pdf>, accessed December 30, 2024.

Beaufort Scale	Wind Speed	Description
7: Near gale	32 to 38 mph	Whole trees in motion; inconvenience felt when walking against the wind.
8: Gale	39 to 46 mph	Twigs break off trees; generally impedes progress.
9: Strong gale	47 to 54 mph	Slight structural damage (chimney pots and slates removed).
10: Storm	55 to 63 mph	Seldom experienced inland; trees uprooted; considerable structural damage.
11: Violent storm	64 to 72 mph	Very rarely experienced; accompanied by widespread damage.
12: Hurricane	73 mph and above	Devastation.

Source: National Weather Service, *Beaufort Wind Scale*, <https://www.weather.gov/mfl/beaufort>, accessed December 30, 2024.

The specific magnitude, severity, and actual impacts from wind events in the City can vary greatly depending on sustained windspeed and event duration. Though tornadoes are rare in the City of Seal Beach, the City is ranked as #30 on the Tornado Index relative to cities in California.⁴³ Although rare, tornadic waterspouts and fair-weather waterspouts are possible in the City's coastline.

6.4.3 PREVIOUS OCCURRENCES

The City of Seal Beach is relatively flat with an average elevation of about 13 feet above sea level, and the Santa Ana Winds can significantly increase in speed to reach 20 – 30 mph or higher in the City. Wind events specifically related to the Santa Ana winds are likely to peak between the months of September to December.

Table 6-5, Santa Ana/High Wind Events in the City of Seal Beach from 2018 – 2024, identifies recent hazard events involving the Santa Ana Winds or other notable high wind events have affected the planning area:

Table 6-5
Santa Ana/High Wind Events in the City of Seal Beach from 2018 – 2024

Date	Description
October 25, 2019	Orange County saw wind gusts up ranging from 35-49 miles per hour. ⁴⁴
December 3, 2020	Orange County saw wind speeds ranging from 40-79 mph. ⁴⁵
December 24, 2021	After an atmospheric river impacted Southern California, strong wind gusts impacted communities across coastal Orange County.

⁴³ USA.com, *Seal Beach, CA Natural Disasters and Weather Extremes*, <http://www.usa.com/seal-beach-ca-natural-disasters-extremes.htm>, accessed January 6, 2025.

⁴⁴ Patch, *Wind Speeds in Orange County: How Windy Was It?*, <https://patch.com/california/orange-county/wind-speeds-orange-county-how-windy-was-it>, published October 25, 2019, accessed January 7, 2025.

⁴⁵ Patch, *Orange County Santa Ana Wind Speeds Calculated*, <https://patch.com/california/orange-county/orange-county-santa-ana-wind-speeds-calculated>, published December 3, 2020, accessed January 7, 2025.

Date	Description
January 27, 2022	Wind advisory in Orange County including the City of Seal Beach. ⁴⁶
February 21, 2023	Strong winds impacted the Orange County Coastline. ⁴⁷
March 13, 2024	Strong Santa Ana Winds impacted coastal portions of Orange County. Peak wind gusts reached 20-40mph.
August 18, 2023	Hurricane Hilary increased high winds throughout Southern California.
November 6, 2024	Santa Ana wind conditions impacted much of Southern California. ⁴⁸
December 9, 2024	Red flag warning issues for Southern California with strong winds and dangers for fire, however coastline reaching up to 30 mph. ⁴⁹
January 7, 2025	Southern California faced a major Santa Ana windstorm with gusts of 50-70 mph forecasted. ⁵⁰ This windstorm lasted several days.

Two federally declared disasters related to Santa Ana Winds or other notable high wind events have impacted the planning area within the last five years:

- DR-4699-CA – Severe Winter Storms, Straight-line Winds, Flooding, Landslides, and Mudslides
- DR-4769-CA – Severe Winter Storms, Tornadoes, Flooding, Landslides, and Mudslides

For additional information on federal disaster declarations impacting the planning area, refer to Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area.

There have been 7 historical tornado events that yielded a recorded magnitude of 2 or above in or near the City of Seal Beach.⁵¹ The nearest tornado occurred 6.4 miles from the City, and was 1,300 yards wide, 10 miles long, and resulted in \$2.5 million in damages.

⁴⁶ Patch, *30 mph Winds in Seal Beach and Los Alamitos, Wind Advisory in OC*, <https://patch.com/california/losalamitos/30-mph-winds-seal-beach-los-alamitos-wind-advisory-oc>, published January 27, 2024, accessed December 30, 2024.

⁴⁷ CBS News, *Winter storm: Heavy wind, snow in Southern California*, <https://www.cbsnews.com/losangeles/live-updates/winter-storm-heavy-wind-rain-and-snow-in-southern-california/>, published February 25, 2023, accessed December 31, 2024.

⁴⁸ Los Angeles Daily News, *Dangerous Santa Ana winds batter Southern California, boosting fire danger*, <https://www.dailynews.com/2024/11/06/dangerous-santa-ana-winds-batter-southern-california-boosting-fire-danger/>, published November 6, 2024, accessed December 30, 2024.

⁴⁹ Orange County Register, *Red flag warning issued for Southern California, with strong winds, fire dangers foreseen*, <https://www.ocregister.com/2024/12/06/southern-california-fire-danger-rising-due-to-warm-dry-santa-ana-winds/>, updated December 9, 2024, December 30, 2024.

⁵⁰ Newsweek, *Santa Ana Winds: What's Causing California's 'Life Threatening Storm'?*, <https://www.newsweek.com/santa-ana-winds-california-what-causing-life-threatening-storm-2010819>, published January 7, 2025, accessed January 7, 2025.

⁵¹ USA.com, *Seal Beach, CA Natural and Weather Extremes*, <http://www.usa.com/seal-beach-ca-natural-disasters-extremes.htm>, accessed January 3, 2025.

6.4.4 PROBABILITY OF FUTURE OCCURRENCES

Santa Ana Wind events are probable events each year within the City of Seal Beach, with historical occurrences of Santa Ana Wind events indicating a likelihood for future events. High winds can exacerbate the risk of significant wildfires, making wind events of particular concern for the future.

There is a highly likely probability of future occurrences, meaning a 90 to 100 percent probability of occurrence in the next year or a recurrence interval of less than 1 year. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that Santa Ana wind events will likely affect the planning area in the future and therefore felt “highly likely” best defined probability for this specific hazard. The LHMP planning team designated a high hazard planning consideration for Santa Ana Wind events after considering the future probability and potential impacts to interrupt communication lines, exacerbate wildfire, and result in power outages.

6.4.5 CLIMATE CHANGE

It is anticipated that wind patterns and development may be altered due to climate change. The resulting change is expected to cause an increase in the number of intense storms, which could in turn lead to an increase in the frequency of strong wind events such as Santa Ana Wind events.

According to the Southwest Climate Adaptation Science Center, climate change is expected to lead to overall decreases in Santa Ana Wind events during the early fall and late spring of each year.⁵² This projection describes decreases in frequency during these months, rather than decreasing intensity of the wind events. The peak of the Santa Ana Wind season (November through January) is expected to be least affected by climate change according to climate projections.

6.5 PUBLIC SAFETY POWER SHUTOFF (PSPS)

6.5.1 DESCRIPTION

Power outages are a major secondary effect of severe weather events in the City. An outage could result in damaged power equipment or equipment failures and can affect multiple jurisdictions for hours. This type of event can range from a moderate event to a catastrophic regional event that may threaten human life, safety, and health, or interfere with vital services.

During severe weather incidents such as high winds, extreme heat, or severe flooding, Southern California Edison (SCE) may implement an operational practice called Public Safety Power Shutoffs (PSPS) to preemptively shut off power in high-risk areas during potentially dangerous conditions. This program is designed to proactively prevent SCE facilities from starting a wildfire in at-risk areas when winds and temperatures are high.

⁵² University of Arizona, *Climate Change Suppresses Santa Ana Winds of Southern California and Sharpens Their Seasonality*, [6-19](https://swcasc.arizona.edu/publication/climate-change-suppresses-santa-ana-winds-southern-california-and-sharpens-their#:~:text=Climate%20Change%20Suppresses%20Santa%20Ana%20Winds%20of%20Southern%20California%20and%20Sharpens%20Their%20Seasonality,-Reference&text=We%20downscale%20Santa%20Ana%20winds,climatology%20over%20the%20historical%20period., published 2019, accessed July 9, 2024.</p>
</div>
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Strong Santa Ana winds, high temperatures, and low humidity are all severe weather conditions that could trigger a PSPS event. It is possible for extreme weather incidents outside of the City to trigger a PSPS that affects the service area (i.e., strong winds affecting regional infrastructure that powers SCE). The frequency of these events depends on the weather and environmental factors, and SCE makes decisions based on internal threat thresholds, assessment of real-time information, and situational awareness data. When possible, SCE intends to notify customers prior to a PSPS event. When weather forecasts indicate extreme fire conditions, SCE begins predictive modeling to assess the potential impacts while monitoring weather watch alerts from the National Weather Service. Three days prior to the forecasted PSPS, SCE would coordinate first with local governments, the emergency management community, first responders, and other critical infrastructure/service providers. Two days prior to the forecasted PSPS, notices would go out to SCE customers with a follow-up one day before the notice of power shutoff. It is noted that actual or sudden onset of extreme weather conditions could impact the intended coordination and notification efforts.⁵³

Outside of the PSPS events, there is the potential for unplanned power outages to occur within Seal Beach. SCE defines a major outage as a large, unexpected outage caused by either accidents or natural disasters. While uncommon, loss of electrical power is a potential secondary effect of heavy rains or strong winds. Other types of events that could occur include mechanical power failure due to aging equipment.

6.5.2 LOCATION

PSPS events often target wildland areas with high wildfire risk, but they can impact a much wider region. The targeted area is the area at risk due to weather conditions, especially during severe storm events in the planning area. Given the long, connected nature of power supply systems, a shutoff event targeted at a small at-risk zone can affect power in larger, neighboring areas.

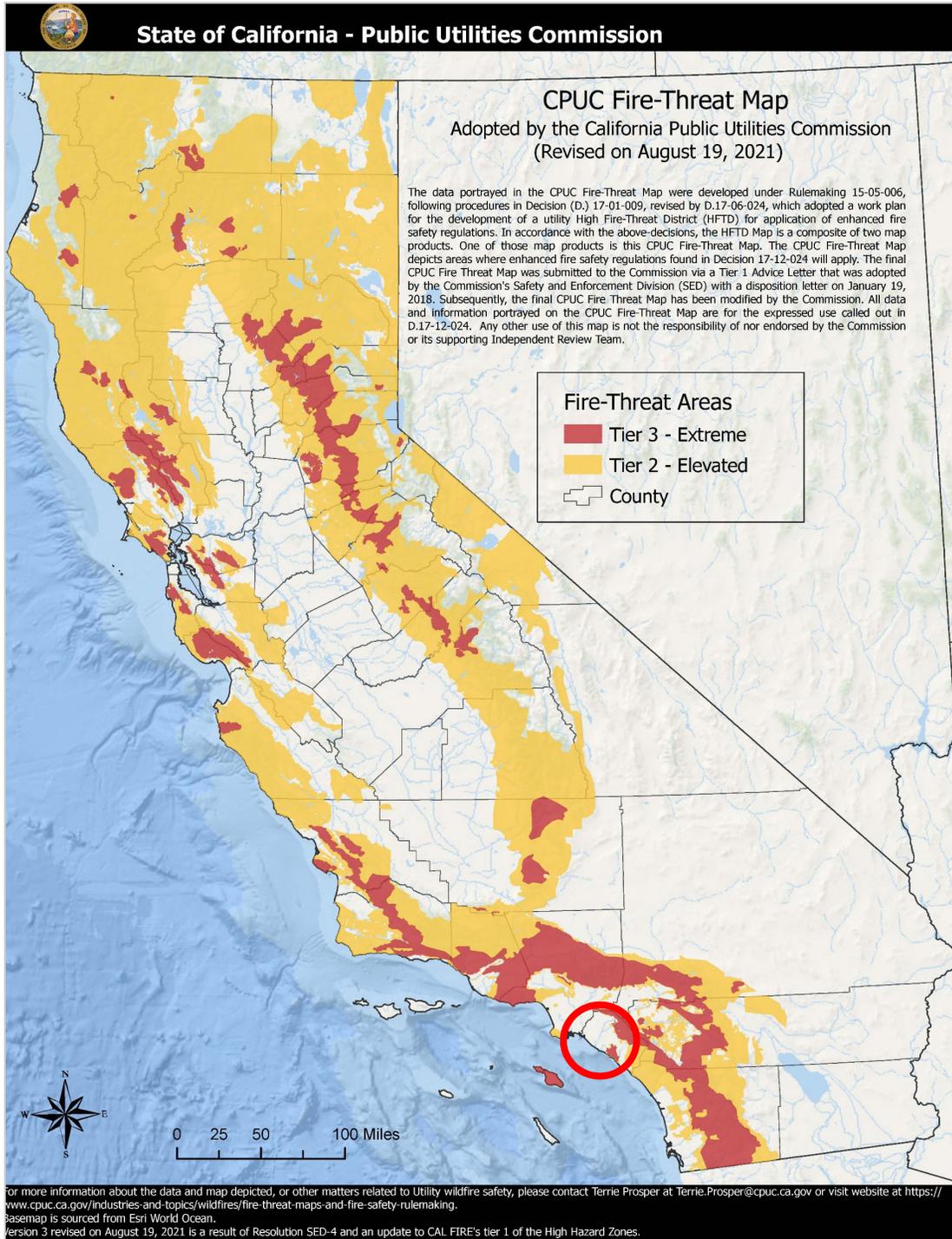
SCE designates High Fire Risk Areas as areas with circuits within California Public Utilities Commission's (CPUC) Tier 2 (elevated risk) and Tier 3 (extreme risk) Fire Threat Areas. The CPUC Fire-Threat Map was developed with input from the U.S. Forest Service, California Department of Forestry and Fire Protection, and the State's investor-owned utilities, including SCE. SCE uses their own thresholds prior to initiating a PSPS event. When evaluating weather and environmental conditions, SCE considers a variety of factors which include but are not limited to:

- National Weather Service Red Flag Warnings
- SCE meteorological assessments
- SCE Fire Potential Index
- SCE Fire Scientist assessments
- Real-time situational awareness information
- SCE Fire Management/Office of Emergency Management input
- Concerns from local or State fire authorities
- Mandatory or voluntary evacuation orders in place
- Expected impact of de-energizing circuits on essential services (including public safety agencies, water pumps, traffic controls, etc.)

⁵³ Southern California Edison, *Public Safety Power Shutoff*, <https://www.sce.com/wildfire/psps>, accessed December 30, 2024.

- Other operational considerations to minimize wildfire ignitions.

Figure 6-6
CPUC Fire-Threat Map



Michael Baker International, Inc.

Note: Red circle indicates the approximate location of the City of Seal Beach.

The magnitude or extent of impacts to the City would depend on the duration of the outage and the size of the impacted area.

6.5.3 PREVIOUS OCCURRENCES

At this time, the City of Seal Beach does not have a history of PSPS events. No PSPS events have affected the City in recent history. Overall, short-term power losses have primarily occurred as isolated incidents, without major impacts to the City.

No federally declared disasters leading to PSPS have impacted the planning area within the last five years; refer to Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area.

6.5.4 PROBABILITY OF FUTURE OCCURRENCES

Based on previous occurrences, there is a highly likely probability of future PSPS events in the future. A highly likely probability means there is a nearly 100 percent probability of occurrence in the next year or a recurrence interval of nearly every year. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that PSPS events will likely affect the planning area in the future and therefore felt “highly likely” best defined probability for this specific hazard. The LHMP planning team assigned a medium hazard planning consideration to the hazards and impacts associated with PSPS events based upon a highly likely probability and limited primary impacts of future events.

6.5.5 CLIMATE CHANGE

As the effects of climate change continue to be observed, PSPS events are expected to increase as hazard events continue to be exasperated due to the effects of climate change. In recent years, PSPS events have been increasingly utilized in California as climate change, wildfire fuel accumulation, and expanded development of fire-prone lands increase the risk of wildfire events.⁵⁴ In the event of a severe storm event, a PSPS may be deployed if electrical infrastructure is damaged to reduce the risk of damage to life and property within the City. An example of this would be high winds causing downed power lines that threaten the safety of local residents.

6.6 VULNERABILITY ASSESSMENT

6.6.1 HAZARD VULNERABILITY ASSESSMENT

Drought

Drought conditions would affect the entirety of the City, and therefore all City critical facilities, infrastructure systems, structures, residents, and businesses are considered vulnerable to the drought hazard. Droughts do not typically result in physical damage to buildings and infrastructure, thus critical facilities are not at risk of destruction or structural failure. Instead, drought could potentially limit the availability of water supplies to City residents and businesses. Concerns with limited water supplies may affect City firefighters’ ability to fight wildfire effectively. Furthermore, drought often coincides with the wildfire season and contributes to conditions conducive to wildfire, causing wildfire smoke and possible urban fires.

⁵⁴ Wong-Parodi, Gabrielle, *Support for public safety power shutoffs in California: Wildfire-related perceived exposure and negative outcomes, prior and current health, risk appraisal and worry*, <https://www.sciencedirect.com/science/article/abs/pii/S2214629622000032#:~:text=In%20recent%20years%2C%20Public%20Safety,development%20in%20fire%20prone%20lands.,> published June 2022, accessed December 30, 2024.

Other effects of drought could be sustained by parks, landscaping, and grounds around commercial and residential facilities, as well as by various plant and animal species, which depend on a delicate meteorological balance to survive. The risk of damage to landscaping and the natural ecosystem, and potential economic impacts from increased water prices or an insufficient supply of water are concerns in addition to the effects of drought on exacerbating wildfire and consequently wildfire smoke conditions.

Extreme Heat, Heavy Rains, Santa Ana Winds and Tornadoes, Public Safety Power Shutoff (PSPS)

Extreme weather events within the City of Seal Beach may include extreme heat, heavy rains, Santa Ana winds and tornadoes, and Public Safety Power Shutoffs (PSPS) as a measure to protect life and property. These extreme weather events could impact the entire City; therefore, all critical facilities and the entirety of the City is considered vulnerable to extreme weather hazards.

Extreme heat does not physically damage buildings, but it can impact City operations resulting in human health concerns such as heat stroke. The day-to-day operations of residents and businesses may be also hindered due to extreme heat if no air conditioning is present. In some cases, cooling centers may be used to temporarily address the health effects of extreme heat. Extreme heat events can also increase the burden on power suppliers due to increased electricity consumption leading to power outages.

Santa Ana Wind events could cause damage to buildings or infrastructure, although events are generally not significant enough to damage critical facilities or substantially impact operations. Significant Santa Ana Wind events are known to cause communication issues, which can disrupt technology infrastructure or result in response challenges. PSPS events are also activated to prevent wildfires that are fanned by Santa Ana winds. Heavy rains can result in physical access challenges to critical facilities if roads are flooded or otherwise unsafe for access.

6.6.2 CHANGES IN VULNERABILITY FROM PREVIOUS FIVE YEARS

Since the 2019 LHMP, development and land use has not substantially changed in the planning area. In the five years since the approval of the previous LHMP, only one significant housing development was identified in the City's most recent 2021-2029 Housing Element: the construction of approximately thirty single family homes on a former Department of Water and Power (DWP) site at the intersection of Marina Drive and 1st Avenue. Other land use changes since the 2019 LHMP were limited in scope, such as the addition of ADUs, and/or lot line adjustments. As these changes were minor in size and scale, vulnerability is not considered to have significantly changed in the past five years.

As development and land use in the planning area has not substantially changed since the 2019 LHMP, population trends have also remained relatively the same. United States Census Data reports a 2020 population of 25,232 and a 2023 population of 24,868, representing a 1.44 percent population decline. Generally, observed population decline in the planning area is associated with an overall aging population.

6.6.3 CHANGES IN VULNERABILITY FOR FUTURE FIVE YEARS

Looking forward, the City anticipates the majority of population growth would align with the 2021-2029 Housing Element, which proposes to accommodate the City's Regional Housing Needs Allocation of 1,243 units largely at commercial sites which are proposed to be rezoned for mixed use. These areas may be impacted by extreme weather especially areas along the coastline areas with additional flooding caused by coastal storms. Areas with insufficient drainage may also be greatly impacted by extreme weather such as heavy rains. Based on anticipated growth and development, it is reasonable to assume that vulnerability to extreme weather will increase over the 5-year planning period of this LHMP.

6.7 SOCIALLY VULNERABLE POPULATIONS ASSESSMENT

Section 3-7 includes a detailed determination of Socially Vulnerable Populations (SVPs) within the planning area and characteristics that make those populations more vulnerable to hazards. The SVPs include census tracts 995.09, 995.10, 995.02 and the Seal Beach Shores Mobile Home Park. The impacts of extreme weather would apply to the entirety of the planning area, including SVPs within census tracts 995.09, 995.10, 995.02 and the Seal Beach Shores Mobile Home Park.

Specific SVPs and high-risk individuals that may be present throughout the planning area include unemployed individuals, elderly populations age 65 and older, young populations under age 17, persons with disabilities, persons with high pollution burden, and tourists, seasonal visitors, and homeless populations. The primary concern for SVPs and other high-risk individuals in the City would be evacuation efforts, access to emergency services and supplies, and recovery.

Unemployed individuals may be more vulnerable to extreme weather hazards as they may be limited in financial resources to prepare for disasters, such as purchasing emergency supplies, securing adequate housing, or evacuating to safer areas with sufficient transportation. Additionally, unemployed individuals may have substandard housing that may not have air conditioning during extreme heat events or sufficient protection against heavy rains and Santa Ana winds and tornadoes. These populations may not have resources to seek medical care following an extreme weather hazard event. These social and economic disparities can further hinder their ability to recover, as unemployed individuals face a greater risk of long-term displacement and financial hardship following an extreme weather hazard event.

Young populations under age 17 may be more vulnerable to the impacts of extreme weather hazards due to being more susceptible to injuries and illnesses as their bodies are still developing. Younger children may also have limited mobility and awareness to evacuate in a timely manner during a disaster and may have a hard time withstanding the force of floodwater from heavy rains or the high temperatures of extreme heat. Younger populations rely heavily on adults for protection, care, and decision-making; thus, if parents/guardians/caregivers are affected by a disaster, the child's safety and well-being may be compromised. Additionally, flooding from heavy rains can lead to school closures and displacement, which may disrupt children's education and social development.

Elderly populations age 65 and older are more vulnerable to extreme weather hazards. Persons aged 65 or older often face several challenges when responding to an emergency, such as mobility challenges, health concerns, social isolation, barriers to transportation, and limited access to information or technology. In addition, there is often overlap between persons aged 65 or older

and persons with a disability, as older adults experience increased prevalence of disabilities. This could include cognitive impairment, difficulties with independent living or hearing and vision problems. Lastly, this population may rely on caregivers for their well-being; thus, evacuation may be more difficult if this service is disrupted.

Similarly, persons with disabilities are highly vulnerable to extreme weather hazards due to mobility challenges, having difficulty transporting to cooling centers or evacuating quickly, and navigating through heavy rains. This population may have more underlying health conditions that can be exacerbated by extreme heat, heavy rains, and Santa Ana winds. In the event of a PSPS, there may be communication barriers to this population as emergency alerts and information may only be accessible in limited communication mediums. Extreme weather events may not allow technology to function properly, especially during a PSPS event. Lastly, persons with disabilities may rely on caregiving services, which may be disrupted during extreme weather events and make evacuation difficult.

Persons exposed to areas with a high pollution burden are more vulnerable to extreme weather events for a variety of reasons. Extreme weather hazards can further exacerbate populations with high pollution burdens who are already exposed to high pollution levels and may have weakened respiratory and cardiovascular systems. Additionally, extreme heat can exacerbate underlying illnesses from pollution exposure. Communities with high pollution often face economic challenges, making it harder to prepare and recover from extreme weather events. Lastly, persons dwelling in areas with a high pollution burden may have older, less resilient infrastructure, increasing their vulnerability during an extreme weather event and ultimately leading to prolonged exposure to hazardous conditions.

Lastly, tourists, seasonal visitors, and homeless populations are particularly vulnerable during extreme weather events due to their lack of familiarity with the area and lack of established support systems. They may not be aware of evacuation routes or local emergency procedures, making it difficult for them to respond quickly. Additionally, they might not have access to timely information about the extreme weather event or the resources needed to cope with the aftermath. The City hosts multiple community events throughout the year and nearby Huntington Beach and Long Beach are expected to host sizeable events for the upcoming 2028 Olympic Games, indicating increased present and future vulnerability. These factors make SVPs throughout Seal Beach especially vulnerable to the impacts of extreme weather.

Considerations for SVPs throughout the planning area were incorporated into the mitigation strategy in [Section 11, *Mitigation Strategy*](#). Specifically, the LHMP Planning Team tailored Mitigation Actions P.1, P.8, 1.8, 5.4, and 5.9 to mitigate hazard impacts to SVPs including issues related to preparedness, evacuation, and access to emergency services.



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CITY OF SEAL

24 HOUR
PARKING
RESTRICTIONS
NO PARKING
ON STREETS

Pah-vaḥ-hā (six)

The Gabrielino Tongva once occupied an area encompassing more than 1,500 square miles, or roughly the size of Rhode Island. Within this territory were numerous villages of which the number of inhabitants varied. These villages maintained a lively trade with Catalina Island (Pimu) for soapstone and with groups as far away as Arizona and New Mexico. The closest Indian village to Landing Hill was *Pavungna*, located where California State University, Long Beach now stands.

7

LANDSLIDE HAZARD ASSESSMENT



SECTION 7: LANDSLIDE HAZARD ASSESSMENT

7.1 LANDSLIDE

7.1.1 DESCRIPTION

Landslide and Slope Failure

Landslide is a generalized term for a falling mass of soil or rocks. When a hillside or slope becomes unstable, downslope movement of rock and soil occurs under the direct influence of gravity. Landslides are often sudden, although some occur very slowly over a long period of time. Loose and fractured materials are more likely to slide than compact materials or solid rock, and steep slopes are at greater risk than gentle rises.

Landslides are usually induced by either earthquakes or saturated slopes. The shaking of an earthquake can decrease slope stability, or in a more severe instance, fracture the earth material enough that the material slides. Moisture-induced landslides can occur when the ground soaks up enough water that the soil becomes loose and unstable. This is often the result of intense or long-lasting rainfall but can also result from a pipeline burst or overwatering landscapes. Loss of vegetation to fire or drought may cause an area to be more vulnerable to landslides. Vegetation holds soil in place and without the root system of trees, bushes, and other plants, the land is more likely to slide away.

One type of landslide that is different from debris flows or rock flows are deep-seated landslides. Deep-seated landslides are not necessarily triggered by any single storm or earthquake. Rather, these types of landslides occur weeks to months after heavy rainfall ends, when water has had time to percolate deeper under the surface to saturate weak zones of rock. This creates a “landslide plane” under the saturated weight of the overlying rock and soil. The landslide plane may often be associated with earlier slides and can occur regardless of whether rain is occurring or not. As these landslides begin so deeply, they tend to carry more material and cover more territory than other types of slides. Deep-seated landslides generally occur on moderately steep slopes, travel much slower than mudflows or debris flows, and can continue for several days.

Regardless of the cause or specific form, a landslide can damage or destroy structures or roadways in its path. Underground infrastructure, such as pipelines or telecommunication lines, may be severed during a landslide. This could lead to infrastructure induced flooding if water pipes, or sewage lines burst. In addition to property damage, landslides can crush or bury people, creating a risk of serious injury or death.

In addition, sinkholes are a related geologic hazard that regularly affect the planning area. Sinkholes are depressions in the ground that form when the underlying rock and soil has been dissolved, eroded, or saturated by water and collapses. A sinkhole has no natural external surface drainage; thus all water remains in the sinkhole and typically drains into the subsurface.^{1,2} While sinkholes can naturally occur due to weathering and erosion of surface rock (especially limestone), sinkholes are most often triggered in the planning area by heavy rains or flooding.

Mudslides

Mudslides, also known as debris flows or mudflows, are a common type of fast-moving landslide that tends to flow in channels.³ A debris flow is a river of rock, earth, mud, and other debris, including saturated vegetation. While landslides can occur without the presence of soil (such as a rock landslide), mudflows consist of material that contains at least 50 percent sand, silt and clay-sized particles. The high percentage of water gives the debris flow a rapid rate of movement down a slope, posing extremely dangerous conditions to people and property. Debris flows normally occur when a landslide moves down slope as a semi-fluid mass scouring or partially scouring soils from the slope. Flows triggered by earthquakes or heavy rainfall can occur on gentle slopes and can move rapidly for large distances.

Wildland fires on hills are often a precursor to debris flows in burned out areas. The extreme heat of a wildfire can create impervious soil conditions by forming a waxy layer below the ground surface. Because water cannot be absorbed into the soil, water rapidly accumulates on the surface, gathering loose particles of soil into a sheet of mud and debris while traveling down the slope. Debris flows can often originate miles away, traveling at high rates of speed with little forewarning.

7.1.2 LOCATION/EXTENT

The City of Seal Beach is a relatively flat city with some elevation shifts, however there are few deep-seated landslide potential zones mapped throughout the City of Seal Beach; refer to [Figure 7-1, *Deep-Seated Landslide Hazard Zones*](#). Although limited areas of the City face risk to landslide, mapped landslide risk areas primarily include portions of the Pacific Coast Highway, the Interstate 405, Bolsa Chica Rd, Golden Rain Rd, the Naval Weapons Station, and Gum Grove Park.

¹ USGS, *What is a sinkhole?* <https://www.usgs.gov/faqs/what-a-sinkhole>, updated March 7, 2024, accessed December 30, 2024.

² California Department of Conservation, *2023 California Landslide Response*, <https://www.conservation.ca.gov/cgs/landslides/2023>, accessed December 30, 2024.

³ California Department of Public Health, *Landslides and Mudslides*, https://www.cdph.ca.gov/Programs/EPO/Pages/BI_Natural-Disasters_Landslides-and-Mudslides.aspx#:~:text=Landslides%20are%20caused%20by%20disturbances,soaked%20rock%2C%20earth%20and%20debris, accessed December 30, 2024.

The extent of a landslide event is largely dependent on the quantity of slope failure, measured in cubic meters or yards. Landslide events of greater magnitude will be associated with larger quantities of slope failure.

7.1.3 PREVIOUS OCCURRENCES

The City of Seal Beach has experienced few landslides and sinkholes during the past five years. One sinkhole formed from December 2023 to January 2024 in a flooded parking lot after high surf storms caused flooding in the area.⁴ No notable landslide events have impacted the City within the last five years.

7.1.4 PROBABILITY OF FUTURE OCCURRENCES

Given the location of the City and previous occurrences, the probability of landslides, mudslides, and slope failure continuing to occur within the City of Seal Beach is considered occasional. An occasional probability means there is a 1 to 10 percent probability of occurrence in the next year or a recurrence interval of 11 to 100 years. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt that landslide will likely affect the planning area in the future and therefore felt “occasional” best defined probability for this specific hazard. The LHMP planning team assigned a medium hazard planning consideration to the hazards and impacts associated with landslide and slope failure based upon an occasional probability and widespread expected impacts of future events.

No federally declared disasters related to landslide and slope failure events have impacted the planning area within the last five years; refer to Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area.

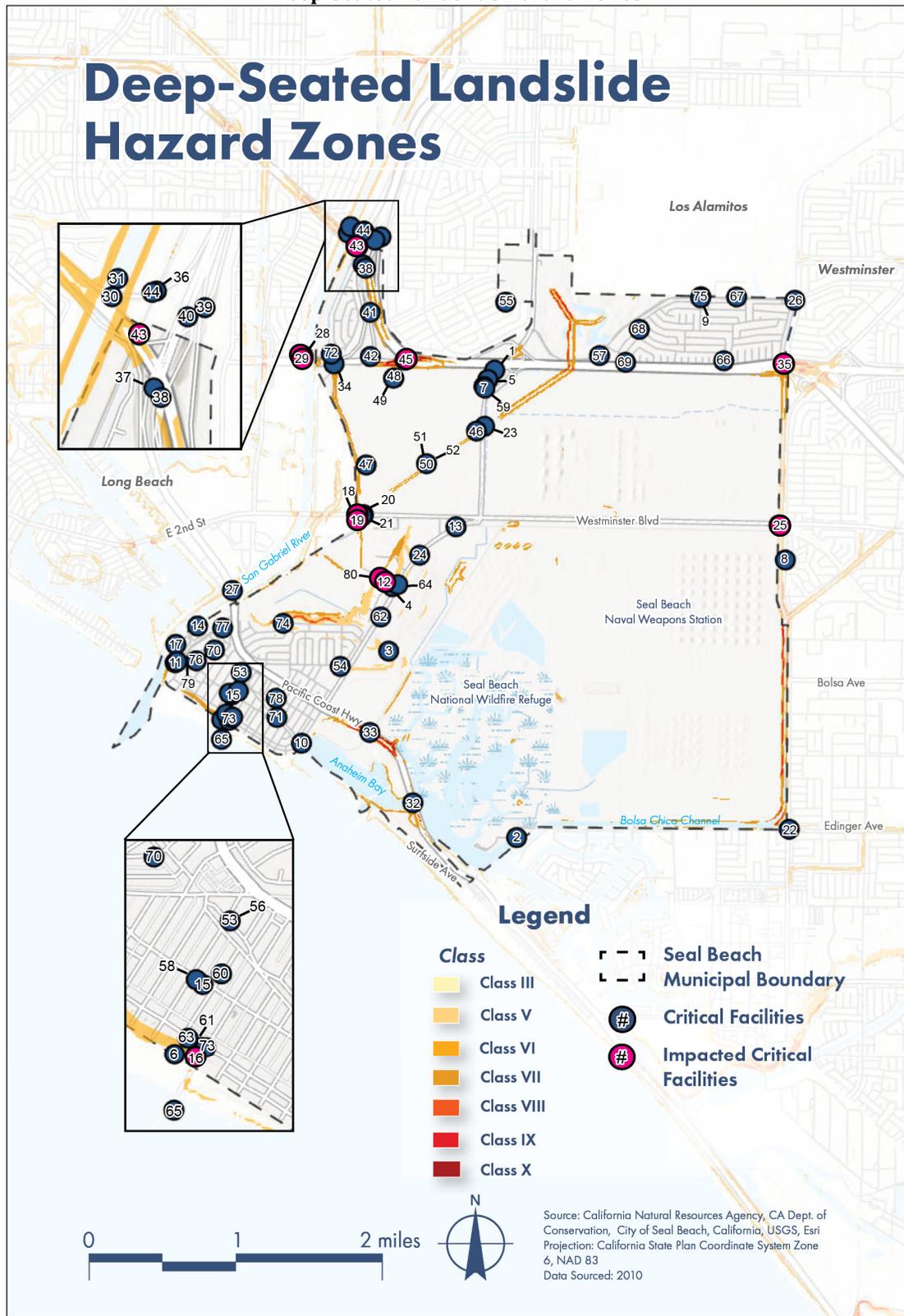
7.1.5 CLIMATE CHANGE

Landslides are generally caused by one of two factors: seismic activity or soil saturation. Earthquakes and ground shaking are not linked to climate change; however, heavy rains are affected by climate change and understood to contribute to saturated soils and landslides. Climate change is linked to increased precipitation and more frequent and/or severe storms. California is already experiencing climate change impacts with increasingly variable precipitation and becoming the highest variability of year-to-year precipitation in the contiguous United States.⁵ Increased rainfall due to climate change will lead to saturated slopes, erosion, and likely will exacerbate the effects of landslide and mudslides within the planning area.

⁴ ABC7, *Sinkhole forms in parking lot of Seal Beach restaurant after high surf causes flooding*, <https://abc7.com/seal-beach-restaurant-sinkhole-orange-county-high-surf/14260406/>, published January 3, 2024, accessed December 3, 2024.

⁵ California Climate Adaptation Strategy, *Summary of Projected Climate Change Impacts on California*, <https://climateresilience.ca.gov/overview/impacts.html#:~:text=California%20is%20already%20experie,ncing%20the,have%20increased%20as%20temperatures%20warm>, accessed December 30, 2024.

Figure 7-1
Deep-Seated Landslide Hazard Zones



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As mudslides are affected by rain, sea levels and wildfire, climate change can indirectly increase the risk of mudslides.⁶ As climate change affects the severity and intensity of wildfires, more vegetation is burned, and soil stability is reduced. This allows for more debris to slide down during a mudslide. Sinkholes are also likely to be exacerbated by climate change. Increased rainfall and storm events may lead to more frequent flooding and bedrock erosion, which contribute to sinkholes.

7.2 VULNERABILITY ASSESSMENT

7.2.1 HAZARD VULNERABILITY ASSESSMENT

Critical facilities located within the landslide hazard zone include those that serve as transportation, water systems, safety and security, communications, and hazardous materials lifelines. In total, there are 25 vulnerable critical facilities located within the City’s landslide hazard zone. Government service and parks and recreation are the primary asset types within the landslide hazard zone, however other types of critical facilities have also been identified as vulnerable. Critical facilities located within the City’s identified landslide hazard zone have been listed in Table 7-1, Critical Facilities in Landslide Hazard Zone.

To identify populations at risk for landslide hazards, hazard data layers were overlaid and compared with City parcel data in Geographic Information Systems, ArcGIS. If a hazard layer either completely or partially overlapped with a parcel in the data layer, then the entire parcel is conservatively considered vulnerable in this analysis. In many instances, the landslide hazard zone intersected with only small portions of individual properties. However, to provide a detailed understanding of risk and vulnerability as part of this hazard mitigation plan, these parcels (including all residential and non-residential development on the parcel, regardless of location) are considered vulnerable.

Approximately 1,118 residential units are located within the landslide hazard zone. The vulnerability assessment cross-referenced hazard layers with parcel data layers in GIS. The number of vulnerable residential units multiplied by the average of 1.90 persons per household for Seal Beach indicates that approximately 2,125 people reside in the landslide hazard zone. Additionally, approximately 1,539,355.2 square feet of non-residential structures are located within the landslide hazard area. Refer to Table 7-2, Populations at Risk for Landslide for a summary of vulnerable residents, residential units, and non-residential buildings.

**Table 7-1
Critical Facilities in Landslide Hazard Zone**

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
9	Sewer lift pump station - 1776 ½ Adolfo Lopez Dr	Water Systems	Water Systems	\$1,050,000

⁶ The Atlantic, *A Recipe for Climate Disaster*, <https://www.theatlantic.com/science/archive/2022/03/climate-change-heavy-rain-landslides-flood/629404/>, published March 29, 2022, accessed December 30, 2024.

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
15	Seal Beach Marine Safety Headquarters	Government Services	Safety and Security, Communications	\$3,129,060
23	San Gabriel River Bike Trail Entry Point	Transportation	Transportation	Not Available
26	Stormwater Pump Station (County owned)	Water Systems	Water Systems	Not Available
28	Bridge 55C0041L - Los Alamitos Channel (Local)	Transportation	Transportation	\$1,574,100
29	Bridge 55C0041R - Los Alamitos Channel (Local)	Transportation	Transportation	\$1,574,100
30	Bridge 55C0042L - Federal Storm Channel (Local)	Transportation	Transportation	\$1,690,700
31	Bridge 55C0042R - Federal Storm Channel (Local)	Transportation	Transportation	\$1,906,410
32	Bridge 55C0075 - Westminster Channel (Local)	Transportation	Transportation	\$5,281,980
35	Bridge 55C0108 - Bolsa Chica Channel (Local)	Transportation	Transportation	\$5,888,300
37	Bridge 53 0060 - San Gabriel River (State)	Transportation	Transportation	\$18,073,000
38	Bridge 53 0302L - San Gabriel River (State)	Transportation	Transportation	\$9,969,300
39	Bridge 53 0302R - San Gabriel River (State)	Transportation	Transportation	\$9,969,300
40	Bridge 53 1185 - San Gabriel River (State)	Transportation	Transportation	\$35,563,000
41	Bridge 53 1737H - San Gabriel River (State)	Transportation	Transportation	\$7,287,500

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Map ID	Name	Asset Type	Community Lifeline	Replacement Value
42	Bridge 55 0010 – Anaheim Bay (State)	Transportation	Transportation	\$16,673,800
43	Bridge 55 0065 - Kitt Highway, US Navy RR (State)	Transportation	Transportation	\$6,879,400
44	Bridge 55 0310 – Los Alamitos Channel (State)	Transportation	Transportation	\$9,328,000
45	Bridge 55 0334 - Bolsa Chica Ditch (State)	Transportation	Transportation	\$67,045,000
51	Bridge 55 0426G – S605 - S405 Connector (State)	Transportation	Transportation	\$12,458,710
53	Bridge 55 0441 - Los Alamitos Channel (State)	Transportation	Transportation	\$15,158,000
55	Bridge 55 1100G - Interstate 405 (State)	Transportation	Transportation	\$44,308,000
70	Police Substation	Municipal Services	Safety and Security; Communications	Not Available
79	Eisenhower Park	Public Park	Safety and Security	\$700,000
86	City Maintenance Yard	Maintenance Yard	Hazardous Materials	\$4,064,100

**Table 7-2
Populations at Risk for Landslide**

Residents at Risk	Residential Units at Risk	Non-Residential Area at Risk (sq. ft.)
2,125	1,118	1,539,355.2

7.2.2 CHANGES IN VULNERABILITY FROM PREVIOUS FIVE YEARS

Since the 2019 LHMP, development and land use has not substantially changed in the planning area. In the five years since the approval of the previous LHMP, only one significant housing development was identified in the City's most recent 2021-2029 Housing Element: the construction of approximately thirty single family homes on a former Department of Water and Power (DWP) site at the intersection of Marina Drive and 1st Avenue. Other land use changes since the 2019 LHMP have been limited in nature, such as the addition of ADUs, and/or lot line adjustments. As these changes were minor in size and scale, vulnerability is not considered to have significantly changed in the past five years.

As development and land use in the planning area has not substantially changed since the 2019 LHMP, population trends have also remained relatively the same. United States Census Data reports a 2020 population of 25,232 and a 2023 population of 24,868, representing a 1.44 percent population decline. Generally, observed population decline in the planning area is associated with an overall aging population.

7.2.3 CHANGES IN VULNERABILITY FOR FUTURE FIVE YEARS

Looking forward, the City anticipates the majority of population growth would align with the 2021-2029 Housing Element, which proposes to accommodate the City's Regional Housing Needs Allocation of 1,243 units largely at commercial sites which are proposed to be rezoned for mixed use. These areas may be impacted by a landslide, especially areas along the coastline areas, along with western and northern portions of the City. Based on anticipated growth and development, it is reasonable to assume that vulnerability to landslide hazards will increase over the 5-year planning period of this LHMP.

7.3 SOCIALLY VULNERABLE POPULATIONS ASSESSMENT

Section 3-7 includes a detailed determination of Socially Vulnerable Populations (SVPs) within the planning area and characteristics that make those populations more vulnerable to hazards. The SVPs include census tracts 995.09, 995.10, 995.02 and the Seal Beach Shores Mobile Home Parks. Census tracts 995.09, 995.10, 995.02 have areas of vulnerability in the event of a landslide event.

SVPs and other high-risk individuals exist throughout the planning area and may be present within landslide hazard zones despite a census tract's social vulnerability classification. Specific SVPs and high-risk individuals that may be present throughout the planning area and landslide hazard zones include unemployed individuals, elderly populations age 65 and older, young populations under age 17, persons with disabilities, persons with high pollution burden, and tourists, seasonal visitors, and homeless populations. The primary concern for SVPs and other high-risk individuals in the City would be evacuation efforts, access to emergency services and supplies, and recovery.

Unemployed individuals may be more vulnerable to the landslide hazard as they may be limited in financial resources to prepare for disasters, such as purchasing emergency supplies, securing adequate housing, or evacuating to safer areas with transportation. Additionally, unemployed individuals may have substandard housing which may be more susceptible to damage during a landslide event. These populations may not have resources to seek medical care following a landslide hazard event. These social and economic disparities can further hinder their ability to

recover, leaving them at greater risk of long-term displacement and financial hardship following a landslide.

Young populations under age 17 may be more vulnerable to the impacts of landslide hazards due to facing higher susceptibility to injuries and illnesses as their bodies are still developing. Younger children may also have limited mobility and awareness to evacuate in a timely manner during a disaster, as they rely heavily on adults for protection, care, and decision-making. Additionally, a landslide event can cause school closures and displacement, which may disrupt children's education and social development.

Elderly populations aged 65 and older are more vulnerable to landslide events. Persons aged 65 or older often face several challenges when responding to an emergency, such as mobility challenges, health concerns, social isolation, barriers to transportation, and limited access to information or technology. In addition, there is often overlap between persons aged 65 or older and persons with a disability, as older adults experience increased prevalence of disabilities. This could include cognitive impairment, difficulties with independent living, or hearing and vision problems. Lastly, this population may rely on caregivers for their well-being; thus, evacuation may be more difficult if this service is disrupted.

Similarly, persons with disabilities are highly vulnerable to landslides due to mobility challenges that make it difficult to navigate and evacuate during a disaster. This population may have more underlying health conditions that can be exacerbated by the stress and demands of a landslide event. There may be communication barriers to this population as emergency alerts and information may only be accessible in limited communication mediums. Landslide hazards can damage or destroy essential assistive devices such as wheelchairs, hearing aids, communication devices, and other medical technology SVPs may rely on. Additionally, persons with disabilities might rely on caregiving services, which may be disrupted during a landslide disaster and make it difficult to evacuate.

Considerations for SVPs throughout the planning area were incorporated into the mitigation strategy in Section 11, Mitigation Strategy. Specifically, the LHMP Planning Team tailored Mitigation Actions P.1, P.8, 1.8, 5.4, and 5.9 to mitigate hazard impacts to SVPs including issues related to preparedness, evacuation, and access to emergency services.



8

SEISMIC HAZARD ASSESSMENT



SECTION 8: SEISMIC HAZARDS

8.1 FAULT RUPTURE/GROUND MOTION

8.1.1 DESCRIPTION

Fault Rupture

The US Geological Survey (USGS) defines an earthquake as a sudden slip on a fault and the resulting ground shaking and radiated seismic energy caused by the slip (or any other sudden stress changes in the earth). Faults are fractures along the earth's crust between two blocks of earth and can be defined as a strike slip, normal, or thrust faults. Earthquakes occur without warning, and result in effects such as fault rupture, ground motion, liquefaction, and landslides described below.

Fault rupture or surface faulting is the differential movement of two sides of a fracture, where the ground breaks apart. The length, width, and displacement of the ground characterize surface faults, which occur based on the type of underlying fault. Faults occur at boundaries between large sections of the earth's surface, called tectonic plates. Most of California underlies the North American plate, but coastal areas (including the City of Seal Beach) are on the Pacific plate. The San Andreas Fault is the main boundary between North American and Pacific plates, but other fault lines can be found up to 200 miles away. The presence of the San Andreas Fault and other regional faults is the reason for frequent seismic activity in California.

Where surface traces of active faults are found in California, an Alquist-Priolo fault zone is mapped. A regulatory zone, which is a 500-foot buffer, is then created around the mapped Alquist-Priolo fault zone.¹ If an active fault has a potential for surface rupture, a structure for human occupancy cannot be placed over the fault and must be a minimum distance from the fault (generally fifty feet). The intent of the Alquist-Priolo Act is to reduce losses from surface fault rupture, and to prevent the construction of buildings used for human occupancy on the surface trace of active faults. Before a new development is permitted, cities and counties require a geological investigation to demonstrate that proposed buildings will not be constructed on active faults.²³⁴

Ground Motion

Ground motion is the movement of the earth's surface from earthquakes. Ground motion is produced by seismic waves that are generated by sudden slip on a fault or sudden pressure at the explosive source and travel through the earth and along its surface.⁵ Seismic waves produce ground vibrations above the surface. The severity of the vibration increases with the amount of energy released and decreases with distance from the causative fault or epicenter. Soft soils can further amplify ground motion.⁶

Seismic shaking can be strong enough to result in widespread devastation or be virtually undetectable by the average person. The intensity of seismic shaking is a result of the release by the fault rupture (how much of the accumulated stress was released), the length of the rupture (the longer the slip along the fault line, the greater the shaking), and the depth at which the rupture occurs (ruptures that occur closer to the surface often cause stronger shaking). Usually, areas closest to the site of the rupture experience the greatest shaking, although differences in geology and soil can also have an impact. Seismic shaking can damage or destroy buildings and structures and may cause partial or total collapse. Ground movement can damage or destroy infrastructure on or beneath the surface, such as roads, rail lines, and utility lines and pipes. This in turn, can cause hazardous materials releases, water main breaks, and other dangerous situations resulting from infrastructure failure. Falling debris and structures also create a risk of injury or death.

8.1.2 LOCATION/EXTENT

Ground motion affecting the City of Seal Beach would be particularly damaging to residential buildings constructed of wood or reinforced masonry construction, and to mobile homes. Other buildings that do not typically perform well in earthquakes are soft-story buildings. These types of buildings have a story (typically the first floor) that lacks adequate strength or toughness due to too few shear walls. The percentage of ground motion shake potential is shown in Figure 8-1, *Shake Potential*.

¹ California Department of Conservation, *Alquist-Priolo Earthquake Fault Zones*, <https://www.conservation.ca.gov/cgs/alquist-priolo>, accessed December 26, 2024.

² USGS, *Alquist-Priolo Faults*, <https://earthquake.usgs.gov/education/geologicmaps/apfaults.php>, accessed December 26, 2024.

³ USGS, *Earthquake Glossary – Earthquake*, <https://earthquake.usgs.gov/learn/glossary/?term=earthquake>, accessed December 26, 2024.

⁴ Geology.com, *The San Andreas Fault*, <https://geology.com/articles/san-andreas-fault.shtml>, accessed December 26, 2024.

⁵ USGS, *Earthquake Glossary – Ground Motion*, <https://www.usgs.gov/glossary/earthquake-hazards-program>, accessed December 26, 2024.

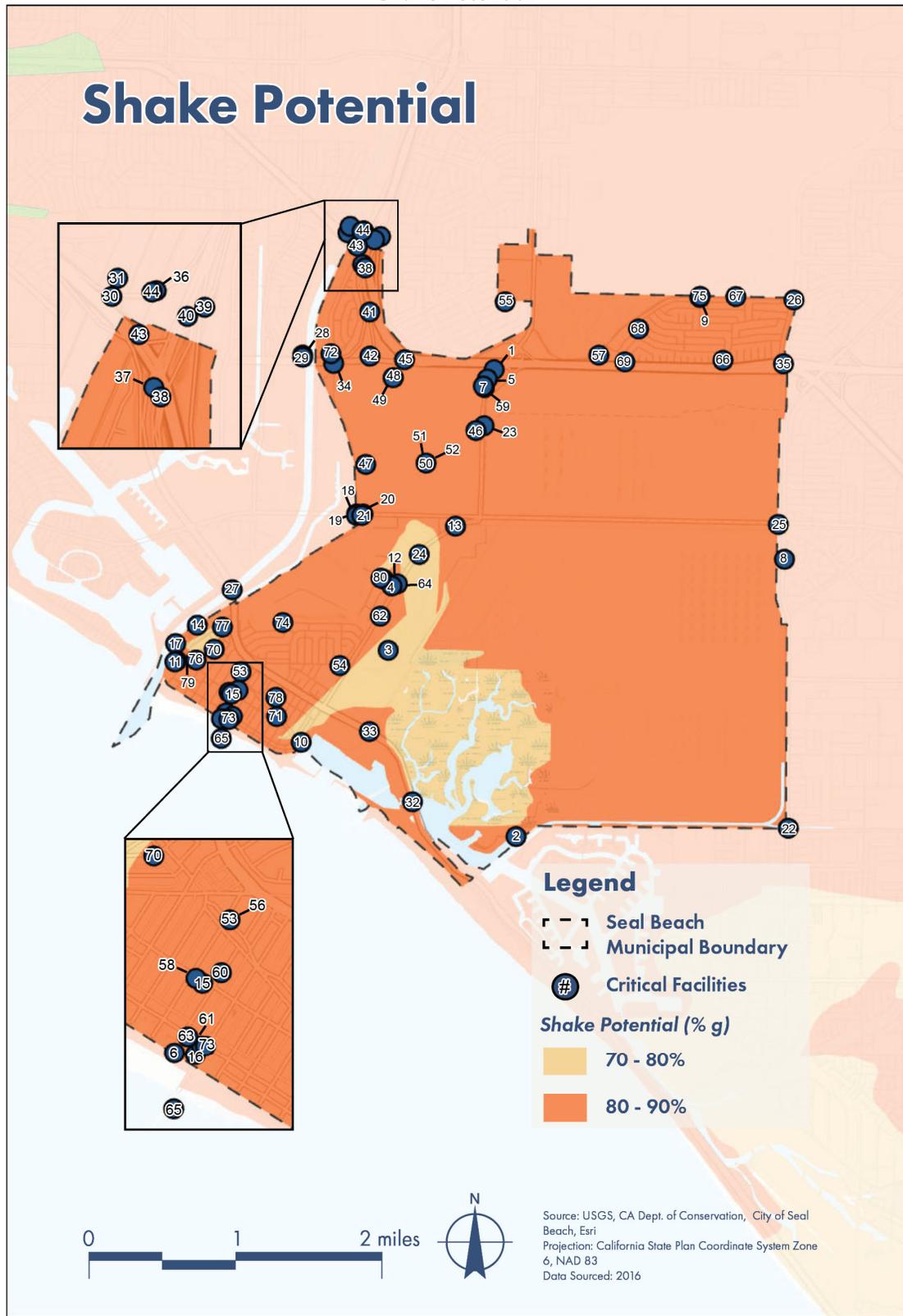
⁶ FEMA, *Multi-Hazard Identification and Risk Assessment - Subpart D: Seismic Hazards*, January 1, 1997.

The most common measures of ground shaking during an earthquake event, the Moment Magnitude and Modified Mercalli Intensity scales, are described below.

There are two scales commonly used by scientists to measure earthquakes: the Moment Magnitude Scale and the Modified Mercalli Intensity Scale. The moment magnitude scale is based on the now largely unused Richter scale and measures the amount of energy released by the earthquake. The Modified Mercalli Intensity Scale (MMI Scale) measures the effects of the earthquake and is based on qualitative observations rather than a mathematical basis. The intensity scale consists of a series of certain key responses such as people awakening from sleep, movement of furniture, damage to chimneys, and destruction. Although numerous scales have been developed to evaluate earthquake effects, the scale currently used in the United States is the Modified Mercalli Intensity Scale. This scale, composed of twelve increasing levels of intensity ranging from imperceptible shaking to catastrophic destruction, is designated by Roman numerals I through XII. Table 8-1, *Modified Mercalli Intensity Scale*, shows the different categories of the Mercalli intensity scale.

Magnitude and intensity measure different characteristics of earthquakes but often correlate. Magnitude measures the energy released at the source of the earthquake, determined by measurements on seismographs. Intensity measures the strength of shaking produced by an earthquake at a certain location, and is determined by effects on people, structures, and the natural environment. Refer to Table 8-2, *Approximate Comparison of Moment Magnitude and Mercalli Intensity Scales*, which lists the intensities that are typically observed at locations near the epicenter of earthquakes of different magnitudes.

Figure 8-1
Shake Potential



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**Table 8-1:
Modified Mercalli Intensity Scale**

Category	Description	Possible Impacts
I	Non felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by few persons at rest, especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very Strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specifically designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Source: USGS, *The Modified Mercalli Intensity Scale*, https://www.usgs.gov/natural-hazards/earthquake-hazards/science/modified-mercalli-intensity-scale?qt-science_center_objects=0#qt-science_center_objects, accessed December 26, 2024.

Table 8-2

Approximate Comparison of Moment Magnitude and Mercalli Intensity Scales

Moment Magnitude	Mercalli Intensity
1.0 to 3.0	I
3.0 to 3.9	II to III
4.0 to 4.9	IV to V
5.0 to 5.9	VI to VII
6.0 to 6.9	VII to IX
7.0 and greater	VIII and greater

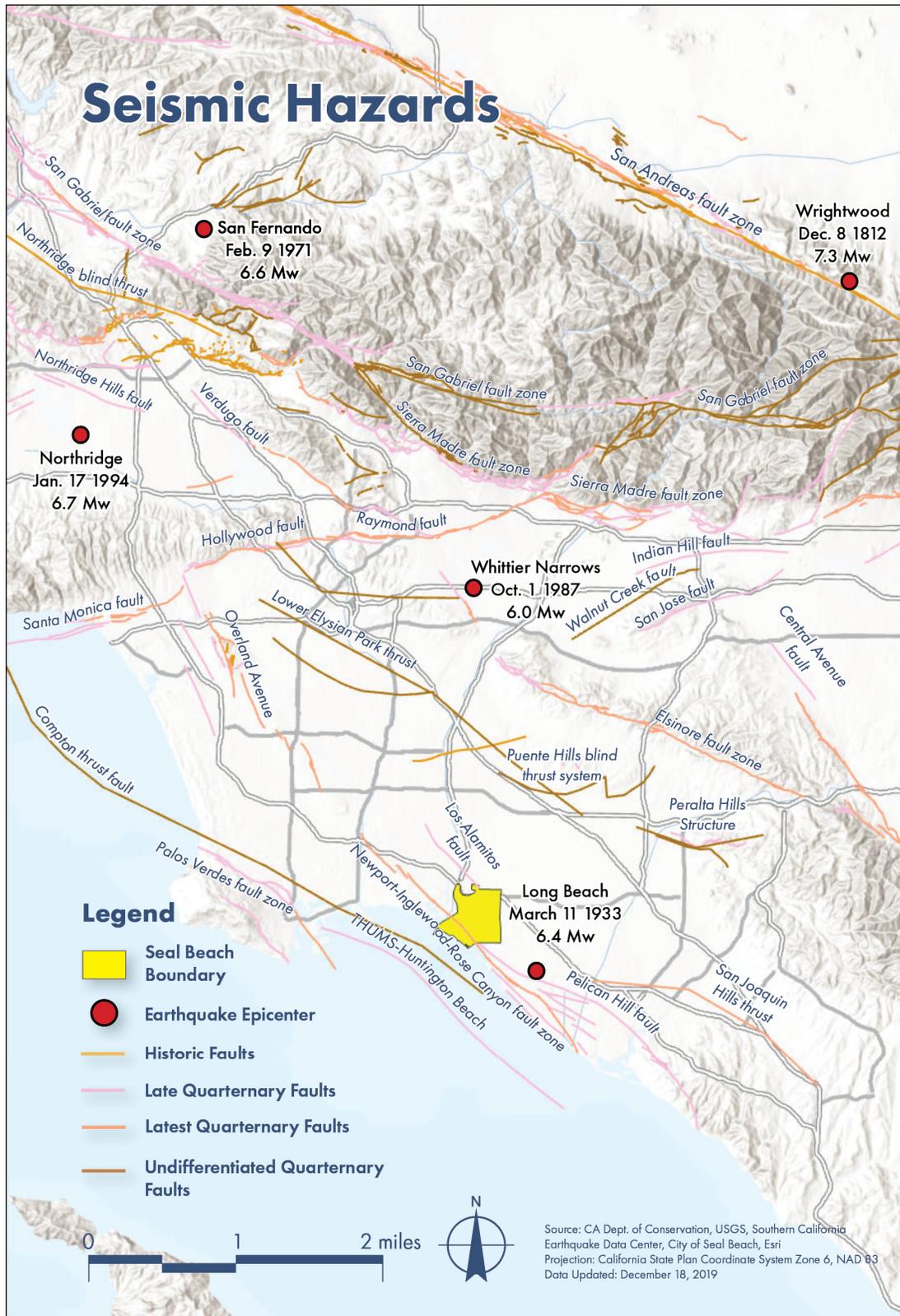
Source: USGS, *Magnitude/Intensity Comparison*, http://earthquake.usgs.gov/learn/topics/mag_vs_int.php, accessed August 11, 2015.

The City of Seal Beach is located within the Southern California region, known to be seismically active. The faults located within the boundaries of the City include Newport-Inglewood, Rose Canyon Fault, and the Los Alamitos fault. Other active faults that are close to the City within five miles include the Compton thrust fault and THUMS Huntington Beach fault. [Figure 8-2, Seismic Hazards](#), shows fault zones near the City of Seal Beach as well as earthquake epicenters.⁷ [Table 8-3, Local Earthquake Faults Within 10 Miles of Seal Beach](#), lists each active and potentially active fault near the City, distance to the City, estimated magnitude, and class type. All faults listed below are active or potentially active and are categorized as class type A, where there is geological evidence demonstrating the existence of Quaternary fault of tectonic origin, whether the fault is exposed for mapping or inferred from liquefaction or other deformational features.⁸

⁷ Source: California Department of Conservation, California's Big Earthquakes, <https://www.conservation.ca.gov/cgs/earthquakes/big>, revised July 11, 2024, accessed April 24, 2025.

⁸ USGS, *Faults*, <https://www.usgs.gov/programs/earthquake-hazards/faults>, accessed December 26, 2024.

Figure 8-2
Seismic Hazards



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**Table 8-3:
Local Known Earthquake Faults Within 10 Miles of Seal Beach**

Fault Name	Distance ¹ (miles)	Type of Faulting	Last Major Rupture	Slip Rate (mm/yr)	Estimated Magnitude ² (mW)
Newport- Inglewood Fault Zone	Within City Boundaries	Right-lateral; local reverse slip associated with fault steps	March 10, 1933, MW 6.4 (but no surface rupture)	0.6	6.0-7.4
Los Alamitos Fault	Within City Boundaries	Uncertain	Uncertain	Uncertain	Uncertain
Garden Grove Fault*	Within City Boundaries	Uncertain	Uncertain	Uncertain	Uncertain
Compton Thrust Fault ⁹	1	Blind thrust fault	Uncertain but suggested Holocene	0.2 – 1.0	7.0 – 7.4
THUMS Huntington Beach ¹⁰	2.6	Blind thrust fault	Late Quaternary	Uncertain	6.7 – 6.8*
Wilmington blind- thrust ¹¹	2.8	Blind thrust fault	Uncertain	0.23 - 0.59	6.2 – 6.3
San Joaquin Hills thrust ^{12,13}	6.6	Blind thrust fault	Uncertain	0.2 – 1.0	>7.0
Palos Verdes fault	6.9	Right-reverse	Holocene, offshore; Late	0.1 – 3.0	6.0 - 7.0

⁹ Statewide California Earthquake Center, *Evidence for Large Holocene Earthquakes on the Compton Thrust Fault*, Los Angeles, California, <https://central.scec.org/publication/1294>, accessed December 26, 2024.

¹⁰ Harvard University and University of Southern California, *U.S. Geological Survey, Final Technical Report: Activity and earthquake potential of Wilmington blind thrust, Los Angeles, CA: The largest earthquake source not on current southern California hazard maps? Collaborative Research with Harvard University and University of Southern California*, https://earthquake.usgs.gov/cfusion/external_grants/reports/G17AP00008.pdf, published 2017, accessed December 27, 2024.

¹¹ Bulletin of the Seismological Society of America, *The Wilmington Blind-Thrust Fault: An Active Concealed Earthquake Source beneath Los Angeles, California*, <https://hcbf.org/wp-content/uploads/2019/09/The-Wilmington-Blind-Thrust-Fault-cmplt-Franklin-D.-Wolfe-17-pgs..pdf>, published 2019, accessed December 27, 2024.

¹² USGS Quaternary Fault and Fold Database of the United States, <https://earthquake.usgs.gov/static/lfs/nshmqfaults/Reports/186.pdf>, last reviewed February 18, 2017, accessed December 30, 2024.

¹³ Energy Blog, San Joaquin Hills Blind Thrust Fault Scenario, <https://sites.uci.edu/energyobserver/2012/04/25/san-joaquin-hills-blind-thrust-fault-scenario/>, posted April 25, 2012, accessed December 30, 2024.

Fault Name	Distance ¹ (miles)	Type of Faulting	Last Major Rupture	Slip Rate (mm/yr)	Estimated Magnitude ² (mW)
Lower Elysian Park thrust ¹⁴	7.25	Blind thrust fault	Quaternary, onshore Undifferentiated Quaternary	2.5 - 5.2	6.2 - 6.7
Puente Hills blind thrust system ¹⁵	8.5	Blind thrust fault	1987 Whittier Narrows Earthquake	0.44 - 1.7	7.5
Cabrillo fault	9.8	Right-normal	Holocene, offshore; Late Quaternary, onshore	Unknown	6.0 - 6.8

*If ruptured with the Wilmington blind thrust
 *Not mapped due to recent documentation

Newport-Inglewood Fault Zone

Of the three faults that traverse the City of Seal Beach, the Newport-Inglewood Fault Zone fault is the most notable, traversing the City from northwest to the southern portion of the City. The system is capable of producing a 6.9 magnitude earthquake and has a slip rate of 1mm/yr. Because of its proximity to the City, it is thought to present a greater danger to the City in terms of death and destruction than the San Andreas fault. The Newport-Inglewood Fault Zone includes fault segments Charnock Fault, Overland Avenue Fault, Inglewood Fault, Portero Fault, Avalon-Compton Fault, Cherry Hill Fault, and Seal Beach Fault. The movement on this fault zone caused the 1933 Long Beach magnitude 6.3 earthquake and the 1920 Inglewood earthquake, with an estimated magnitude 4.9. The 1933 Long Beach earthquake resulted in 120 deaths and over \$50 million in property damage. Most of the damaged buildings were of unreinforced masonry. Many school buildings were destroyed. In addition to the Newport-Inglewood Fault Zone, seismic data shows there are additional near-surface faults, some of which are currently active.¹⁶ This Newport-Inglewood Fault Zone has the potential to sink the Seal Beach Wildlife Refuge up to 3 ft should a 7.5 mW occur.¹⁷

¹⁴ USGS Quaternary Fault and Fold Database of the United States, *Lower Elysian Park thrust (Class A) No. 134*, <https://earthquake.usgs.gov/static/lfs/nshm/qfaults/Reports/134.pdf>, last review date June 14, 2017, accessed December 30, 2024.

¹⁵ Bulletin of the Seismological Society of America, *Puente Hills Blind-Thrust System, Los Angeles California*, http://activetectonics.asu.edu/bidart/bibliography/bssa/bssa_92_8/shaw_plesch_dolan_pratt_fiore_2002.pdf, published December 2002, accessed December 30, 2024.

¹⁶ Temblor, *Newly identified fault in Seal Beach, CA quietly rattles beneath the city*, <https://temblor.net/earthquake-insights/newly-identified-fault-in-seal-beach-ca-quietly-rattles-beneath-the-city-13477/>, published November 8, 2021, accessed December 26, 2024.

¹⁷ USGS, *History of Abrupt Sinking of the Seal Beach Wetlands: New Study Reveals Past Quakes along Fault and Offers Glimpse into the Future*, <https://www.usgs.gov/news/state-news-release/history-abrupt-sinking-seal-beach-wetlands-new-study-reveals-past-quakes>, published March 20, 2017, accessed December 31, 2024.

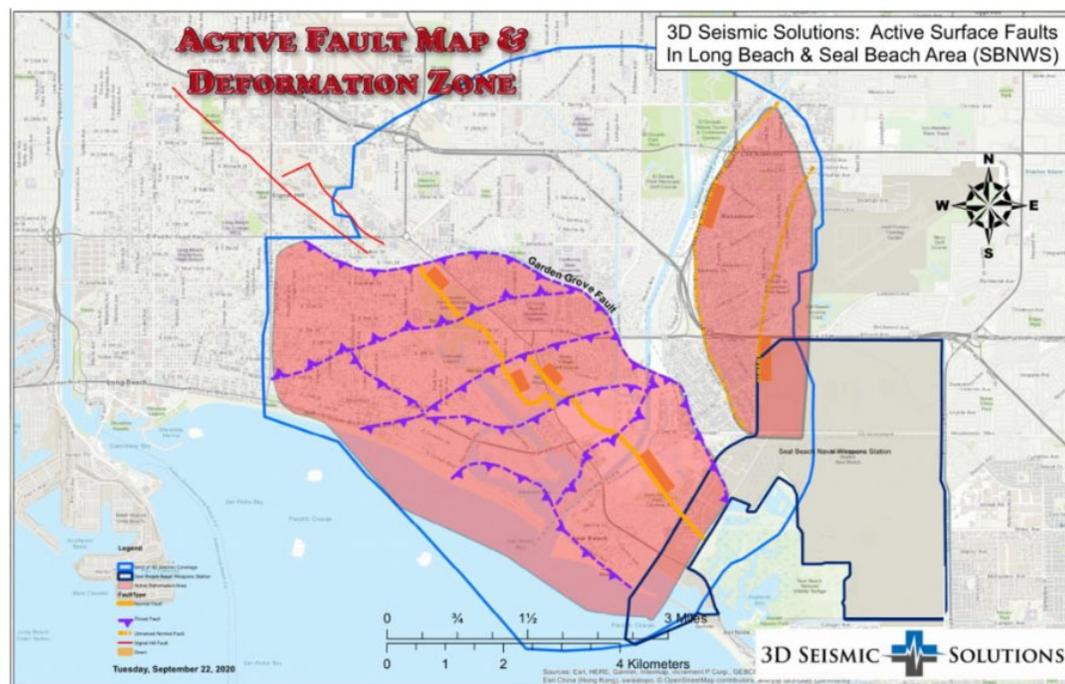
The Los Alamitos Fault

The Los Alamitos fault traverses a small portion of the City northeastern portion of the City. Much is unknown about the fault including its age, and magnitude. However, the fault system is known to be a part of a larger system called the Compton-Los Alamitos Fault. The type of fault is approximately 11 km.¹⁸ The most recent surface rupture of this fault occurred in the Late Quaternary period.

Garden Grove Fault

Recently, USGS conducted a high-density seismic survey of the subsurface and identified new subsurface faults between the Los Alamitos fault and the Newport Inglewood Fault. The Garden Grove Fault is located approximately 1.5 miles northeast of the Newport-Inglewood Fault Zone and appears to be active and primarily responsible for the formation of the Seal Beach Anticline (SBA).¹⁹ The location of the Garden Grove Fault is not mapped in Figure 8-2, *Seismic Hazards* due to its more recent discovery in 2021; however, the approximate location is shown in Figure 8-3, *Location Garden Grove Fault*

Figure 8-3
Location of Garden Grove Fault



Location of the newly identified shallow faults (purple), areas of recent deformation (red) and the current surface trace of the NIFZ (yellow).

¹⁸ Southern California Earthquake Data Center, Los Alamitos Fault, <https://scedc.caltech.edu/earthquake/losalamitos.html>, published 2024, accessed December 26, 2024.

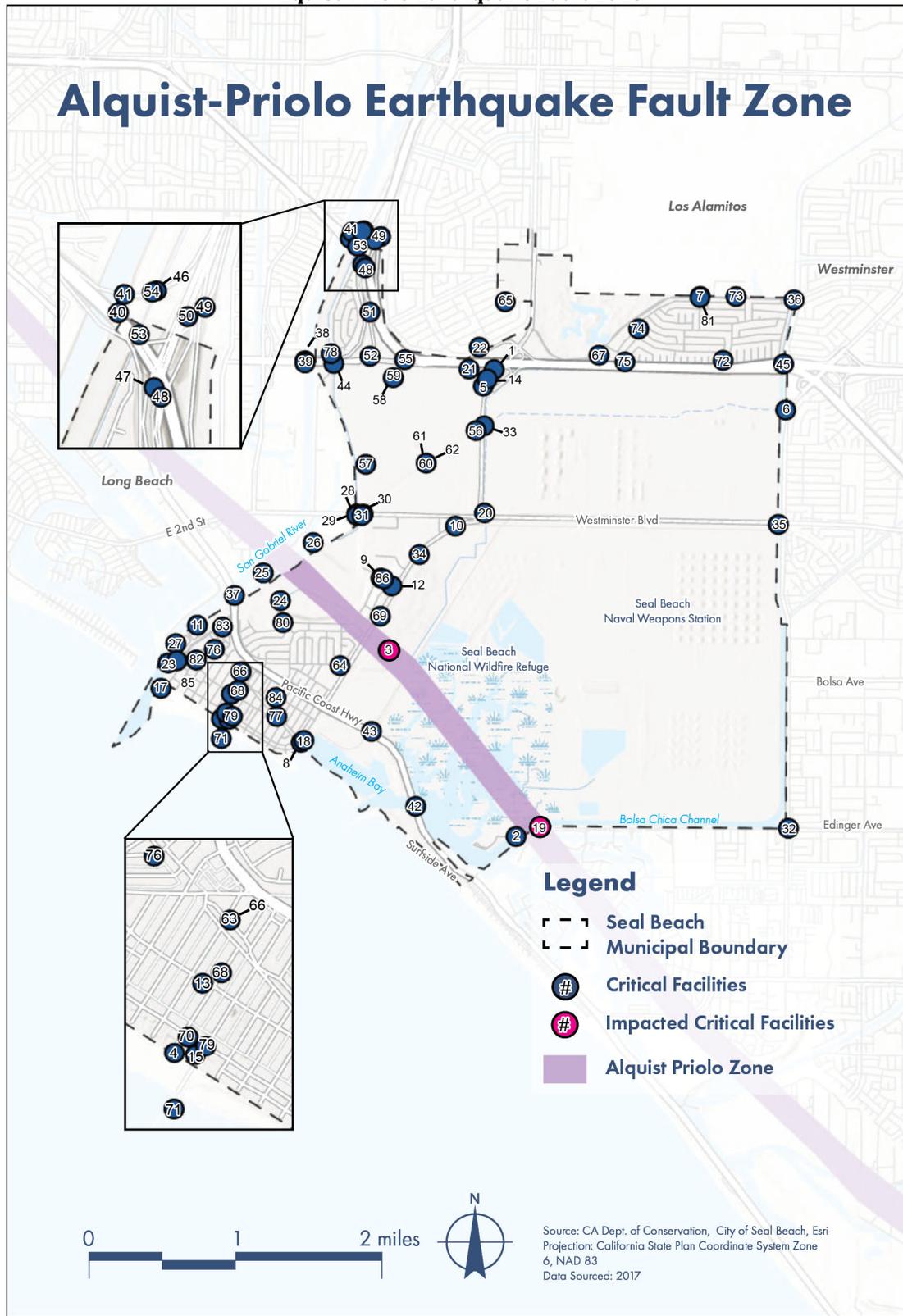
¹⁹ Los Angeles Basin Geological Society, *February 2023 Newsletter: Tectonic Evaluation of Seal Beach Anticline Using Modern 3D Seismic*, https://www.labgs.org/newsletters/labgs_2023-02.pdf, published February 2023, accessed December 27, 2024.

Temblor, *Newly identified fault in Seal Beach, CA, quietly rattles beneath the city*, <https://temblor.net/earthquake-insights/newly-identified-fault-in-seal-beach-ca-quietly-rattles-beneath-the-city-13477/>, published November 8, 2021, accessed December 27, 2024.

Alquist-Priolo Earthquake Fault Zones

Alquist-Priolo earthquake fault zones are regulatory zones surrounding the surface traces of active faults in California as mapped and defined by the California Department of Conservation. The Alquist-Priolo Earthquake Fault Zoning Act is a California law enacted in 1972 to reduce the risk of damage from surface rupture during earthquakes. Areas within the eastern portion of the City of Seal Beach are located within an Alquist-Priolo Earthquake Fault Zone due to the presence of the Newport-Inglewood Rose Canyon fault zone; refer to Figure 8-4, *Alquist Earthquake Fault Priolo Zone*. Areas within the Alquist-Priolo Earthquake Fault Zone primarily include residential uses, with some open space and recreational uses included. The City of Seal Beach is required to regulate development projects within the Alquist Priolo Fault Zone with consideration for seismic risk, to ensure all construction and land divisions are safe for human occupancy. It is assumed fault rupture within the City is most likely to occur within the Alquist Priolo Fault Zone.

Figure 8-4
Alquist-Priolo Earthquake Fault Zone



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8.1.3 PREVIOUS OCCURRENCES

As discussed above, are located and near the City of Seal Beach. Table 8-4, Major Earthquake Faults of Particular Concern, identifies faults of concern within the region and their last major ruptures.

**Table 8-4
Major Earthquake Faults of Particular Concern**

Fault Name	Type of Faulting	Last Major Rupture	Slip Rate	Interval Between Major Ruptures	Probable Magnitudes
Whittier	Right-lateral strike-slip	Holocene	2.5 to 3.0 mm/yr	Unknown	6.0 - 7.2 Mw
Elsinore	Right-lateral strike-slip with some reverse slip	18th century A.D.	Roughly 4.0 mm/yr	Roughly 250 years	6.5 - 7.5 Mw
Palos Verdes	Right-reverse	Holocene	0.3 to 3.0 mm/yr	Unknown	6.0 to 7.0 Mw
Sierra Madre	Reverse	Holocene	0.36 to 4.0 mm/yr	Several thousand years	6.0 to 7.0 Mw
Newport/Inglewood	Right lateral; local reverse slip associated with fault steps	March 10, 1933, Magnitude 6.4	0.6 mm/yr	Unknown	6.0 - 7.4 Mw
San Jacinto	Right-lateral strike-slip; minor right-reverse	April 9, 1968, Magnitude 6.5	7 to 17 mm/yr	Varies; between 100 and 300 years	6.5 - 7.5 Mw
San Andreas	Right lateral strike-slip	April 18, 1906, Magnitude 7.9	20 to 35 mm/yr	Varies; average 140 years	6.8 - 8.0 Mw

Notes: Mm = millimeters, yr = year, Mw = Moment Magnitude

Source: Southern California Earthquake Center, *Significant Earthquakes and Faults*, <http://scedc.caltech.edu/significant/fault-index.html>, accessed May 2, 2023.

As shown in Figure 8-2, Seismic Hazards, multiple regional major earthquakes over the past two decades have resulted in seismic ground shaking in the City of Seal Beach. The list below discusses major earthquakes that may have yielded some form of impact to the City:

- In 1933, an earthquake off the coast of Long Beach on the Newport-Inglewood fault measured an estimated 6.4 on the moment magnitude scale with an estimated Mercalli

intensity of VIII. This earthquake killed 115 people, largely in southern Los Angeles County and Long Beach. Significant damage occurred in the City of Seal Beach including damaged roadway between Seal Beach and Bolsa Chica Gun Club.²⁰

- The 1971 San Fernando earthquake in the San Gabriel Mountains measured 6.6 on the moment magnitude scale and XI on the Mercalli intensity scale, killing 64 people and causing extensive damage to freeway structures and buildings. Fault rupture occurred outside of the planning area, and no substantial damage or impacts were reported by the City.
- The Northridge earthquake in 1994 measured 6.7 on the moment magnitude scale with a Mercalli intensity of IX. It killed 57 people, caused over 5,000 injuries, and spawned multiple strong aftershocks. This earthquake caused an estimated \$20 billion or more in damages across Los Angeles and Orange Counties. No major damage or impact to City. The I-10 freeway experienced collapse at several overpasses (La Cienega Boulevard, Venice Boulevard, Fairfax Avenue and Washington Boulevard) near the planning area, requiring a three-month closure to rebuild.



USGS, *Long Beach, California, Earthquake March 10, 1933. Roadway between Seal Beach and Bolsa Chica Club.* Photo by W.W Bradley. <https://www.usgs.gov/media/images/long-beach-california-earthquake-march-10-1933-roadway-between-seal-beach-and-bolsa>, accessed December 27, 2024.

No federally declared disasters relating to fault rupture or ground shaking have occurred including the planning area within the last five years; refer to Table 4-4, *Summary of Federally Declared Disasters Affecting the Planning Area.*

²⁰ USGS, *Earthquake in Southern California 90 Years Ago Changed the Way We Build*, <https://www.usgs.gov/news/featured-story/earthquake-southern-california-90-years-ago-changed-way-we-build>, published March 7, 2023, accessed December 30, 2024.

8.1.4 PROBABILITY OF FUTURE OCCURRENCES

Fault Rupture & Ground Shaking

The southern California region is known to be seismically active, and thus the probability for future seismic hazard occurrences is considered highly likely. Given the historic seismic events in the region affecting the City of Seal Beach and presence of several local/regional faults, it is certain that such events will continue. The probability of a fault rupture/ground motion is considered highly likely. Highly likely means a 90 to 100 percent probability of occurrence in the next year or a recurrence interval of less than 1 year. The LHMP planning team assigned a high hazard planning consideration to the hazards and impacts associated with fault rupture/ground shaking based upon a highly likely probability and potential widespread expected impacts of future events. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that future earthquakes affecting the planning area will occur in the future and therefore felt “highly likely” best defined probability for this specific hazard.

The USGS Uniform Earthquake Rupture Forecast Version 3, released in 2017, provides a prospect of the likelihood each California region will experience a magnitude 6.7 or larger earthquake in the next 30 years; refer to Table 8-5, Likelihood of One or More Earthquakes Occurring in the Next 30 Years in Los Angeles Region by Fault. The Newport-Inglewood Fault, located within the planning area, shows lower probabilities for an earthquake greater than 6.7 M in the next 30 years compared to the San Andreas, San Jacinto, and Elsinore Fault. It is noted that while less likely, an earthquake on the Newport-Inglewood Fault would have the highest probability of fault rupture and strong ground shaking within the City.

**Table 8-5
Likelihood of One or More Earthquakes Occurring in the Next 30 Years in Los Angeles Region by Fault**

Magnitude	Whittier Fault	Elsinore Fault	Newport/Inglewood	San Jacinto	San Andreas
M ≥ 6.7	1.17%	3.66%	0.95%	5.41%	19.21%
M ≥ 7.0	1.07%	1.82%	0.81%	5.39%	12.86%
M ≥ 7.5	0.58%	0.90%	0.42%	5.28%	10.21%
M ≥ 8.0	< 0.01%	<0.01%	--	2.75%	3.24%

Notes:

1. M≥6.7 means magnitude greater than or equal to 6.7, and likewise for the other magnitude thresholds.
2. The 30-year period measured by this report is 2014 to 2044; a 30-year period is the typical duration of a homeowner mortgage.
3. Percentages for fault sections closest to the City.

Source: U.S. Department of the Interior and U.S. Geological Survey, <https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf>, published March 2015, accessed July 23, 2024

The impact and potential losses of such an event reveal significant risk and could be devastating to not only the planning area but the entire Southern California region. With the highly concentrated county population of almost 10 million and the heavy use of local transportation

infrastructure, a major earthquake could virtually shut down large portions of Southern California. This would ultimately result in substantial impacts to the City.

Table 8-6, *Possibility of Earthquakes in Los Angeles Region* shows the average time between earthquakes in the various regions together with the likelihood of having one or more such earthquakes in the next 30 years (starting from 2014).²¹ Values listed in parentheses indicate the factor by which the rates and likelihoods have increased, or decreased, since the previous model (UCERF2). “Readiness” indicates the factor by which likelihoods are currently elevated, or lower, because of the length of time since the most recent large earthquakes (see text). These values include aftershocks. It is important to note that actual repeat times may be subject to a high degree of variability and will almost never exactly equal to the average listed here.

Table 8-6
Possibility of Earthquakes in Los Angeles Region

Magnitude (greater than or equal to)	Average repeat time (years)	30- year likelihood of one or more events	Readiness
5	1.4 (0.6)	100% (1.0)	1.0
6	10 (1.1)	96% (1.1)	1.0
6.7	40 (2.1)	60% (0.8)	1.1
7	61 (2.0)	46% (0.7)	1.2
7.5	109 (1.3)	31% (0.9)	1.3
8	532 (0.4)	7% (2.5)	1.3

Source: USGS, *UCERF3: A New Earthquake Forecast for California's Complex Fault System*, <https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf>, published March 2015, accessed July 23, 2024

8.1.5 CLIMATE CHANGE

Fault Rupture & Ground Shaking

Both fault rupture and ground shaking are caused by seismic activity, which is not correlated with climate change. Thus, fault ruptures or ground shaking are not more likely to occur as climate change impacts become more significant.

8.2 LIQUEFACTION

8.2.1 DESCRIPTION

Liquefaction occurs when ground shaking causes saturated soils, primarily clay-free deposits such as sand or silt, to lose strength and act like a viscous fluid. Certain soils are more susceptible to liquefaction, particularly younger and looser sediment closer to the water table. According to FEMA, liquefaction causes three types of ground failure, as described below:

- Lateral spreads involve the lateral movement of large blocks of soil as a result of liquefaction of an underlying layer. They generally develop on gentle slopes, most commonly between 0.3 and 3 degrees. Horizontal movements commonly are as much as 10 to 15 feet. However, where slopes are particularly favorable, and the duration of

²¹ USGS, *UCERF3: A New Earthquake Forecast for California's Complex Fault System*, <https://pubs.usgs.gov/fs/2015/3009/pdf/fs2015-3009.pdf>, published March 2015, accessed July 23, 2024.

- ground shaking is long, lateral movement may be as much as 100 to 150 feet. Lateral spread usually breaks up internally, forming numerous fissures and scarps.
- Flow failures consist of liquefied soil or blocks of intact material riding on a layer of liquefied soil and are the most catastrophic type of ground failure caused by liquefaction. They commonly move several feet and up to dozens of miles under certain conditions. Flow failures usually form in loose saturated sands or silts on slopes greater than three degrees.
 - Loss of bearing strength occurs when the soil supporting buildings or other structures liquefies. When large deformations occur, structures settle and tip. The general subsurface geometry required for liquefaction-caused bearing failures is a layer of saturated, cohesionless soil that extends from near the ground surface to a depth equal to about the width of the building.

8.2.2 LOCATION/EXTENT

The potential for liquefaction exists in areas susceptible to ground shaking with loose soils and/or shallow groundwater. Given the active faults in the region and the presence of geologically young, unconsolidated sediments, liquefaction is possible throughout the City. The California Geological Survey Seismic Hazard Zonation Program identifies and maps areas prone to liquefaction; refer to [Figure 8-5, *Liquefaction Hazard Zone*](#).

Areas most at risk for liquefaction are primarily located within the vicinity of current or historical rivers or other drainages. Nearly the entire area of the City is susceptible to liquefaction with the exception of portions of the Old Town area.

8.2.3 PREVIOUS OCCURRENCES

Although not documented in detail, it is possible that liquefaction occurred in various areas throughout the City of Seal Beach during the 1933 Long Beach Earthquake and other significant seismic events. It is confirmed that liquefaction did occur during this event in several areas near the City.²²

8.2.4 PROBABILITY OF FUTURE OCCURRENCES

Because there are several areas in the planning area that are located within an identified liquefaction zone, the LHMP Planning Team indicated the probability of future occurrences is considered highly likely. The FEMA hazard prioritization tool defines a highly likely probability as 90 to 100 percent probability in the next year or a recurrence interval of less than 1 year. While the LHMP Planning Team acknowledges this recurrence interval does not bear out historically, the team felt strongly that future earthquakes affecting the planning area will occur in the future and therefore felt “highly likely” best defined probability for this specific hazard. Because seismic activity is expected to continue in the southern California region, liquefaction should also be expected and anticipated as a secondary impact in the planning area from this hazard.

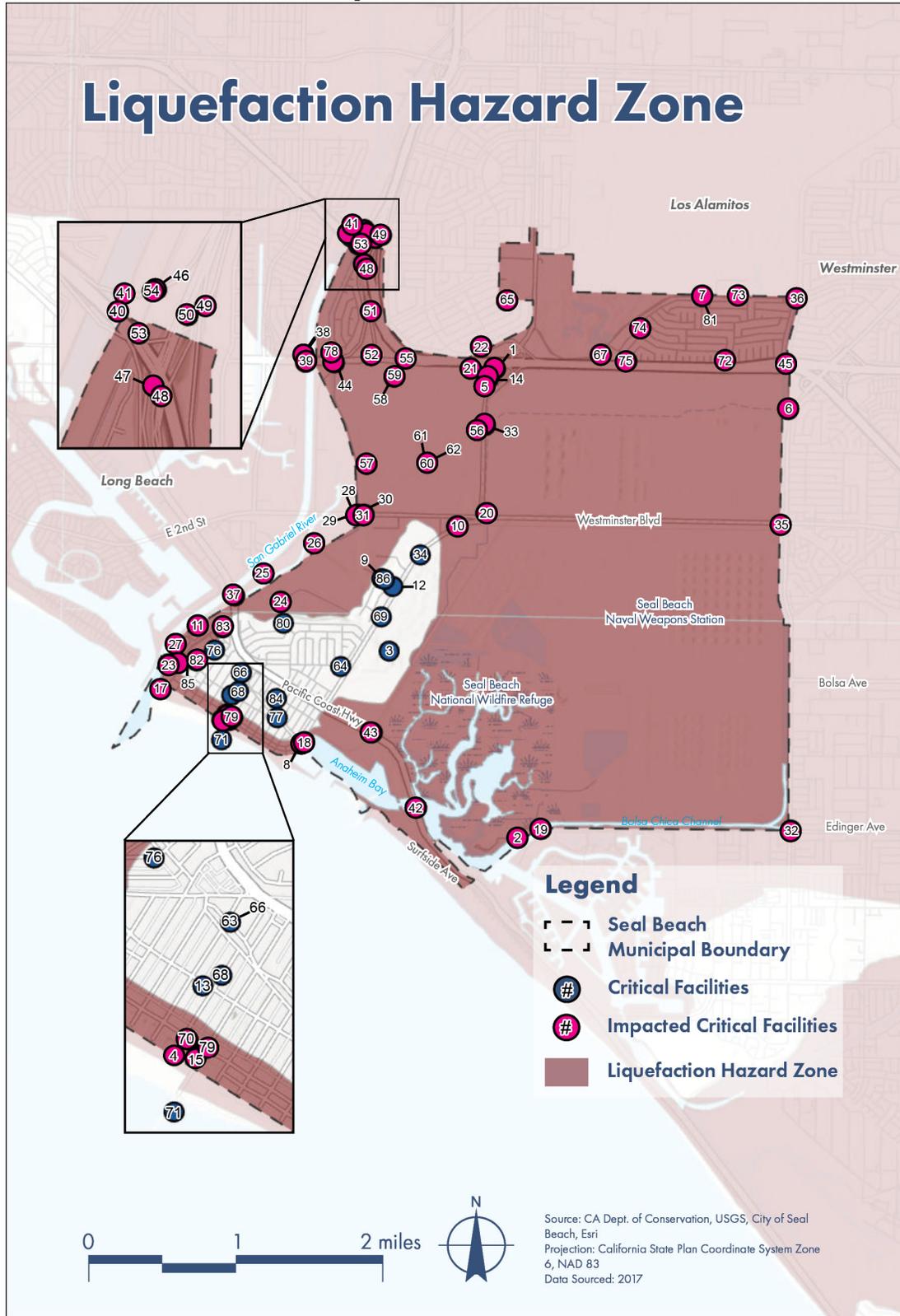
It should be noted that liquefaction would most likely be triggered by a significant earthquake event within one of the fault zones close to or within the planning area. As previously noted, the

²² California Department of Conservation, *The 1933 Long Beach Earthquake*, <https://www.conservation.ca.gov/cgs/earthquakes/long-beach>, accessed December 30, 2024.

Newport-Inglewood Fault has limited probability to produce a 6.7 Mw earthquake or greater in the next 30 years. This would then reduce the probability of future liquefaction as a result of an earthquake on this fault. Earthquakes are more probable to occur on the San Andres, San Jacinto, or Elsinore Faults. These three faults are located several miles from the planning area and depending on the epicenter and magnitude of the earthquake, may not be strong enough to trigger liquefaction within the jurisdiction.

Figure 8-5
Liquefaction Hazard Zone

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8.2.5 CLIMATE CHANGE

Climate change may increase susceptibility to liquefaction. Climate change is likely to bring more severe rain events to southern California, increasing the amount of water saturation in loose soils. Saturated soils are known to be at risk for liquefaction or ground failure in an earthquake. Thus, heavy periods of rain combined with a local earthquake with strong ground shaking could increase the likelihood of liquefaction potential.

8.3 VULNERABILITY ASSESSMENT

8.3.1 MAPPED HAZARDS VULNERABILITY ASSESSMENT

To identify populations at risk for mapped seismic hazards, hazard data layers were overlaid and compared with City parcel data in Geographic Information Systems, ArcGIS. If a hazard layer either completely or partially overlapped with a parcel in the data layer, then the entire parcel is conservatively considered vulnerable in this analysis. In many instances, the landslide hazard zone intersected with only small portions of individual properties. However, to provide a detailed understanding of risk and vulnerability as part of this hazard mitigation plan, these parcels (including all residential and non-residential development on the parcel, regardless of location) are considered vulnerable.

Fault Rupture and Ground Motion

Critical facilities located within the Alquist-Priolo Earthquake Fault Zone primarily include 2 water systems facilities. Critical facilities located within the City's identified Alquist Priolo Zone have been listed in [Table 8-7, *Critical Facilities in the Alquist Priolo Zone*](#). This data may not reflect recent discoveries of fault lines within the City of Seal Beach.

This analysis includes potential fault rupture along the Alquist Priolo Earthquake Fault Zone whereas the entirety of the City may be vulnerable to ground motion as seen in [Figure 8-1, *Shake Potential*](#). Approximately 76 residential units are located within the Alquist-Priolo Earthquake Fault Zone. The number of vulnerable residential units multiplied by the average of 1.90 persons per household for Seal Beach indicates that approximately 145 people reside in the Alquist Priolo Earthquake Fault Zone. Additionally, approximately 7,553 square feet of non-residential structures are located within the landslide hazard area. Refer to [Table 8-8 *Populations in the Alquist Priolo Zone*](#) for a summary of vulnerable residents, residential units, and non-residential buildings.

**Table 8-7
Critical Facilities in the Alquist Priolo Zone**

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
3	2901 Edinger Ave - Sewer lift pump station	Water Systems	Water Systems	\$2,025,000
19	Stormwater Pump Station - 202 Seal Beach Blvd (County owned)	Water Systems	Water Systems	Not Available

**Table 8-8
Populations in the Alquist Priolo Zone**

Residents at Risk	Residential Units at Risk	Non-Residential Area at Risk (sq. ft.)
145	76	7,553

Liquefaction

Critical facilities located within the liquefaction hazard include those that serve as transportation, water systems, safety and security, communications, and hazardous materials lifelines. In total, there are 70 vulnerable critical facilities located within the City’s liquefaction hazard zone. Transportation, water systems, and safety and security are the primary asset types within the liquefaction hazard zone, however other types of critical facilities have also been identified as vulnerable. Critical facilities located within the City’s identified liquefaction hazard zone have been listed in Table 7-1, Critical Facilities in Liquefaction Hazard Zone.

Approximately 10,728 residential units are located within the landslide hazard zone. The number of vulnerable residential units multiplied by the average of 1.90 persons per household for Seal Beach indicates that approximately 20,384 people reside in the landslide hazard zone. Additionally, approximately 3,099,408.6 square feet of non-residential structures are located within the liquefaction hazard area. Refer to Table 8-10, Populations at Risk for Liquefaction for a summary of vulnerable residents, residential units, and non-residential buildings.

**Table 8-9
Critical Facilities in Liquefaction Zone**

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
1	3101 ½ N Gate Rd - Potable water reservoir, well and pump station.	Water Systems	Water Systems	\$2,425,000
2	2901 Edinger Ave - Sewer lift pump station	Water Systems	Water Systems	\$1,050,000
4	Sewer lift pump station - 800 Ocean Ave	Water Systems	Water Systems	\$1,050,000
5	Potable water well - 2700 North Gate Rd	Water Systems	Water Systems	\$400,000
6	Potable water well - 3333 Bolsa Chica Rd	Water Systems	Water Systems	\$400,000
7	Potable water well - 4307 Lampson Ave	Water Systems	Water Systems	\$400,000
8	Sewer lift pump station - 200 Seal Beach Blvd	Water Systems	Water Systems	\$1,050,000

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
10	Sewer lift pump station - 2701 Seal Beach Blvd	Water Systems	Water Systems	\$1,050,000
11	Stormwater pump station - 43 ½ Riversea Rd	Water Systems	Water Systems	\$1,050,000
14	OCFA Fire Station 48	Government Services	Safety and Security, Communications	\$1,630,720
15	Seal Beach Marine Safety Headquarters	Government Services	Safety and Security, Communications	\$3,129,060
16*	OC-35 Import Waterline Turnout	Transportation	Transportation	Not Available
17	Sewer lift station - 1st St	Water Systems	Water Systems	\$1,050,000
18	Stormwater Pump Station - 202 Seal Beach Blvd (County owned)	Water Systems	Water Systems	Not Available
19	Bridge to Sunset Aquatic Park (not City-owned)	Water Systems	Water Systems	Not Available
20	OC San Regional Wastewater Collections Station (not City-owned)	Water Systems	Water Systems	Not Available
21	Leisure World Water Well (inactive)	Water Systems	Water Systems	Not Available
22	OC San Wastewater Station - (3112 Yellowtail, Rossmoor)	Water Systems	Water Systems	Not Available
23	San Gabriel River Bike Trail Entry Point	Transportation	Transportation	Not Available
24	Los Cerritos Wetlands Restoration (not City-owned)	Wetlands	Safety and security	Not Available
25	Hellman Oil Field (not City-owned)	Oil Field	Hazardous Materials	Not Available
26	Stormwater Pump Station (County owned)	Water Systems	Water Systems	Not Available
27	Bridge 53C1998 – San Gabriel River (Local)	Transportation	Transportation	\$16,324,000

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Map ID	Name	Asset Type	Community Lifeline	Replacement Value
28	Bridge 55C0041L – Los Alamitos Channel (Local)	Transportation	Transportation	\$1,574,100
29	Bridge 55C0041R – Los Alamitos Channel (Local)	Transportation	Transportation	\$1,574,100
30	Bridge 55C0042L - Federal Storm Channel (Local)	Transportation	Transportation	\$1,690,700
31	Bridge 55C0042R - Federal Storm Channel (Local)	Transportation	Transportation	\$1,906,410
32	Bridge 55C0075 - Westminster Channel (Local)	Transportation	Transportation	\$5,281,980
33	Bridge 55C0104 – Federal Storm Channel (Local)	Transportation	Transportation	\$4,185,940
35	Bridge 55C0108 – Bolsa Chica Channel (Local)	Transportation	Transportation	\$5,888,300
36	Bridge 55C0160 – Bolsa Chica Channel (Local)	Transportation	Transportation	\$2,157,100
37	Bridge 53 0060 – San Gabriel River (State)	Transportation	Transportation	\$18,073,000
38	Bridge 53 0302L – San Gabriel River (State)	Transportation	Transportation	\$9,969,300
39	Bridge 53 0302R – San Gabriel River (State)	Transportation	Transportation	\$9,969,300
40	Bridge 53 1185 – San Gabriel River (State)	Transportation	Transportation	\$35,563,000
41	Bridge 53 1737H – San Gabriel River (State)	Transportation	Transportation	\$7,287,500
42	Bridge 55 0010 – Anaheim Bay (State)	Transportation	Transportation	\$16,673,800
43	Bridge 55 0065 – Kitt Highway, US Navy RR (State)	Transportation	Transportation	\$6,879,400

Map ID	Name	Asset Type	Community Lifeline	Replacement Value
44	Bridge 55 0310 – Los Alamitos Channel (State)	Transportation	Transportation	\$9,328,000
45	Bridge 55 0334 – Bolsa Chica Ditch (State)	Transportation	Transportation	\$67,045,000
46	Bridge 55 0347H – Service Rd (State)	Transportation	Transportation	\$378,950
47	Bridge 55 0412L – Interstate 405 (State)	Transportation	Transportation	\$19,822,000
48	Bridge 55 0412R – Interstate 405 (State)	Transportation	Transportation	\$11,660,000
49	Bridge 55 0413F – Rte 405, 605, CONN, RIV (State)	Transportation	Transportation	\$44,891,000
50	Bridge 55 0415 – E22 - N405 Connector Ramp (State)	Transportation	Transportation	\$131,175,000
51	Bridge 55 0426G – S605 - S405 Connector (State)	Transportation	Transportation	\$12,458,710
52	Bridge 55 0428G – State Route 22 (State)	Transportation	Transportation	\$26,818,000
53	Bridge 55 0441 – Los Alamitos Channel (State)	Transportation	Transportation	\$15,158,000
54	Bridge 55 0471H – Los Alamitos Channel (State)	Transportation	Transportation	\$1,107,700
55	Bridge 55 1100G – Interstate 405 (State)	Transportation	Transportation	\$44,308,000
56	Leisure World Clubhouse 1	Community Facility	Safety and Security	Not Available
57	Leisure World Clubhouse 2	Community Facility	Safety and Security	Not Available
58	Leisure World Clubhouse 3	Community Facility	Safety and Security	Not Available
59	Leisure World Clubhouse 4	Community Facility	Safety and Security	Not Available
60	Leisure World Clubhouse 5	Community Facility	Safety and Security	Not Available
61	Leisure World Clubhouse 6	Community Facility	Safety and Security	Not Available
62	Leisure World Healthcare Center	Community Facility	Health and Medical	\$3,000,695

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Map ID	Name	Asset Type	Community Lifeline	Replacement Value
65	North Seal Beach Community Center	Community Facility	Safety and Security; Food, Water, Shelter	\$995,610
67	Seal Beach Tennis Center	Community Facility	Safety and Security	\$1,000,000
70	Police Substation	Municipal Services	Safety and Security; Communications	Not Available
72	Almond Park	Public Park	Safety and Security	\$750,000
73	Arbor Park	Public Park	Safety and Security	\$6,500,000
74	Aster Park	Public Park	Safety and Security	\$650,000
75	Bluebell Park	Public Park	Safety and Security	\$650,000
78	Edison Park	Public Park	Safety and Security	\$5,000,000
79	Eisenhower Park	Public Park	Safety and Security	\$700,000
81	Heather Park	Public Park	Safety and Security	\$800,000
82	Marina Park + Community Center	Community Facility	Safety and Security	\$500,000
83	Schooner Park	Public Park	Safety and Security	\$950,000
85	Beach Maintenance yard	Government Building	Hazardous Materials	\$4,064,100

**Table 8-10
Populations at Risk for Liquefaction**

Residents at Risk	Residential Units at Risk	Non-Residential Area at Risk (sq. ft.)
20,384	10,728	3,099,408.6

8.3.2 CHANGES IN VULNERABILITY FROM PREVIOUS FIVE YEARS

Since the 2019 LHMP, development and land use has not substantially changed in the planning area. In the five years since the approval of the previous LHMP, only one significant housing development was identified in the City’s most recent 2021-2029 Housing Element: the construction of approximately thirty single family homes on a former Department of Water and Power (DWP) site at the intersection of Marina Drive and 1st Avenue. Other land use changes since the 2019 LHMP have been limited in nature, such as the addition of ADUs, and/or lot line adjustments. As these changes were minor in size and scale, vulnerability is not considered to have significantly changed in the past five years.

As development and land use in the planning area has not substantially changed since the 2019 LHMP, population trends have also remained relatively the same. United States Census Data reports a 2020 population of 25,232 and a 2023 population of 24,868, representing a 1.44 percent population decline. Generally, observed population decline in the planning area is associated with an overall aging population.

8.3.3 CHANGES IN VULNERABILITY FOR FUTURE FIVE YEARS

Looking forward, the City anticipates the majority of population growth would align with the 2021-2029 Housing Element, which proposes to accommodate the City's Regional Housing Needs Allocation of 1,243 units largely at commercial sites which are proposed to be rezoned for mixed use. Based on anticipated growth and development, it is reasonable to assume that vulnerability to seismic hazards will increase over the 5-year planning period of this LHMP. As the entirety of the city is vulnerable to seismic hazards, any new development or population increase would overall increase vulnerability within the planning area

8.4 SOCIALLY VULNERABLE POPULATIONS ASSESSMENT

Section 3-7 includes a detailed determination of Socially Vulnerable Populations (SVPs) within the planning area and characteristics that make those populations more vulnerable to hazards. Seismic hazards can affect all SVPs including census tracts 995.09, 995.10, 995.02 and the Seal Beach Shores Mobile Home Park. Seal Beach Shores Mobile Home Park may be more severely impacted by ground shaking and liquefaction as the structures are not as foundationally stable and lack structural integrity.

Additionally, SVPs and other high-risk individuals exist throughout the planning area and may be present within seismic hazard zones despite a census tract's social vulnerability classification. Specific SVPs and high-risk individuals that may be present throughout the planning area include unemployed individuals, elderly populations age 65 and older, young populations under age 17, persons with disabilities, persons with high pollution burden, and tourists, seasonal visitors, and homeless populations. The primary concern for SVPs and other high-risk individuals in the City would be evacuation efforts, access to emergency services and supplies, and recovery.

Unemployed individuals may be more vulnerable to seismic hazards as they may be limited in financial resources to prepare for disasters, such as purchasing emergency supplies, securing adequate housing, or evacuating to safer areas with transportation. Additionally, unemployed individuals may have substandard housing, which may not be as resilient during an earthquake or liquefaction hazard event. These populations may also not have resources to seek medical care following an earthquake or liquefaction event. These social and economic disparities can further hinder their ability to recover, leaving them at greater risk of long-term displacement and financial hardship following a seismic event.

Young populations under age 17 may be more vulnerable to the impacts of seismic hazards due to being more susceptible to injuries and illnesses as their bodies are still developing. Younger children may also have limited mobility and awareness to evacuate in a timely manner during a disaster. Younger populations rely heavily on adults for protection, care, and decision-making; thus, if parents/guardians/caregivers are affected by a disaster, the child's safety and well-being may be compromised. Lastly, a seismic hazard event can lead to school closures and displacement, which may disrupt children's education and social development.

Elderly populations aged 65 and older are more vulnerable to seismic hazard events. Persons aged 65 or older often face several challenges when responding to an emergency, such as mobility challenges, health concerns, social isolation, barriers to transportation, and limited access to information or technology. In addition, there is often overlap between persons aged 65 or older

and persons with a disability, as older adults experience increased prevalence of disabilities. This could include cognitive impairment, difficulties with independent living or hearing and vision problems. Lastly, this population may rely on caregivers for their well-being; thus, evacuation may be more difficult if this service is disrupted.

Similarly, persons with disabilities are highly vulnerable to seismic hazards due to mobility challenges, having difficulty evacuating quickly, or navigating through debris. This population may have more underlying health conditions that can be exacerbated by the stress and demands of a seismic event. There may be communication barriers to this population as emergency alerts and information may only be accessible in limited communication mediums. Seismic hazards can damage or destroy essential assistive devices such as wheelchairs, hearing aids, communication devices, and other medical technology. Additionally, persons with disabilities might rely on caregiving services which may be disrupted during seismic events and make it difficult to evacuate.

Persons exposed to areas with a high pollution burden are more vulnerable to seismic hazards for a variety of reasons. Seismic hazards can further exacerbate populations with high pollution burdens who are already exposed to high pollution levels and have weakened respiratory and cardiovascular systems. Communities with high pollution often face economic challenges, making it harder to prepare and recover from seismic hazard events. Lastly, persons dwelling in areas with a high pollution burden may have older, less resilient infrastructure, increasing the likelihood of damage during an earthquake or liquefaction event and ultimately leading to prolonged exposure to hazardous conditions.

Tourists, seasonal visitors, and homeless populations are particularly vulnerable during seismic hazard events due to their lack of familiarity with the area and lack of established support systems. They may not be aware of evacuation routes or local emergency procedures, making it difficult for them to respond quickly. Additionally, they might not have access to timely information about disasters or the resources needed to cope with the aftermath. The City hosts multiple community events throughout the year and nearby Huntington Beach and Long Beach are expected to host sizeable events for the upcoming 2028 Olympic Games, indicting increased present and future vulnerability. These factors make SVPs throughout Seal Beach especially vulnerable to the impacts of seismic hazards.

Considerations for SVPs throughout the planning area were incorporated into the mitigation strategy in Section 11. Mitigation Strategy. Specifically, the LHMP Planning Team tailored Mitigation Actions P.1, P.8, 1.8, 5.4, and 5.9 to mitigate hazard impacts to SVPs including issues related to preparedness, evacuation, and access to emergency services.



9

WILDFIRE AND URBAN FIRE HAZARD ASSESSMENT





SECTION 9: WILDFIRE AND URBAN FIRE HAZARD ASSESSMENT

9.1 WILDFIRE AND URBAN FIRE

9.1.1 DESCRIPTION

Fire is an integral component of many of California's ecosystems. However, uncontrolled fire hazards threaten lives, property, and natural resources and present a considerable risk to vegetation and wildlife habitats. Fires occur in wildland and urban areas. A wildland fire is a large destructive fire that can spread quickly over woodland or brush. A wildfire is an uncontrolled fire spreading through vegetative fuels. Wildfires can be caused by human error (such as campfires), intentionally by arson, by mechanical sources of ignition (such as heaters and generators), and by natural events (such as lightning). Wildfires often occur in forests or other areas with ample vegetation. In areas where structures and other human development meets or intermingles with wildland or vegetative fuels (referred to as the wildland urban interface), wildfires can cause significant property damage and present extreme threats to public health and safety.

There are three categories of interface fire: the classic wildland urban interface exists where well-defined urban and suburban development presses up against open wildland areas; the mixed wildland urban interface is characterized by isolated homes, subdivisions and small communities situated predominantly in wildland settings; and the occluded wildland urban interface exists where islands of wildland vegetation occur inside a largely urbanized area.

Certain conditions must be present for significant interface fires to occur. The most common conditions include hot, dry and windy weather; the inability of fire protection forces to contain or suppress the fire; the occurrence of multiple fires that overwhelm committed resources; and a large fuel load (dense vegetation). Once a fire has started, several conditions influence its behavior, including fuel topography, weather, drought and development.

Urban fires are fires that burn in developed areas, affecting or destroying private homes, commercial properties, parks, or public facilities. Wildfires have the potential to turn into urban fires if their trajectory takes them close enough to developed urban areas. Urban fires may start from a range of causes, such as downed power lines, a broken gas main, arson, poor disposal or management of toxic substances, or a lack of maintenance to wooden structures or facilities.

Southern California faces challenges with wildfire hazards from the increasing number of houses being built in the wildland-urban interface. Every year the growing population has expanded further and further into the hills and mountains, including into brush and forest lands. The increased “interface” between urban/suburban areas and the open spaces created by this expansion has produced a significant increase in threats to life and property from fires and has pushed existing fire protection systems beyond original or current design and capability.

During wildfire season, Southern California Edison (SoCal Edison) monitors weather conditions in fire prone areas. To prevent strong winds and extreme heat from causing fire accidents, SoCal Edison may proactively turn off power through activation of their Public Safety Power Shutoff (PSPS) program. Power outages as a secondary effect is discussed in detail in [Section 6, *Extreme Weather*](#).

The Santa Ana winds can also further exacerbate wildfires. Santa Ana winds ranging from 45 to 100 mph push dry air from the inland deserts of California and the Southwest over the mountains that lie between these desert areas and coastal California. The Santa Ana winds also remove moisture in the air resulting in evaporation and dry vegetation.¹ Dry vegetation acts as a fuel for wildfires to grow, with the strong Santa Ana winds driving wildfire spread.²

9.1.2 LOCATION/EXTENT

The California Department of Forestry and Fire Protection (CAL FIRE) prepares fire hazard severity maps including mapping areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. These zones, referred to as Fire Hazard Severity Zones (FHSZ), define the application of various mitigation strategies and influence how people construct buildings and protect property to reduce risk associated with wildland fires. While FHSZ do not predict when or where a wildfire will occur, zones identify where wildfire hazards could be more severe and therefore, are of greater concern for mitigation purposes.

While some areas of Seal Beach may face susceptibility to the wildfire hazard based on certain conditions, no mapped wildfire hazard severity zones have been identified within the City. [Figure 9-1, *Orange County Mapped Wildfire Zones*](#), identifies mapped wildfire hazards severity zones within Orange County. Open space in the City including areas on the Naval Weapons Station may

¹ Spectrum News 1, *What are Santa Ana winds and do they cause wildfires?*, <https://spectrumnews1.com/ca/la-west/weather/2020/10/01/what-are-santa-ana-winds-and-do-they-cause-wildfires->, published November 5, 2021, accessed December 27, 2024.

² KTLA, *What are Santa Ana winds and how do they impact fire season?*, <https://ktla.com/news/local-news/what-are-santa-ana-winds-and-how-do-they-impact-fire-season/#:~:text=Santa%20Ana%20winds%20are%20often%20strong%20enough%2C%20and%20being%20warm,perfect%20environment%20for%20a%20fire.>, published November 18, 2022, accessed December 27, 2024.

face increased vulnerability to wildfire, but substantial risk to these areas have not been identified at this time.

Within the City is a large open space managed by the Seal Beach Naval Weapons Station. The City of Seal Beach contracts Orange County Fire Authority (OCFA) for any fire services. OCFA services include technical rescue, fire prevention, fire investigation, hazardous materials response, public information/education, paramedic, and ambulance transport services.³ The Naval Weapons Station is also supported by the Naval Weapons Station Seal Beach Federal Fire Department.

Several policies are in place to prevent wildfires in the City, as Seal Beach has adopted the California Fire Code by reference into its municipal code. Specific requirements are in place regarding the use of welding equipment, cutting torches, tar pots, grinding devices, and other tools to prevent the ignition of a wildfire. The City also has a weed abatement program, which consists of monitoring for overgrowth of vegetation, and violations if vegetation if property owners do not manage vegetation overgrowth.

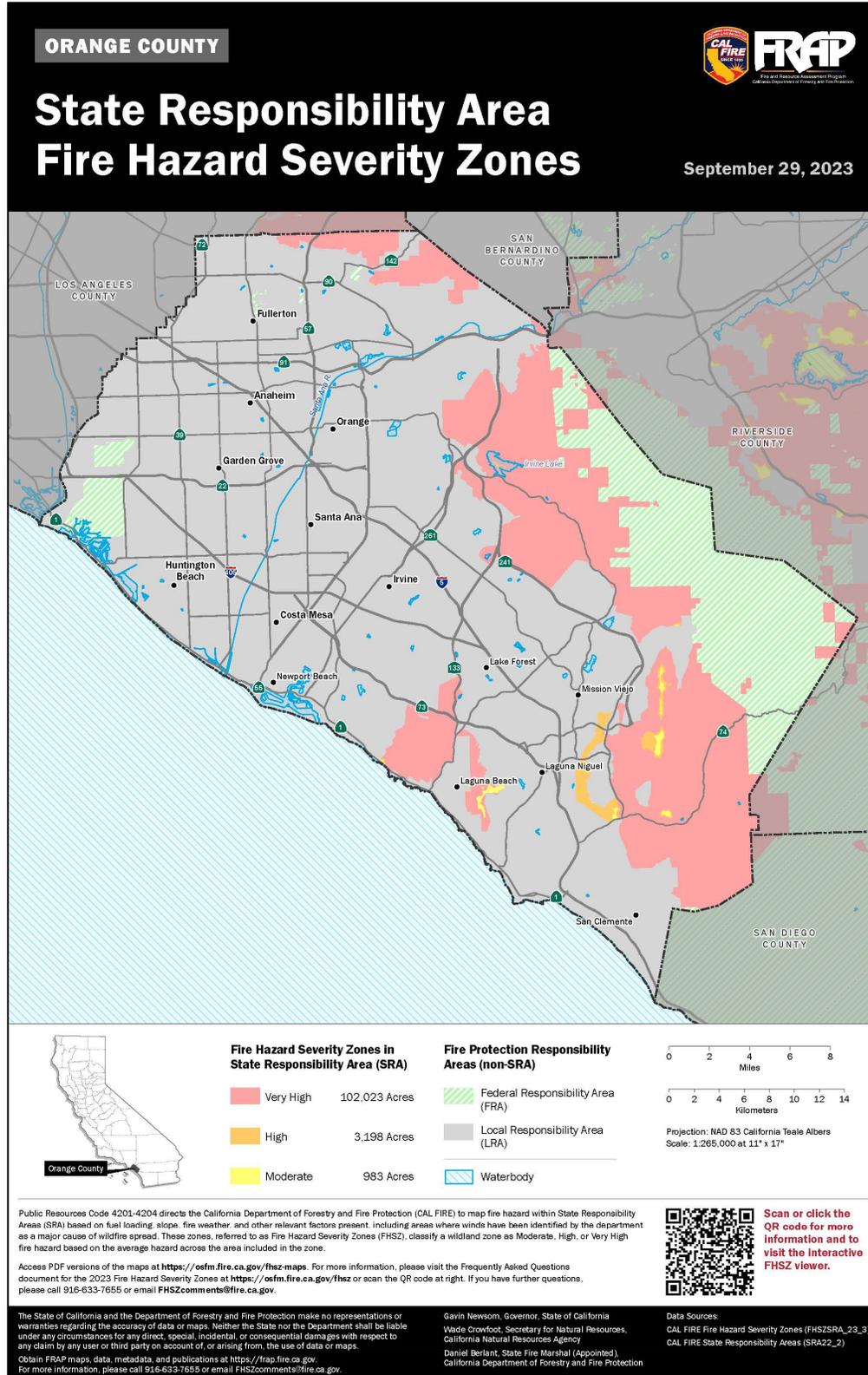
The magnitude and severity of wildfire and urban fire impacts can vary significantly, based on size, scale and location of the fire. Wildfires are not measured on a specific scale and are usually classified by size or impact. The size and severity of any fire depends on the availability of fuel, weather conditions, and topography, although wildfires in the wildland urban interface do not need to be significant in acreage to be damaging. Small fires in Orange County history have been known to cause significant property damage or loss of human life, highlighting the need for local fire crews to be prepared for wildfires that may develop from smaller, more isolated fire incidents.

Seal Beach's developed land is at risk of urban fires due to arson or malicious intent. Areas near infrastructure like power lines or gas transmission lines also face vulnerability, especially if these structures are damaged during weather or seismic events. Additionally, buildings with wood-frame construction or flammable materials are more likely to catch fire. Gas stations throughout the City can also be sources of urban fires.

Fire protection challenges occur where development is located within and directly adjacent to wildland urban interface areas, thus increasing the extent of the hazard. As the number of structural features increases, so does the risk of incidence of fire. While no Very High Fire Hazard Severity Zones (VHFHSZs) have been identified within or in immediate vicinity of the City at this time, there is the potential for wildfire to spread quickly within the City if an ignition does occur.

³ City of Seal Beach, *City of Seal Beach Fire Services*, <https://www.sealbeachca.gov/Departments/Fire>, accessed January 9, 2024.

Figure 9-1
Orange County Mapped Wildfire Zones



Michael Baker International, Inc.

9.1.3 PREVIOUS OCCURRENCES

No recent wildfire events have been reported within the City of Seal Beach or in areas immediately surrounding the City. While limited wildfire events have impacted the City and mapped wildfire areas have not presently been identified nearby, Seal Beach may face increased risk to wildfire under certain weather and environmental conditions.

Seal Beach has experienced a number of urban fires in recent history. Recent urban fire events affecting the City in the last five years have been summarized below:

- February 5, 2019 - Firefighters battled a multi-unit apartment fire in Seal Beach on the 800 block of Ocean Avenue. No injuries were reported in this incident.⁴
- May 26, 2019 - A two-alarm fire at a four-story apartment building on the 12400 block of Montecito Road was reported. The fire destroyed one unit, damaged four others, and displaced nine adults and two children. No injuries were reported in this incident.⁵
- January 20, 2020 - A massive third-alarm fire broke out at the Rossmoor Park Apartments in Seal Beach, forcing the displacement of over 30 people. Two people suffered from smoke inhalation, and another victim was burned in this incident.⁶
- June 19, 2022 - Firefighters battled an urban fire that fully engulfed the garage of a two-story home on the 1000 block of Crestview Avenue. No injuries resulted from this incident.⁷

No federally declared disasters related to wildfire or urban fire events have impacted the planning area within the last five years; refer to Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area.

9.1.4 PROBABILITY OF FUTURE OCCURRENCES

Given the history of urban fire events in and near the City of Seal Beach, the probability of wildfires and urban fires occurring in the future is considered likely. A likely probability means a 10% to 90% probability of occurrence in the next year or a recurrence interval of 1 to 10 years. Seal Beach's risk for personal injury, loss of life, and damage to property due to wildfire events is presently considered low given the lack of identified wildfire risk within the City. The City's location near the coast, land maintenance on open space areas, and the City's high water table due to its coastal location and the nearby San Gabriel River are factors contributing to Seal Beach's low wildfire risk. Wildfire smoke as a secondary hazard is also considered to have a likely probability of occurrence in the future for similar reasons.

While the City has a limited history of major wildfire occurrences, there is a likelihood of future regional wildfire occurrence in surrounding areas. Outbreaks of wildfire may occur during the dry season or following periods of limited rainfall or drought. Large regional fires outside the City of

⁴ Ludwig, Ashley, *Apartment Fire Doused In Seal Beach*, <https://patch.com/california/losalamitos/apartment-fire-doused-seal-beach>, accessed December 26, 2024.

⁵ Orange County Register, *Fire at Seal Beach apartment complex displaces 11 residents*, <https://www.ocregister.com/2019/05/26/fire-at-seal-beach-apartment-complex-displaces-11-residents/>, accessed December 26, 2024.

⁶ NBC 4 Los Angeles, *2 Hurt, Dozens Displaced Following Three-Alarm Blaze at Seal Beach Apartment Complex*, <https://www.nbcalosangeles.com/news/2-hurt-dozens-displaced-following-three-alarm-blaze-at-seal-beach-apartment-complex/2294936/>, accessed December 26, 2024.

⁷ Long Beach Post, *Crews douse garage fire at home near Gum Grove Park in Seal Beach*, <https://lbpost.com/news/garage-fire-seal-beach-video-gum-grove/>, accessed December 26, 2024.

Seal Beach may result in wildfire smoke impacts depending on the severity, location, weather, and wind patterns of the fire. The LHMP planning team assigned a medium hazard planning consideration to the hazards and impacts associated with wildfire based upon a likely probability and the potential impacts of future events.

9.1.5 CLIMATE CHANGE

Climate change and global warming patterns cause an increase in temperatures, as well as more frequent and intense drought conditions. This is understood to be a contributing factor to more frequent and severe wildfires. As mentioned previously, the severity of a wildfire is dependent on the amount of oxygen, heat, wind, relative humidity, and fuel. Most of these factors have direct or indirect ties to climate change and increased global temperatures.

A 2016 study identified the contribution of climate change to dry vegetation as it doubled the occurrence of large fires from 1984 and 2015 throughout the western United States.⁸ As climate change continues to increase global temperatures, drought conditions and excessive heat may become more common.⁹ Excessive heat and low humidity during the summer and fall months are likely to occur. This would increase dry vegetation, which could cause wildfires to move more quickly or spread into developed areas.

Regional wildfires will likely become an increased threat in the City of Seal Beach and surrounding areas. Wildfires release smoke, ash, and other particulate matter that degrade air and water quality. Thus, fires located in various parts of the City of Seal Beach and surrounding areas can negatively impact air and water quality throughout the planning area. As such, wildfire mitigation should consider the cumulative impacts associated with climate change.

9.2 WILDFIRE SMOKE

9.2.1 DESCRIPTION

Wildfire smoke poses a risk to the City of Seal Beach as a secondary hazard. Wildfire smoke is a mixture of gases and fine particles from burning trees, plants, buildings, and other materials.¹⁰ Fine particulate matter are particles smaller than 2.5 micrometers, which can be inhaled deeply into the lungs. When inhaled, fine particulate matter, also referred to as PM2.5, increases the risk of cardiovascular and respiratory problems. Additionally, wildfire smoke is a complex mixture that consists of other pollutants that have also been shown to lead to a variety of health effects.

Wildfire smoke distribution is affected by factors such as wind, weather, terrain, and fire heat intensity.¹¹ Wind, particularly the Santa Ana winds, may affect wildfire smoke by either clearing

⁸ John, T. Abatzoglou, and A. Park William, "Impact of Anthropogenic Climate Change on Wildfire Across western US Forests," Proceedings of the National Academy of Sciences, October 10, 2016. <https://www.pnas.org/doi/10.1073/pnas.1607171113>, accessed December 27, 2024.

⁹ National Oceanic and Atmospheric Administration, *Wildfire Climate Connection*, <https://www.noaa.gov/noaa-wildfire/wildfire-climate-connection>, accessed December 27, 2024.

¹⁰ Centers for Disease Control and Prevention, *How Wildfire Smoke Affects Your Body*, <https://www.cdc.gov/air/wildfire-smoke/default.htm>, published April 19, 2024, accessed December 27, 2024.

¹¹ United States Environmental Protection Agency, *Health Effects Attributed to Wildfire Smoke*, <https://www.epa.gov/wildfire-smoke-course/challenges-predicting-smoke-concentrations>, updated February 2, 2024, accessed December 27, 2024.

out an area or blow more smoke in or fan the flames which can therefore intensify the fire and worsen smoke.¹² Intense heat generated by wildfire can drive smoke high into the air where it remains until it cools and begins to descend to ground level however it becomes more diluted and widespread. Terrain affects smoke concentrations by altering dispersal patterns.¹³ For example, as the sun warms mountain slopes, air is heated and rises, ultimately bringing smoke and fire with it from lower elevations. After sunlight passes, the terrain cools and the air descends, creating a down-slope airflow that can alter smoke dispersal.

Wildfire smoke is measured by the Air Quality Index (AQI). The AQI also focuses on health effects within a few hours or days after breathing polluted air. The EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide.¹⁴ The AQI is divided into six categories ranging from good to hazardous (refer to [Table 9-2, Air Quality Index](#)).

Table 9-2
Air Quality Index

Air Quality Index	Category	Associated Health Impacts
0 – 50	Good	Air quality is satisfactory and poses little or no risk
51 – 100	Moderate	Sensitive individuals should avoid outdoor activity as they may experience respiratory symptoms
101 – 150	Unhealthy for Sensitive Groups	General public and sensitive individuals in particular are at risk to experience irritation and respiratory problems
151 – 200	Unhealthy	Increased likelihood of adverse effects and aggravation to the heart and lungs among general public
201 – 300	Very Unhealthy	General public will be noticeably affected. Sensitive groups should restrict outdoor activities.
301 – 500	Hazardous	General public at high risk of experiencing strong irritations and adverse health effects. Should avoid outdoor activities.

Source: U.S. Environmental Protection Agency, *Air Data Basic Information*, <https://www.epa.gov/outdoor-air-quality-data/air-data-basic-information>, updated December 8, 2023, accessed August 10, 2024.

Health effects of wildfire smoke may be relatively minor, such as respiratory irritation, or may be serious and cause significant respiratory problems, heart failure, and death.¹⁵ Certain groups of people are more susceptible to the effects of wildfire smoke. Particularly vulnerable populations include unemployed individuals, elderly populations age 65 and older, young populations under age 17, persons with disabilities, persons with high pollution burden, and tourists, seasonal visitors, and homeless populations.

¹² Ibid.

¹³ Ibid.

¹⁴ National Weather Service NOAA, *Air Quality Index*, <https://www.weather.gov/safety/airquality-aqindex>, updated 2024, accessed December 27, 2024.

¹⁵ United States Environmental Protection Agency, *Health Effects Attributed to Wildfire Smoke*, <https://www.epa.gov/wildfire-smoke-course/health-effects-attributed-wildfire-smoke>, accessed December 27, 2024.

9.2.2 LOCATION

The extent of wildfire smoke would depend heavily on the size and severity of the wildfire as well as weather and wind patterns. Larger wildfires generally create more significant wildfire smoke impacts that extend throughout the county. This may be exacerbated by strong winds, which would drive the smoke further throughout the planning area. Various health impacts are associated with wildfire smoke and poor air quality including coughing, phlegm, wheezing, difficulty breathing, eye irritation, heart failure, and death. Impacts would worsen with increased duration of exposure. Poor air quality and wildfire smoke may impact people even when indoors, leading to health impacts. However, vulnerable populations are most at risk of the health impacts associated with wildfire smoke.¹⁶

The nearest air quality monitoring stations to the City of Seal Beach are ARB #70033 in Signal Hill and #70110 in Long Beach.¹⁷

9.2.3 PREVIOUS OCCURRENCES

Previous occurrences of wildfire smoke impacting the City are very limited. However, on September 10, 2024, a smoke advisory was issued in Seal Beach due to the nearby Bridge, Line, Airport, and Roblar fires. Air quality during this time was classified as moderate, and residents were advised to limit outdoor exposure.¹⁸

No federally declared disasters related to wildfire smoke events have impacted the planning area within the last five years; refer to Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area.

9.2.4 PROBABILITY OF FUTURE OCCURRENCES

As smoke can travel hundreds or thousands of miles, air quality can also be a problem from the wildfire itself.¹⁹ Predicting if air quality will improve or worsen can be difficult because of the unpredictable behavior of wildfires and factors such as wind, weather, and terrain.²⁰ For example, a wind that usually clears out a valley could also blow more smoke in an area or even fan the flames therefore intensifying the fire and worsening smoke.

As previously mentioned in Section 9.1.4, Probability of Future Occurrences, the probability of wildfires and urban fires occurring in Seal Beach in the future is considered likely (10% to 90% probability of occurrence in the next year or a recurrence interval of 1 to 10 years). Given the limited history of wildfire events in and near the City of Seal Beach, the probability of wildfire

¹⁶ United States Environmental Protection Agency, *Health Effects Attributed to Wildfire Smoke*, <https://www.epa.gov/wildfire-smoke-course/health-effects-attributed-wildfire-smoke>, accessed December 27, 2024.

¹⁷ California Air Resources Board, *Air Monitoring Sites*, <https://ww2.arb.ca.gov/applications/air-monitoring-sites-interactive-map>, updated 2024, accessed December 27, 2024.

¹⁸ Barnes, Rachel, *Smoke Advisory Issued in Seal Beach Due to Multiple Nearby Fires*, <https://patch.com/california/losalamitos/smoke-advisory-issued-seal-beach-due-multiple-nearby-fires>, accessed December 24, 2024.

¹⁹ United States Environmental Protection Agency, *Challenges in Predicting Smoke Concentrations*, <https://www.epa.gov/wildfire-smoke-course/challenges-predicting-smoke-concentrations>, updated February 2, 2024, accessed December 27, 2024.

²⁰ Ibid.

smoke occurring as a secondary hazard of wildfire in the future is considered likely. A likely probability means a 10% to 90% probability of occurrence in the next year or a recurrence interval of 1 to 10 years. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that wildfires and wildfire smoke will likely affect the planning area in the future and therefore felt “likely” best defined probability for this specific hazard. The LHMP planning team assigned a medium hazard planning consideration to the hazards and impacts associated with wildfire smoke based upon a likely probability and the potential impacts of future events.

9.2.5 CLIMATE CHANGE

As climate change increases the intensity and frequency of wildfires, this will inevitably increase the amount of wildfire smoke. According to the Stanford Center for Innovation in Global Health, about one-third of all particulate matter pollution in the United States comes from wildfire smoke – wildfires that are more intense and common because of climate change.²¹

9.3 VULNERABILITY ASSESSMENT

9.3.1 HAZARD VULNERABILITY ASSESSMENT

Wildfire and Urban Fire

Although CAL FIRE did not identify fire hazard severity zones within the City of Seal Beach, fires can occur in open spaces and parks throughout the City. This could include areas such as Gum Grove Park which includes highly flammable vegetation such as eucalyptus trees, Los Cerritos Wetlands, and areas of the Naval Weapon Station. Additionally, urban fires can occur anywhere within Seal Beach, which may spread throughout the City. Therefore, urban fires can affect the entirety of the City and yield potential impacts to critical facilities. This may inhibit critical facilities from functioning properly, acting as evacuation routes, and/or acting as shelters.

Wildfire Smoke

Depending upon the extent and magnitude of a wildfire event, major transportation routes could become severely congested or inaccessible. Evacuation efforts may face challenges due to limited exit routes available in the event of a wildfire, especially for socially vulnerable populations. Wildfire smoke may cause emergency medical events that hinder the ability for residents and visitors to exit the hazard area, and smoke may be carried through the air to areas outside of the City, impacting the health of nearby populations. Wildfire impacts to critical facilities in the planning area such as local pump stations, reservoirs, water treatment facilities, and other utility stations could result in loss of power, gas, and water supply. Critical facilities designated as shelter locations may be damaged or inaccessible during a wildfire event, increasing the vulnerability of the local population to secondary hazards such as smoke inhalation.

²¹ Stanford Center for Innovation in Global Health, *How climate change exacerbates air pollution (and its health impacts)*, <https://globalhealth.stanford.edu/planetary-health-fellowship/how-climate-change-exacerbates-air-pollution-and-its-health-impacts.html/>, published August 24, 2023, accessed June 28, 2024.

9.3.2 CHANGES IN VULNERABILITY FROM PREVIOUS FIVE YEARS

Since the 2019 LHMP, development and land use has not substantially changed in the planning area. In the five years since the approval of the previous LHMP, only one significant housing development was identified in the City's most recent 2021-2029 Housing Element: the construction of approximately thirty single family homes on a former Department of Water and Power (DWP) site at the intersection of Marina Drive and 1st Avenue. Other land use changes since the 2019 LHMP occurred at the property level, such as the addition of ADUs, subdivisions, and/or lot line adjustments. As these changes were minor in size and scale, vulnerability is not considered to have significantly changed in the past five years.

As development and land use in the planning area has not substantially changed since the 2019 LHMP, population trends have also remained relatively the same. United States Census Data reports a 2020 population of 25,232 and a 2023 population of 24,868, representing a 1.44 percent population decline. Generally, observed population decline in the planning area is associated with an overall aging population.

9.3.3 CHANGES IN VULNERABILITY FOR FUTURE FIVE YEARS

Looking forward, the City anticipates the majority of population growth would align with the 2021-2029 Housing Element, which proposes to accommodate the City's Regional Housing Needs Allocation of 1,243 units largely at commercial sites which are proposed to be rezoned for mixed use. These areas may be impacted by wildfire, urban fire, and wildfire smoke. Based on anticipated growth and development, it is reasonable to assume that vulnerability to wildfire/urban fire and wildfire smoke hazards will increase over the 5-year planning period of this LHMP.

9.4 SOCIALLY VULNERABLE POPULATIONS ASSESSMENT

Section 3-7 includes a detailed determination of Socially Vulnerable Populations (SVPs) within the planning area and characteristics that make those populations more vulnerable to hazards. As wildfires, urban fires, and wildfire smoke are not mapped, these hazards may affect SVPs across the planning area including census tracts 995.09, 995.10, 995.02 and the Seal Beach Shores Mobile Home Park.

Additionally, SVPs and other high-risk individuals exist throughout the planning area and may be present within wildfire/urban fire and wildfire smoke hazards zones despite a census tract's social vulnerability classification. Specific SVPs and high-risk individuals that may be present throughout the planning area include unemployed individuals, elderly populations age 65 and older, young populations under age 17, persons with disabilities, persons with high pollution burden, and tourists, seasonal visitors, and homeless populations. The primary concern for SVPs and other high-risk individuals in the City would be evacuation efforts, access to emergency services and supplies, and recovery.

Unemployed individuals may be more vulnerable to wildfire/urban fire and wildfire smoke as they may be limited in financial resources to prepare for disasters, such as purchasing emergency supplies, securing adequate housing, or evacuating to safer areas by transportation. Additionally, unemployed individuals may have substandard housing, thereby potentially exposing them to wildfire smoke if their air filters are inadequate. These populations may not have resources to seek medical care following a wildfire/urban fire and wildfire smoke hazard event. These social and

economic disparities can further hinder their ability to recover, leaving them at greater risk of long-term displacement and financial hardship following a wildfire/urban fire and wildfire smoke hazard event.

Young populations under age 17 may be more vulnerable to the impacts of wildfire/urban fire and wildfire smoke hazards due to being more susceptible to injuries and illnesses as their bodies are still developing. Younger children may also have limited mobility and awareness to evacuate from a wildfire/urban fire or escape incoming wildfire smoke. Younger populations rely heavily on adults for protection, care, and decision-making; thus, if parents/guardians/caregivers are affected by a disaster, the child's safety and well-being may be compromised. Additionally, wildfire/urban fire and wildfire smoke can lead to school closures and displacement, which may disrupt children's education and social development.

Elderly populations age 65 and older are more vulnerable to wildfire/urban fire and wildfire smoke events. Persons aged 65 or older often face several challenges when responding to an emergency, such as mobility challenges, health concerns, social isolation, barriers to transportation, and limited access to information or technology. In addition, there is often overlap between persons aged 65 or older and persons with a disability, as older adults experience increased prevalence of disabilities. This could include cognitive impairment, difficulties with independent living, or hearing and vision problems. Wildfire smoke can also exacerbate underlying health conditions that this SVP may have. Lastly, this population may rely on caregivers for their well-being; thus, evacuation may be more difficult if this service is disrupted.

Similarly, persons with disabilities are highly vulnerable to wildfire/urban fires and wildfire smoke due to mobility challenges, having difficulty evacuating quickly, and difficulty navigating evacuation routes. This population may have more underlying health conditions that can be exacerbated by the stress and demands of a wildfire event. There may be communication barriers to this population as emergency alerts and information may only be accessible in limited communication mediums. Wildfire/urban fires can damage or destroy essential assistive devices such as wheelchairs, hearing aids, communication devices, and other medical technology. Additionally, persons with disabilities might rely on caregiving services, which may be disrupted during a wildfire event and make it difficult to evacuate.

Persons exposed to areas with a high pollution burden are more vulnerable to wildfire/urban fire and wildfire smoke hazards for a variety of reasons. Wildfire/urban fire and wildfire smoke hazards can further exacerbate conditions for those who are already exposed to high pollution levels and have weakened respiratory and cardiovascular systems. Additionally, contaminated wildfire smoke can further increase their risk of illness. Communities with high pollution often face economic challenges, making it harder to prepare and recover from wildfire/urban fire events. Lastly, persons dwelling in areas with a high pollution burden may have older, less resilient infrastructure, increasing their vulnerability during a wildfire event and ultimately leading to prolonged exposure to hazardous conditions.

Tourists, seasonal visitors, and homeless populations are particularly vulnerable during wildfire events due to their lack of familiarity with the area and lack of established support systems. They may not be aware of evacuation routes or local emergency procedures, making it difficult for them

to respond quickly. Additionally, they might not have access to timely information about the wildfire event or the resources needed to cope with the aftermath. The City hosts multiple community events throughout the year and nearby Huntington Beach and Long Beach are expected to host sizeable events for the upcoming 2028 Olympic Games, indicating increased present and future vulnerability. These factors make SVPs throughout Seal Beach especially vulnerable to the impacts of a wildfire/urban fire and wildfire smoke.

Considerations for SVPs throughout the planning area were incorporated into the mitigation strategy in Section 11. Mitigation Strategy. Specifically, the LHMP Planning Team tailored Mitigation Actions P.1, P.8, 1.8, 5.4, and 5.9 to mitigate hazard impacts to SVPs including issues related to preparedness, evacuation, and access to emergency services.



10

HUMAN-CAUSED HAZARD ASSESSMENT





SECTION 10: HUMAN-CAUSED HAZARDS ASSESSMENT

10.1 HAZARDOUS MATERIALS SPILL

10.1.1 DESCRIPTION

A hazardous material is a substance that, because of its quantity, concentration or physical or chemical composition, poses a significant present or potential hazard to human health and safety or to the environment if released. The term “release” means spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment, unless permitted or authorized by a regulatory agency. Hazardous materials can be in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. Hazardous materials accidents can occur during production, storage, transportation, use, or disposal.

The impacts of a hazardous materials release can vary, depending on the type and amount of material released. Hazardous materials exposure can include the following effects: skin/eye irritation; difficulty breathing; headaches; nausea; behavior abnormalities; cancer; genetic mutations; physiological malfunctions (i.e., reproductive impairment, kidney failure); physical deformations; or birth defects.

10.1.2 LOCATION/EXTENT

Hazardous materials are generated, used, and stored by facilities throughout the City of Seal Beach and in surrounding communities for a variety of purposes in service industries, small businesses, schools, and households. Uses known to handle, store, and/or maintain hazardous materials within the City involve commercial/retail businesses and the Seal Beach Naval Weapons Station. Further, transportation of hazardous materials is known to occur on roadways and freeways within the City.

Most hazardous materials in the City of Seal Beach are associated with low-risk, small-scale operations consistent with day-to-day activities. Common hazardous materials include diesel fuel, chlorine, flammable waste, fuel waste, radiator coolant, ethylene glycol, pesticides, paint/paint thinner, non-halogenated solvents, toxics, and petroleum distillate solvents. The Seal Beach Naval Weapons Station produces a large quantity of hazardous materials and is the source of most active cleanup sites in the City.

Hazardous materials spills are accounted for using two statewide geodatabases. The EnviroStar is the Department of Toxic Substances Control’s data management system that tracks cleanup, permitting, enforcement and investigation efforts at hazardous waste facilities and sites with known contamination or sites where there may be reasons to investigate further.¹² The GeoTracker is the California State Water Resources Control Board’s data management system for sites that impact or have the potential to impact water quality in California with emphasis on groundwater.^{34 5}

According to the Department of Toxic Substances Control EnviroStar database, there is one active voluntary cleanup site. This site, Naval Weapons Station Seal Beach (Seal Beach Blvd and Westminster Ave), contains 56 sites that have been subject to contamination investigations. Contaminants at this site include acids, alkaline, explosives, waste oils, polychlorinated biphenyls (PCBs), fuels, solvents, paint thinners, asbestos, mercury, volatile organic compounds (VOCs), heavy metals, oil drilling fluids, and paint wastes.

According to the GeoTracker, there are 14 open sites undergoing active clean up in the City; refer to Table 10-1 Active Cleanup Sites. Eight of these active sites are located on the Naval Weapons Station, with five other sites located near downtown, and one near Westminster Blvd. and Seal Beach Blvd. The potential contaminants of concern primarily include gasoline for those sites not located on the Naval Weapons Station.

**Table 10-1
Active Cleanup Sites**

Name	Address	ID	Type	Date
G&M Oil #01	1300 Pacific Coast Hwy	T0605901801	Open – Remediation	10/10/2005
SEAL BEACH MARINA PARK LEASE AND HELLER FEE	101 Marina Dr	T10000017860	Open – Site Assessment	4/10/2024

¹ Department of Homeland Security, *Chemicals and Hazardous Materials Incidents*, <https://www.ready.gov/hazardous-materials-incidents>, accessed December 27, 2024.

² Department of Toxic Substances Control, *EnviroStar*, <https://dtsc.ca.gov/your-envirostor/>, updated 2024, accessed December 31, 2024.

³ State Water Resources Control Board, *GeoTracker*, <https://geotracker.waterboards.ca.gov/>, updated 2024, accessed December 31, 2024.

⁴ Health and Safety Code Division 20, Chapter 6.95, *Hazardous Materials Release Response Plans and Inventory*, Article 1.

⁵ U.S. EPA, *Health and Ecological Hazards Caused by Hazardous Substances*, <https://www.epa.gov/emergency-response/health-and-ecological-hazards-caused-hazardous-substances>, accessed December 27, 2024.

Name	Address	ID	Type	Date
ARCO #6066	490 Pacific Coast	T0605900372	Open - Remediation	3/26/2013
SHELL OIL	347 Main	T0605900293	Open - Remediation	11/6/2002
CHEVRON #9-3530	350 Main	T0605900085	Open - Remediation	2/18/2022
Momart Dry Cleaning Facility (Former)	1101 Pacific Coast Highway	T10000010250	Open - Remediation	3/22/2017
Seal Beach Naval Weapons Station- IR - US Naval Weapons Station Seal Beach, IR-5 Landfill/UXO	800 Seal Beach Blvd	DOD100379100	Open - Verification Monitoring	11/14/2003
Seal Beach Naval Weapons Station- IR - US Naval Weapons Station Seal Beach, IR-70 Research, Testing and Evaluation Area	800 Seal Beach Blvd	DOD100355700	Open - Remediation	1/5/2009
Seal Beach Naval Weapons Station- IR - Seal Beach Naval Weapons Station, Site 74 - Old Skeet Range	800 Seal Beach Blvd	T10000005653	Open - Remediation	4/13/2015
Seal Beach Naval Weapons Station - MMRP - Naval Weapons Station Seal Beach MMRP AOC-2 Explosives Drop Test Tower	800 Seal Beach Blvd	T10000017346	Open - Remediation	5/28/2021
Seal Beach Naval Weapons Station - MMRP - US Naval Weapons Station Seal Beach - MRP - UXO1 Primer/Salvage Yard	800 Seal Beach Blvd	T10000000673	Open - Remediation	3/21/2022
Seal Beach Naval Weapons Station - MMRP - Seal Beach Naval Weapons Station - MMRP, MRP Site UXO6	800 Seal Beach Blvd	T10000021004	Open - Remediation	4/27/2023
Seal Beach Naval Weapons Station- IR - US Naval Weapons Station	800 Seal Beach Blvd	DOD100350600	Open - Verification Monitoring	4/2/2004

Name	Address	ID	Type	Date
Seal Beach, IR-7 Station Landfill				
Seal Beach Naval Weapons Station- IR - Naval Weapons Station Seal Beach, Agricultural Well KAYO-SB, IRP Site 75	800 Seal Beach Blvd	T10000003011	Open - Site Assessment	5/3/2011

Source: State Water Resources Control Board, *GeoTracker*, <https://geotracker.waterboards.ca.gov/>, updated 2024, accessed January 8, 2025.

The Environmental Protection Agency (EPA) biennially collects information regarding the generation, management, and disposal of hazardous materials under the Resource Conservation and Recovery Act (RCRA). The Biennial Report Summary for 2023 indicated three hazardous waste generators in the City of Seal Beach: CVS Pharmacy #8843 (921 Pacific Coast Hwy), CVS Pharmacy #9551 (12490 Seal Beach Blvd), and Naval Weapons Station Seal Beach (800 Seal Beach Blvd).⁶ Multiple hazardous waste types are generated at these locations (most notably acids, alkaline, explosives, waste oils, PCBs, fuels, oil drilling fluids, and other materials) are disposed pursuant to RCRA regulations.

Hazardous materials are transported throughout California and Orange County, primarily along highways under the regulatory authority of the California Highway Patrol (CHP). The primary transportation routes for hazardous materials near the City of Seal Beach include the I-405 and I-605 freeways. Some hazardous material transportation activities are conducted through Pacific Coast Highway and Seal Beach Boulevard within the City.⁷ Disruption to a major freeway due to a hazardous materials release could result in significant safety and economic impacts to City, county, or even state populations and assets.

In addition, the Alamitos Energy Center (AEC), sometimes referenced as Alamitos Energy Station (AES) or Alamitos Generating Station (AGS) is located within the neighboring City of Long Beach, adjacent to the planning area. AEC is a natural gas power station and is a major source of electricity in California. Beginning in 2013, the AEC began phasing modernization of equipment including improvements to power blocks, turbines and other ancillary equipment. As part of this modernization, a battery energy storage system (BESS) was incorporated into the system to provide energy storage solutions for capacity and grid reliability. In the event of a disaster, AEC could pose a unique hazard due to the presence of natural gas and BESS. This facility is regulated and permitted through the California Energy Commission, and compliance proceedings and documentation are available through this agency.

⁶ United States Environmental Protection Agency, *Biennial Report Summary 2021*, <https://rcrapublic.epa.gov/rcrainfoweb/action/modules/br/summary/view>, accessed April 29, 2025.

⁷ City of Seal Beach, *General Plan Safety Element*, <https://www.sealbeachca.gov/Portals/0/Documents/Safety%20Element.pdf>, accessed January 8, 2025.

10.1.3 PREVIOUS OCCURRENCES

The Comprehensive Environmental Response, Compensations, and Liability Act (CERCLA), Emergency Planning and Community Right-to-Know Act (EPCRA), and California law require responsible parties to report hazardous materials releases if certain criteria are met. All hazardous materials releases exceeding reportable quantities must be reported to the National Response Center. The majority of historical hazardous materials releases in the City of Seal Beach are relatively small in scale and are efficiently cleaned up. According to the Pipeline and Hazardous Materials Safety Administration (PHMSA) incident database, no hazardous materials spills have been recorded to PHMSA in Seal Beach since 1992.⁸ The following incidents involving hazardous materials outside of the PHMSA database within the last five years have been detailed below:

- September 5, 2022 – Local residents stepped in a tar ball while walking in Seal Beach at E Dolphin Avenue and E Seal Way. The source of the tar ball is unknown, and no injuries were reported.⁹
- March 2022 – Tar balls were reported on multiple Orange County beaches as a result of the rupture of two oil pipelines. Over 25,000 gallons of oil was released in this incident, yielding significant environmental impacts.¹⁰
- December 22, 2021 – A boat crew located a rainbow-colored sheen on the Pacific Ocean from an unknown source. No injuries were reported in this incident, and the sheen was quickly cleaned up.¹¹

No federally declared disasters related to hazardous materials have impacted the planning area within the last five years; refer to Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area.

10.1.4 PROBABILITY OF FUTURE OCCURRENCES

Hazardous materials use throughout the City of Seal Beach will continue in the future and thus the possibility of a hazardous materials release will continue to be a concern. However, federal, State, and local governments implement applicable policies and regulations regarding the use, storage, and disposal of hazardous materials in order to mitigate the risk of a hazardous materials release. The City participates in a household hazardous waste disposal program, set up by Orange County in accordance with the California Integrated Solid Waste Management Act of 1989. There are four household hazardous waste disposal facilities in the County: Anaheim Collection Center; Huntington Beach Collection Center; Irvine Collection Center; and San Juan Capistrano Collection Center. The Huntington Beach facility is closest to the City of Seal Beach.

Both the federal government and the State require hazardous materials handling to be reported with the local Certified Unified Program Agency, a local agency certified by the California

⁸ PHMSA, *Incident Statistics*, <https://www.phmsa.dot.gov/hazmat-program-management-data-and-statistics/data-operations/incident-statistics>, accessed January 8, 2025.

⁹ Cal OES, *Hazardous Materials Spill Report*, <https://w3.calema.ca.gov/operational/mal haz.nsf/f1841a103c102734882563e200760c4a/5d8416ab0a34be41882588b5000e8fd1?OpenDocument>, accessed January 8, 2025.

¹⁰ Heal the Bay, *What We Know (and Don't) About the Oil Spill in Orange County*, <https://healthebay.org/oil-spill-in-orange-county-california/#:~:text=We%20will%20not%20know%20the,.publicaffairs@dot.gov.>, accessed January 8, 2025.

¹¹ Cal OES, *Hazardous Materials Spill Report*, <https://w3.calema.ca.gov/operational/mal haz.nsf/f1841a103c102734882563e200760c4a/6c1161f35d596403882587b3006aa292?OpenDocument&Highlight=0,D.C.O.R>, accessed January 8, 2025.

Environmental Protection Agency to implement and enforce hazardous materials management programs.¹² Many different industries handle hazardous materials as part of day-to-day operations, and each agency/company are responsible to follow policies and programs dictated by federal and State regulation to ensure that hazardous materials are not released into the environment. Because of the preventative action taken by the City, State, and federal agencies and private industries, the probability is considered somewhat likely. A probability of somewhat likely indicates a 1 to 10 percent probability of occurrence in the next year or a recurrence interval of 11 to 100 years. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that future hazardous material releases affecting the planning area will occur in the future and therefore felt “somewhat likely” best defined probability for this specific hazard. The likelihood for future hazardous materials spills is considered medium.

10.1.5 CLIMATE CHANGE

Accidental hazardous materials releases can be caused by human error or equipment failure, unrelated with climate change. However, hazardous materials releases can be a secondary impact as a result of infrastructure failure during a natural hazard event, such as a wildfire or severe storm. Climate change could cause an increase in destructive natural hazards in the City and surrounding region, and thus risk future hazardous materials spills. Further, hazardous materials releases during severe weather events or even wildfire could spread contamination to large geographic areas and amplify long-term impacts on human and ecological health. Spills or releases in challenging clean-up conditions can result in more severe damage or impacts compared to spills during normal conditions.

10.2 TERRORISM/CYBERATTACKS

10.2.1 DESCRIPTION

Domestic terrorism is defined by the Federal Bureau of Investigation (FBI) as perpetuated by individuals and/or groups inspired by or associated with a primarily United States based movement that espouses extremist ideologies of a political, religious, social, racial, or environmental nature. International terrorism is perpetuated by individuals and/or groups inspired by or associated with designated foreign terrorist organizations or nations (i.e., State sponsored).¹³ The United States Federal Code states that terrorism must be intended to 1) intimidate or coerce a civilian population; 2) influence the policy of a government by intimidation or coercion; or, 3) affect the conduct of a government by mass destruction, assassination, or kidnapping.¹⁴

Other types of terrorism include cyberterrorism or cyber-attacks. Generally speaking, cyberterrorism is carried out using computers or information technology. The National Institute of Standards and Technology (NIST), defines cyber-attack as targeting an enterprise’s use of cyberspace for the purpose of disrupting, disabling, destroying, or maliciously controlling a computing environment/infrastructure; or destroying the integrity of the data or stealing

¹² Department of Toxic Substances Control, *Certified Unified Program Agencies (CUPA)*, <https://dtsc.ca.gov/certified-unified-program-agencies-cupa/>, accessed January 8, 2025.

¹³ Federal Bureau of Investigation, *Terrorism*, <https://www.fbi.gov/investigate/terrorism>, accessed December 27, 2024.

¹⁴ U.S. Federal Code Title 18, Chapter 113B, Section 2331.

controlled information.¹⁵ Cyber-attacks can be the result of insider threats or external hacking. Insider threats are personally motivated attackers, such as former employees, who aim to disrupt a system to seek retribution or accidental abuse of access to a company's assets. External hackers usually seek financial gain through money or data theft or business disruption. There are numerous types of hacking, including malware, phishing, and ransomware. Malware is malicious software that destroys key data or files rendering a system inoperable. Phishing is a scam attempt designed to look like a legitimate request for information in order to steal an individual's credentials or sensitive data. Ransomware is a more complex malware that encrypts data or functionality, thereby preventing the use of a system until the attacker's financial demands are met.¹⁶ Many critical facilities and infrastructure within the City operate using information technology and thus are potential targets for cyberterrorism or cyber-attacks.

10.2.2 LOCATION/EXTENT

The specific location and severity of impacts of terrorism is difficult to predict. Generally, locations most vulnerable to terrorism are places where people gather, places of political importance, infrastructure, and destinations. Examples include but are not limited to:

- Schools
- Hospitals
- City Hall
- Community centers
- Libraries
- Transit operations and stops
- Shopping malls/large retail centers
- Highways and other transportation infrastructure
- Power plants and utility infrastructure
- Event/entertainment centers

The City of Seal Beach has locations such as those identified above that could be vulnerable to terrorism or mass attacks. The severity of a terrorist attack would heavily depend on the nature of the attack and the potential target. Seal Beach hosts a Naval Weapons Station within City limits. Depending on the type and size of an attack, impacts of terrorism or other acts of violence on the base could significantly affect entirety of the City of Seal Beach.

Unlike physical terrorist attacks, cyberterrorism is not location-based. Hacking could occur from great distances away from the City, but impacts could be severe and widely distributed. Cyberterrorism may have similar motives as physical terrorism and likely target similar industries including government, businesses, healthcare or medical facilities, financial institutions, educational institutions, and/or public utilities. Cyberterrorist attacks have the potential to cause violence, service disruptions, physical damage, psychosocial impacts, economic damage, or data breaches. Depending on the target and intended motive, the effects of cyberterrorism may impact the entirety of the City or may impact specific businesses. For example, a cyber-attack aimed at an

¹⁵ National Institute of Standards and Technology, *NIST Special Publication 1800-10, Protecting Information and System Integrity in Industrial Control System Environments: Cybersecurity for the Manufacturing Sector*, <https://csrc.nist.gov/pubs/sp/1800/10/final>, accessed December 27, 2024.

¹⁶ International Business Machines Corporation, *What is a cyberattack?*, <https://www.ibm.com/topics/cyber-attack>, accessed December 27, 2024.

energy provider may leave the entire City without power in an effort to coerce some action from the utility company or the City. On the other hand, cyberterrorism may occur on a relatively small scale aimed at individuals to obtain personal or financial information.

10.2.3 PREVIOUS OCCURRENCES

While the City of Seal Beach has not previously experienced any terrorist attacks, the City was the subject of a ransomware attack on December 24, 2019. Hundreds of private businesses and government entities were targeted in this attack, as attackers encrypted City computers with malware and locked victims out of their computers.¹⁷ No known financial or personal information was stolen during this incident. As a result of this attack, the City has taken swift action to increase cybersecurity measures, including the preparation of the 2022 Cyber Security Incident Response Plan.

The Orange County Transportation Authority (OCTA), which services the planning area, was also struck with a major cyberattack in 2016. The cyberattack cost over \$600,000 and disabled dozens of computer servers for days including a total shutdown of email, voicemail, and numerous other services.¹⁸ Transportation services, however, were still functioning normally, and no personal information, such as social security numbers or credit card information, was stolen.

No federally declared disasters related to terrorism/cyberattacks have impacted the planning area within the last five years; refer to Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area.

10.2.4 PROBABILITY OF FUTURE OCCURRENCES

The probability of a terrorist attack/cyberattack in the City of Seal Beach is considered likely. A probability of likely indicates a 10 to 100 percent probability of a terrorist attack/cyberattack occurrence in the next year or a recurrence interval of 10 years or less. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that future terrorist attacks/cyberattacks affecting the planning area will occur in the future and therefore felt “likely” best defined probability for this specific hazard. Additionally, because of the dynamic nature of a terrorist threat, terrorism can occur without warning and may occur in any area within the City. The prevalent use of technology and the internet increases the likelihood for cyberterrorism. Targets of cyberterrorism, particularly industries including governments, businesses, healthcare or medical facilities, financial institutions, educational institutions, and/or public utilities, implement cybersecurity measures to prevent cyberterrorism. Thus, the likelihood for cyberterrorism or cyber-attacks is considered medium.

¹⁷ City of Seal Beach, *Cyber Security Incident Response Plan*, published April 2022.

¹⁸ Voice of OC, *Transportation Authority Kept Secret Cyber Attacker That Cost \$600,000*, <https://voiceofoc.org/2024/06/santana-cyber-attacking-your-right-to-know/#:~:text=Here%20in%20Orange%20County%2C%20we%20have%20some%20experience,cybersecurity%20dealings%20with%20large%20agencies.&text=And%20thanks%20to%20the%20reporting,out%20computer%20servers%20for%20days.>, published August 2, 2016, accessed January 8, 2025.

10.2.5 CLIMATE CHANGE

As terrorism and cyberattack events are human caused, these types of hazards are not directly tied to climate change impacts. However, the interaction of natural hazards and global climate change could increase the frequency and severity of events. Significant and prolonged climate change impacts can cause conflicts regarding natural resources and livelihood insecurity, as well as food insecurity or water scarcity. Terrorist organizations could operate more easily in fragile and conflict-affected environments, according to the Climate Diplomacy Organization.¹⁹

10.3 CIVIL DISTURBANCE/CIVIL UNREST

10.3.1 DESCRIPTION

The Federal Emergency Management Agency (FEMA) defines civil disturbance as an activity such as a demonstration, riot, or strike that disrupts a community and requires intervention to maintain public safety.²⁰ Civil disturbance can also be referenced as civil disorder, civil unrest, or social unrest. The Orange County Emergency Operations Plan (EOP) notes that civil disturbance often arises from a mass act of civil disobedience that escalates when participants become hostile towards authority.²¹ According to the County of Orange, civil disturbances may be triggered by:

- Spontaneous reactions to verdicts in high-profile trials (retaliation or celebration)
- Spontaneous reactions to organized sporting event outcomes
- Organized reactions or demonstrations
- Political rallies or demonstrations

A civil disturbance could be initiated by small gatherings or large crowds. Impacts can range from a passive disturbance where groups block roadways or buildings that interfere with public order, or full-scale riots where participants also commit crimes such as arson, theft, property damage, vandalism, assault, or other violence. Secondary impacts from civil disturbance can vary significantly, and potentially include urban fire, utility failure, transportation, and environmental hazards. While rare, the most significant impact is the interruption of the continuity of government.

In Orange County, responses to civil unrest are generally handled at the City level; in the case of Seal Beach, the local Seal Beach Police Department would serve as the primary response agency. According to the Orange County EOP, other Operational Area and Mutual Aid Region resources could be activated to support the local response agency if needed. If restoration of law and order is beyond local and county abilities, state and federal resources could be deployed.²²

¹⁹ Climate Diplomacy Organization, *Insurgency, Terrorism and Organized Crime in a Warming Climate*, <https://www.climate-diplomacy.org/publications/insurgency-terrorism-and-organised-crime-warming-climate>, accessed January 8, 2025.

²⁰ FEMA, *Glossary – FEMA Acronyms, Abbreviations, and Terms*, <https://training.fema.gov/programs/emischool/el361toolkit/glossary.htm>, accessed December 27, 2024.

²¹ County of Orange, *Unified County of Orange and Orange County Operational Area Emergency Operations Plan*, <https://www.ochealthinfo.com/sites/hca/files/2021-08>, February 2019, accessed December 27, 2024.

²² Ibid.

10.3.2 LOCATION/EXTENT

Civil disorder can occur anywhere within the City of Seal Beach. Government facilities and landmarks are common places for these events to happen. Peaceful protests, concerts, sporting events, and political events can all become sites of civil unrest. Government structures and prominent economic districts may be more vulnerable to damage due to their significance and their proximity to prominent areas where people gather.²³

The specific location of a civil disturbance and civil unrest within the City of Seal Beach can be difficult to predict. Severe episodes of civil unrest have the potential to cause significant property damage over large areas. Depending on the cause of motivation of the civil disturbance, certain buildings and facilities may be at greater risk of damage than others. Politically motivated civil unrest may target government facilities like City Hall, the public library, or community centers. Downtown Seal Beach and other central commercial corridors could serve as a starting point for a civil disturbance, along with other localized opportunities for citizens to gather. Schools, parks and other places of assembly are located throughout the City and may be potential areas for civil unrest. Civil disturbances and civil unrest have the potential to migrate from a specific starting point and impact public facilities, businesses, and private property throughout the City.

The extent and severity of damages is highly dependent on various factors including the motivation behind the civil disturbance, the number of participants, and level of law enforcement and other public safety agency response. The aftermath of civil disturbance/civil unrest is usually measured by number of injuries, deaths, and property damage/losses in U.S. dollars. Less severe civil unrest may occur in small geographic areas, involve limited individuals, and result in minor property damage. Severe civil unrest can occur City-wide, involve significant numbers of people, resulting in injuries or deaths, and result in significant property damage from mass rioting, looting, or arson. Standard business/commercial insurance policies typically include coverage for damages associated with civil disturbance/civil unrest. Financial impacts to uninsured residents and business owners may be more severe than impacts to those with insurance. Depending on the extent and severity of damages, significant downtime may be required to cleanup and/or rebuild after an event. Generally, extended duration of civil unrest would be associated with greater extent of impacts and damages compared to short durations.

10.3.3 PREVIOUS OCCURRENCES

Civil disturbance/civil unrest is a rare occurrence in Seal Beach, with only a few recent incidents affecting the City. The following incidents involving acts of civil disorder or civil disturbance have affected the planning area over the last five years:

- September 4, 2020 – Crowd gathers to protest the fatal shooting of a homeless man, resulting in a minor altercation.
- September 2, 2020 – Crowd gathers to protest police brutality.
- May 3, 2020 – Crowd gathers at the Seal Beach Pier to protest Covid-19 stay-at-home orders.

²³ Cal OES, *2023 State Hazard Mitigation Plan*, chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.caloes.ca.gov/wp-content/uploads/Hazard-Mitigation/Documents/2023-California-SHMP_Volume-1_11.10.2023.pdf, accessed January 8, 2025.

No federally declared disasters related to civil disorder/civil disturbance have impacted the planning area within the last five years; refer to [Table 4-4, *Summary of Federally Declared Disasters Affecting the Planning Area*](#).

10.3.4 PROBABILITY OF FUTURE OCCURRENCES

Civil unrest incidents occur throughout the country and worldwide for varying reasons and causes. In the current political and social climate, it is reasonable to assume that lawful protests, lawful assembly, and civil unrest will continue, because lawful protests are protected under the First Amendment. However, lawful assembly can quickly erupt into civil unrest, making it difficult to predict when intervention from law enforcement will be necessary. The presence of law enforcement at protests is a standard preemptive measure to mitigate civil unrest. Additionally, increased vigilance and increased intelligence gathering methods can be used by law enforcement in Seal Beach to better prepare for gatherings that may result in civil disturbance/civil unrest.

Because of the nature of civil disturbance and civil unrest and the linkages to political, social, racial and or environmental movements, the probability is considered somewhat likely with a 1 to 10 percent probability of occurrence in the next year or a recurrence interval of 11 to 100 years. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that future civil disturbance/civil unrest affecting the planning area will occur in the future and therefore felt “somewhat likely” best defined probability for this specific hazard. The likelihood of future occurrences is considered medium.

10.3.5 CLIMATE CHANGE

Similar to terrorism and cyber-attack, civil disturbance/civil unrest are human-caused hazards and are not directly tied to climate change impacts. However, environmental concerns and climate change implications could drive conflict on a local, regional, or global scale. Academic research has connected climate change influenced droughts to periods of societal unrest over the course of many centuries. Most recently, research from Colombia University links climate change and unprecedented drought as they key societal stressor that led to uprisings and initiated the Syrian Civil War. Vulnerability associated with limited resources can make periods of civil unrest more likely to occur in the future. Additionally, more and more demonstrations are centered around the environment and climate change. As climate change continues, protests and demonstrations may become more extreme, escalating to civil unrest.

10.4 PANDEMIC

10.4.1 DESCRIPTION

Disease (Infectious/Vector-Borne)

Infectious diseases are caused by undesirable organisms (insects, bacteria, viruses, etc.), resulting in health impacts, symptoms and/or serious harm to plants, animals, or humans. These organisms threaten human health by infecting people with disease, some of which are potentially fatal. Vector-borne diseases are a type of infectious disease which the World Health Organization (WHO) defines as human illnesses caused by parasites, viruses, and bacteria that are only

transmitted by vectors. In this context, vectors are “living organisms that can transmit infectious pathogens between humans, or from animals to humans”.²⁴

Communicable disease is an umbrella term for infectious diseases that are spread from one person to another through contaminated surfaces, bodily fluids, and through the air. In any case, infectious diseases transmitted from vector-to-person or person-to-person may have significant health impacts and symptoms that affect the structure or function of the immune, neurological, or other physiological system of the human body. In many cases, infectious diseases have severe health impacts up to and including death.

Specific vectors of concern in Seal Beach include mosquitos, ticks, rodents, and other animals. These vectors are known carriers of hantavirus, rabies, West Nile Virus (WNV), and tick-borne diseases such as Lyme disease.

Pandemic

The Centers for Disease Control and Prevention (CDC) defines an epidemic as an increase, often sudden, in the number of cases of a disease above what is normally expected in a population. The CDC makes the distinction that a pandemic refers to an epidemic that has spread over several countries or continents, usually affecting significant proportions of the population.²⁵ This definition of pandemic refers specifically to infectious diseases that have spread over or impacted large geographic areas. Non-infectious diseases, such as asthma or diabetes, may exist in “pandemic proportions” but do not readily spread throughout a population and thus do not constitute a pandemic. Pandemics also exclude vector-borne diseases, categorized by transmission through a vector (rats, mosquitos, etc.).

Pandemics require two components: 1) an agent (disease or virus) and 2) a susceptible host population. The host population, usually humans, is the primary mode by which agents are spread under this definition of pandemic. Pandemic agents are spread from person to person through direct or indirect contact, so humans are understood to be the causal element of pandemics. Airborne diseases and those spread through physical contact pose higher risks to the community because they are difficult to isolate and control. Diseases such as influenza, pertussis, tuberculosis, and meningitis are spread by these pathways and therefore have the potential to reach pandemic levels.

Viruses of special concern in pandemics are novel viruses, which are new viral strains not previously identified in humans. Novel viruses present public health challenges as limited information about transmission, prevention, and treatment is available. Further, the human body does not have natural immune defenses prepared to fight novel viruses.²⁶ In recent history, novel viruses originated as zoonotic diseases; the virus beginning in animals evolves to transfer from

²⁴ World Health Organization, *Vector-Borne Diseases*, <https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases>, accessed December 27, 2024.

²⁵ CDC, *Lesson 1: Introduction to Epidemiology*, Section 11, <https://archive.cdc.gov/#/details?url=https://www.cdc.gov/csels/dsepd/ss1978/lesson1/section11.html>, accessed December 27, 2024.

²⁶ GoodRX Health, *The Novel Coronavirus: What are Novel Viruses, and How do they Impact Public Health?*, <https://www.goodrx.com/conditions/covid-19/what-does-novel-coronavirus-mean-science-medical-definition>, updated February 21, 2023, accessed December 27, 2024.

human to human. Examples of zoonotic diseases becoming human pandemics include Covid-19 (theorized to originate in bats), H1N1 influenza (originated in pigs), and H5N1 influenza (originated in birds).²⁷

10.4.2 LOCATION/EXTENT

Disease (Infectious/Vector-Borne)

A public health crisis involving vector-borne diseases can originate within the City or neighboring communities before spreading into and throughout the planning area. Vector-borne diseases and pests could potentially impact any areas throughout the City of Seal Beach and Orange County. Outdoor spaces are most likely to be areas of vector congregation, but specific vectors prefer different environments. Vectors such as rats may thrive in unmaintained structures or other areas with trash and food sources. Mosquitos require standing water to reproduce, prefer warmer environments, and may be found throughout the planning area. Ticks and rodents may interact with humans anywhere throughout the planning area, although outdoor and wildland areas may pose a higher risk of contact.

The magnitude and severity of vector-borne diseases rely on many factors such as the range and distribution of the vector population. A crisis can occur if dense populations of vectors carrying disease encounter large groups of people. Vector-borne disease could spread quickly among residents in urban areas, including vulnerable populations such as the elderly. The severity of impacts from vector-borne diseases are highly variable; some diseases may have relatively minor health impacts while others could be deadly. A worst-case scenario would be a vast vector population that transmits a disease with an extremely high mortality rate. In this scenario, impacts would be severe and could extend throughout populations within the City of Seal Beach.

Pandemic

By definition, a pandemic is understood to have a significant geographic range with impacts on a global scale. Effects of a pandemic would impact the entirety of the planning area, depending on the disease and susceptible population. Pandemic diseases have been known to spread quickly throughout communities. Many diseases spread through close contact, meaning that highly populated areas are more prone to widespread outbreaks; many public activities are centered out of Downtown Seal Beach, making this area more likely to experience the spread of pandemic disease. Indoor areas where people are in close contact with each other appear to be significant vectors for diseases that are spread through respiratory droplets.²⁸ Areas with relatively low population densities throughout the planning area are less likely to experience a widespread outbreak. While the entirety of the City would be at risk, specific subsets of the population may be

²⁷ CDC, *Lesson 1: Introduction to Epidemiology*, Section 11, <https://archive.cdc.gov/#/details?url=https://www.cdc.gov/csels/dsepd/ss1978/lesson1/section11.html>, accessed December 27, 2024.

²⁸ California Department of Public Health, *Isolation Q&A*, <https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Covid-19/Isolation-QA.aspx>, accessed January 8, 2025.

more susceptible than others, including vulnerable populations such as the very young (those under 1 year), elderly, and immuno-compromised individuals, depending on the disease.^{29, 30}

The extent to which a pandemic could impact Seal Beach depends on the disease type and symptoms. Some diseases may be highly transmissible and affect a significant portion of the population but may carry minor symptoms. On the other hand, a disease might be very deadly but not be easily transmitted. The worst-case pandemic scenario is a disease that is both highly transmissible and carries a high mortality rate. The severity and extent of a pandemic may also depend on the ability to respond by developing and administering vaccinations, or other public health measures for mitigating the spread of the disease.

10.4.3 PREVIOUS OCCURRENCES

In 2020, the Covid-19 pandemic began in Wuhan, China before becoming a global pandemic that would infect over 775 million people and claim the lives of over 7 million.³¹ The entire population of the City of Seal Beach was impacted by this event, and the City was included in the federal disaster declaration issued for this hazard event by FEMA.

Seal Beach experienced significant impacts from the Covid-19 Pandemic. A novel coronavirus disease, namely SARS-CoV-2 or Covid-19, was identified in Wuhan, China in December 2019. By March 2020, Governor Gavin Newsom issued a statewide stay at home order, prohibiting all people in the State of California from leaving their homes apart from essential services and limiting the operations of non-essential businesses.

At the time this document was prepared, 8,831 known deaths in Orange County have been attributed to Covid-19.³² As part of the response to slow the spread of the virus, non-essential businesses and schools were closed or transitioned to remote environments, if feasible. A significant milestone and improvement against the pandemic came in December of 2020 with the release of the Covid-19 vaccine. The City of Seal Beach and County of Orange made various resources available based on guidance from the WHO, CDC, and California Department of Public Health (CDPH). Mask mandates were issued for indoor spaces, and proof of vaccination requirements were established for certain activities to help stop transmission. Generally, the pandemic resulted in significant economic and public health impacts that are still reverberating throughout the City. At the time of this writing, Covid-19 is a seasonally recurring issue as vaccines, masks, and social distancing has made disease transmission and treatment much more manageable.

²⁹ Mayo Clinic, *Covid-19 in babies and children*, <https://www.mayoclinic.org/diseases-conditions/coronavirus/in-depth/coronavirus-in-babies-and-children/art-20484405>, published October 21, 2022, accessed January 8, 2025.

³⁰ University of Michigan, *Which Populations are Most Vulnerable to the Coronavirus Pandemic?* <https://sph.umich.edu/news/2020posts/which-populations-are-most-vulnerable-to-coronavirus.html>, published April 6, 2020, accessed January 8, 2025.

³¹ World Health Organization, *WHO Covid-19 Dashboard*, <https://data.who.int/dashboards/Covid19/deaths?n=0>, accessed January 8, 2025.

³² OC Healthcare Agency, *Orange County Covid-19 Dashboard*, <https://ohealthdata.com/dashboard/Covid-dashboard>, accessed January 8, 2025.

Before Covid-19, the most recent pandemic occurred in 2009: the (H1N1) pdm09, “swine flu” pandemic.³³ H1N1pdm09 primarily affected children and young/middle-aged adults, atypical from most influenza pandemics. Between April 2009 and April 2010, the CDC estimates over 60 million cases, nearly 275,000 hospitalizations, and over 12,000 deaths affected the United States population. The World Health Organization declared an end to the global pandemic in August 2010; however, the virus continues to circulate as a seasonal influenza virus.³⁴

Both the 1968 and 1918 pandemics were caused by avian flu outbreaks. The 1968 pandemic was caused by an influenza H3N2 virus, with an estimated death toll of 116,000 in the United States and an estimated worldwide toll of 1.1 million.³⁵ Medical advances in the 1960s including antiviral medications and expanded influenza vaccine options significantly helped to combat this pandemic. The 1918 pandemic was an outbreak of influenza caused by an H1N1 virus. The virus spread worldwide from 1918-1919. It is estimated that one third of the worldwide population at the time, about 500 million people, became infected with the virus. The pandemic resulted in an estimated 675,000 deaths in the United States alone and over 50 million deaths worldwide.³⁶

In the last five years, two FEMA-declared disasters for the pandemic hazard have affected the planning area:

- DR-3428-CA: Covid-19 Pandemic – March 13, 2020
- DR-4482-CA: Covid-19 Pandemic – March 22, 2020

Refer to Table 4-4, Summary of Federally Declared Disasters Affecting the Planning Area for a full list of federally declared disasters affecting the planning area.

10.4.4 PROBABILITY OF FUTURE OCCURRENCES

Physical structures are not typically vulnerable to pandemics; thus, a failure of a critical facility due to pandemic is unlikely. The main concern for pandemic vulnerability is the impact on human health, and critical facilities support in minimizing this impact. Health and medical community lifelines may be strained in response to a pandemic. Health impacts may be widespread throughout the City and impact a significant percentage of the population. Additionally, pandemics may result in significant economic impacts to the City, businesses, and residents. Depending on the size and scale of the disease outbreak, the City or other emergency responders may experience staffing challenges to continue services. Additionally, areas with a higher population density have an increased risk of exposure or transmission of disease due to closer proximity to potentially infected people.

The probability of a pandemic in the City of Seal Beach is considered somewhat likely. A probability of somewhat likely indicates a 1 percent to 10 percent probability of pandemic occurrence in the next year or a recurrence interval of 11 to 100 years. While the LHMP Planning Team acknowledges this reoccurrence interval does not bear out historically, the team felt strongly that

³³ CDC, *Origin of 2009 H1N1 Flu (Swine Flu): Questions and Answers*, https://www.cdc.gov/h1n1flu/information_h1n1_virus_qa.htm, published November 25, 2009, accessed January 8, 2025.

³⁴ CDC, *Past Pandemics*, <https://www.cdc.gov/flu/pandemic-resources/basics/past-pandemics.html>, accessed January 8, 2025.

³⁵ Ibid.

³⁶ Ibid.

future pandemics affecting the planning area will occur in the future and therefore felt “somewhat likely” best defined probability for this specific hazard. The LHMP planning team assigned a medium hazard planning consideration for pandemics.

10.4.5 CLIMATE CHANGE

While pandemics typically originate for reasons outside of climate change, it is possible that the impacts of climate change will make pandemics more severe. According to the National Science Foundation, climate change will likely require humans to relocate and wild animals to find new habitats, dramatically increasing the risk of viral jumps/transmissions. For example, rising temperatures are expected to have a major impact on bats – a species known for novel virus sharing, most recently with Covid-19 or the Ebola virus.³⁷ Furthermore, according to the Harvard T.H. Chan School of Public Health, increases in climate change and development such as rising temperatures and deforestation for agricultural purposes contribute to habitat loss worldwide.³⁸ Consequently, the loss of habitat forces animals to migrate and potentially face additional contact with other animals and humans, increasing the risk of disease transmission. When coupled with increased urbanization and globalization, pandemics could continue to spread as quickly or more quickly than the Covid-19 pandemic. While the full effects of climate change on pandemics are not fully known, it is reasonable to assume the risk for future pandemics continues to exist.

10.5 VULNERABILITY ASSESSMENT

10.5.1 HAZARD VULNERABILITY ASSESSMENT

Hazardous Materials Spill

Hazardous materials spills may occur anywhere within the planning area. Additionally, due to the proximity of the AES Alamitos Battery Energy Storage System, a hazardous materials spill from this plant may pose a threat to the City. Vulnerable areas for hazardous materials spills or nuclear release are not geographically defined and thus it is reasonable to assume that the entire City of Seal Beach is potentially vulnerable. This vulnerability includes all City critical facilities, infrastructure systems, structures, residential and non-residential buildings and the entire population.

A hazardous materials spill or radioactive release from a nuclear power plant could potentially have severe consequences for City residents, businesses, critical infrastructure, and natural resources in Seal Beach. Residents may face health risks from exposure, necessitating evacuations and long-term medical monitoring. Businesses could suffer from operational disruptions and economic losses, while critical infrastructure like water and power supplies might be compromised. Natural resources, including local wildlife and water bodies, could be contaminated, leading to long-term ecological damage. Cleanup and emergency response efforts would be complex and resource-intensive, potentially hindered by the need for specialized equipment and personnel, as well as the ongoing risk of exposure to hazardous materials.

Terrorism/Cyberattacks

Vulnerable areas for terrorism and cyberattacks are not geographically defined and thus it is reasonable to assume that the entire City of Seal Beach is potentially vulnerable. This vulnerability includes all City critical facilities, infrastructure systems, structures, residential and non-residential buildings, and the entire population.

Terrorist attacks may either focus on places where people gather or target schools and/or City-owned facilities or public infrastructure (such as substations, transportation infrastructure, or water reservoirs). In a worst-case scenario, such attacks could result in significant casualties, extensive property damage, and long-term disruptions to essential services. Depending on the nature of the attack, impacts could be widespread throughout the planning area or highly localized. Additionally, the City could be vulnerable to impacts from terrorism or cyberattack incidents outside of the planning area but within the greater Orange County region, potentially causing cascading effects that strain local resources and emergency response capabilities.

Civil Disturbance/Civil Unrest

Vulnerable areas for civil disturbances or acts of civil unrest are not geographically defined and thus it is reasonable to assume that the entire City of Seal Beach is potentially vulnerable. This vulnerability includes all City critical facilities, infrastructure systems, structures, residential and non-residential buildings, and the entire population. City assets viewed as symbols of government authority may be particularly vulnerable, as incidents of civil unrest are most often focused on challenging decisions or actions of government authorities.

As acts of civil unrest are often perpetrated around population centers or downtown areas where protests are most visible to the general public and local authorities, businesses located in Old Towne and Main Street area of Seal Beach may face increased vulnerability to theft, looting, arson, or other criminal activity depending upon the intent and severity of a civil disturbance. Depending upon the political nature of an act of civil unrest, outside individuals with interest in the political outrage at hand may enter the City to participate in the act of civil disturbance. Large-scale acts of civil unrest may present additional vulnerabilities to City assets.

Pandemic

Due to the nature of this hazard, areas vulnerable to pandemic or infectious disease are not geographically defined and thus it is reasonable to assume that the entire City of Seal Beach is potentially vulnerable. This vulnerability includes all City critical facilities, infrastructure systems, structures, residential and non-residential buildings, and the entire population.

Physical structures are not typically vulnerable to pandemics; thus, a failure of a critical facility due to pandemic is unlikely. The main concern for pandemic vulnerability is the impact on human health, and critical facilities support in minimizing this impact. Health and medical community lifelines may be strained in response to a pandemic. Health impacts may be widespread throughout the City and impact a significant percentage of the population. Additionally, pandemics may result in significant economic impacts to the City, businesses, and residents. Depending on the size and scale of the disease outbreak, the City or other emergency responders may experience staffing challenges to continue services. Additionally, areas with a higher population density have

an increased risk of exposure or transmission of disease due to closer proximity to potentially infected people.

10.5.2 CHANGES IN VULNERABILITY FROM PREVIOUS FIVE YEARS

Since the 2019 LHMP, development and land use has not substantially changed in the planning area. In the five years since the approval of the previous LHMP, only one significant housing development was identified in the City’s most recent 2021-2029 Housing Element: the construction of approximately thirty single family homes on a former Department of Water and Power (DWP) site at the intersection of Marina Drive and 1st Avenue. Other land use changes since the 2019 LHMP occurred at limited level, such as the addition of ADUs and/or lot line adjustments. As these changes were minor in size and scale, vulnerability is not considered to have significantly changed in the past five years.

As development and land use in the planning area has not substantially changed since the 2019 LHMP, population trends have also remained relatively the same. United States Census Data reports a 2020 population of 25,232 and a 2023 population of 24,868, representing a 1.44 percent population decline. Generally, observed population decline in the planning area is associated with an overall aging population.

10.5.3 CHANGES IN VULNERABILITY FOR FUTURE FIVE YEARS

Looking forward, the City anticipates the majority of population growth would align with the 2021-2029 Housing Element, which proposes to accommodate the City’s Regional Housing Needs Allocation of 1,243 units largely at commercial sites which are proposed to be rezoned for mixed use. These areas may be impacted by human-caused hazards while areas with high foot-traffic may experience higher vulnerability to civil disturbance/unrest and terrorism/cyberattacks. Based on anticipated growth and development, it is reasonable to assume that vulnerability to human-caused hazards will increase over the 5-year planning period of this LHMP.

10.6 SOCIALLY VULNERABLE POPULATIONS ASSESSMENT

Section 3-7 includes a detailed determination of Socially Vulnerable Populations (SVPs) within the planning area and characteristics that make those populations more vulnerable to hazards. Human-caused hazards can affect all SVPs including census tracts 995.09, 995.10, 995.02 and the Seal Beach Shores Mobile Home Park. Hazardous materials spill and pandemic can affect the entirety of the planning area, potentially affecting all SVPs. Human-caused hazards such as civil disturbance/unrest may occur more in mixed commercial areas with high foot traffic away from identified SVPs, whereas terrorism/cyberattacks can occur on the Seal Beach Naval Weapons Station and potentially affect SVPs in census tract 995.02. However, these hazards are not limited to these areas and can affect the whole City.

SVPs and other high-risk individuals exist throughout the planning area and may be present within human-caused hazard areas despite a census tract’s social vulnerability classification. Specific SVPs and high-risk individuals that may be present throughout the planning area include unemployed individuals, elderly populations age 65 and older, young populations under age 17, persons with disabilities, persons with high pollution burden, and tourists, seasonal visitors, and

homeless populations. The primary concern for SVPs and other high-risk individuals in the City would be evacuation efforts, access to emergency services and supplies, and recovery.

Unemployed individuals may be more vulnerable to human-caused hazards as they may be limited in financial resources to prepare for disasters, such as purchasing emergency supplies, securing adequate housing, or evacuating to safer areas with transportation. Additionally, unemployed individuals may have substandard housing that may be more susceptible to human-caused hazards such as hazardous materials spills. These populations also may not have resources to seek medical care following a human-caused hazard event. These social and economic disparities can further hinder their ability to recover, leaving them at greater risk of long-term displacement and financial hardship following a human-caused hazard event.

Young populations under age 17 may be more vulnerable to the impacts of human-caused hazards due to being more susceptible to injuries and illnesses as their bodies are still developing. Younger children may also have limited mobility and awareness to evacuate in a timely manner during a disaster, and rely heavily on adults for protection, care, and decision-making. Thus, if parents/guardians/caregivers are affected by a disaster, the child's safety and well-being may be compromised. Additionally, a human-caused hazard event can lead to school closures and displacement, which may disrupt children's education and social development.

Elderly populations age 65 and older are more vulnerable to human-caused hazard events. Persons aged 65 or older often face several challenges when responding to an emergency, such as mobility challenges, health concerns, social isolation, barriers to transportation, and limited access to information or technology. In addition, there is often overlap between persons aged 65 or older and persons with a disability, as older adults experience increased prevalence of disabilities. This could include cognitive impairment, difficulties with independent living, or hearing and vision problems. Lastly, this population may rely on caregivers for their well-being; thus, evacuation may be more difficult if this service is disrupted.

Similarly, persons with disabilities are highly vulnerable to human-caused hazardous events due to mobility challenges including difficulties evacuating quickly. This population may have more underlying health conditions that can be exacerbated by the stress and demands of a human-caused hazard event. There may be communication barriers to this population as emergency alerts and information may only be accessible in limited communication mediums. Human-caused hazards can damage or destroy essential assistive devices such as wheelchairs, hearing aids, communication devices, and other medical technology. Additionally, persons with disabilities might rely on caregiving services, which may be disrupted during a human-caused hazard event and make it difficult to evacuate.

Persons exposed to areas with a high pollution burden are more vulnerable to human-caused hazards for a variety of reasons. Human-caused hazards can further exacerbate populations with high pollution burdens who are already exposed to high pollution levels and have weakened respiratory and cardiovascular systems. Additionally, human-caused hazards such as a hazardous materials spill or a pandemic can further increase this SVP's risk of illness. Communities with high pollution often face economic challenges, making it harder to prepare and recover from human-caused hazard events. Lastly, persons dwelling in areas with a high pollution burden may have

older, less resilient infrastructure, increasing the likelihood of damage during events such a hazardous materials spill and ultimately leading to prolonged exposure to hazardous conditions.

Tourists, seasonal visitors, and homeless populations are particularly vulnerable during human-caused hazard events due to their lack of familiarity with the area and lack of established support systems. They may not be aware of evacuation routes or local emergency procedures, making it difficult for them to respond quickly. Additionally, they might not have access to timely information about the ongoing emergency or the resources needed to cope with the aftermath. The City hosts multiple community events throughout the year and nearby Huntington Beach and Long Beach are expected to host sizeable events for the upcoming 2028 Olympic Games, resulting in increased present and future vulnerability. These factors make SVPs throughout Seal Beach especially vulnerable to the impacts of a human-caused hazard events.

Considerations for SVPs throughout the planning area were incorporated into the mitigation strategy in Section 11. Mitigation Strategy. Specifically, the LHMP Planning Team tailored Mitigation Actions P.1, P.8, 1.8, 5.4, and 5.9 to mitigate hazard impacts to SVPs including issues related to preparedness, evacuation, and access to emergency services.



CITY OF SEASIDE BEACH ADMINISTRATION



11

MITIGATION STRATEGY



WHAT'S DIFFERENT IN THE 2025 PLAN?

- The City completed 7 of the actions identified in the 2019 LHMP.
- The City carried over 42 actions from the previous 2019 LHMP for inclusion in this LHMP update.
- The City collaborated with stakeholders and members of the community to establish new hazard mitigation actions to be accomplished over the 5-year planning horizon of this LHMP.

SECTION 11: MITIGATION STRATEGY

Hazard mitigation strategies are used to reduce hazard impacts on critical facilities or other infrastructure identified by the City and LHMP Planning Team. This section is developed from an in-depth review of the vulnerabilities and capabilities described in the previous plan section. Overall, the actions represent the City's approach for reducing and/or eliminating potential losses as identified in [Section 4.0](#).

11.1 HAZARD MITIGATION OVERVIEW

11.1.1 FEMA'S NATIONAL FLOOD INSURANCE PROGRAM

The National Flood Insurance Program (NFIP) provides flood insurance to property owners, renters, and businesses by encouraging communities to adopt and enforce floodplain management regulations. Participation in the NFIP is optional; however, property owners who live in a non-participating community with flood-prone areas are not able to purchase flood insurance through the program. Communities with mapped floodplains cannot receive federal grants or loans for development activities in flood-prone areas and cannot receive federal disaster assistance to repair flood damaged buildings or structures in mapped floodplains if the jurisdiction is not a participant of the NFIP.

The City is a participant of the NFIP and implements the requirements of NFIP through the Seal Beach Municipal Code Chapter 9.45, Floodplain Management. Specific administration and enforcement regulations are outlined in Chapter 9.45 and Chapter 11.4.10.020, Performance Standards. Section 11.4.10.020, Performance Standards, states: “National Flood Insurance Program. The provisions of Chapter 9.45: Floodplain Management, of the municipal code and the provisions of 44 C.F.R. Parts 59-77, shall be complied with, in all respects, for compliance with the National Flood Insurance Program administered by the Federal Emergency Management Agency (FEMA).” The latest FIRM maps adopted for the City are dated effective March 21, 2019.

The Seal Beach Municipal Code Section 9.45.070 designated the City Engineer responsible for administering and implementing the provisions of the NFIP. All development, including new construction and substantial improvements, within designated special flood hazard zones must be in full compliance with Chapter 9.45. The terms “new construction” and “substantial improvement” are defined in Section 9.45.050 of the Municipal Code. All new construction and substantial improvement are subject to the development standards outlined in Chapter 9.45, which implement NFIP requirements. Requirements for new construction and significant improvement would also apply after any event where the property has been impacted by flood. No other specific regulations or requirements are outlined in the City code for implementation after any event where a property had substantial improvement or damage. Significant flood events are rare within the City, even during heavy precipitation years. To date, the City contains zero Severe Repetitive Loss (SRL) and eleven Repetitive Loss (RL) properties within the jurisdiction.

Additionally, it is noted that the City’s General Plan Land Use Map identifies where specific land uses are allowed within the City. The two major drainage channels within the City are the Los Alamitos Channel and the Federal Storm Channel. Much of the remaining runoff not flowing through these channels drains into the Pacific Ocean, San Gabriel River, and the Naval Weapons Station. This land use does not permit habitable development within these drainages, nor would other regulatory easements permit habitable development. The City will continue to use and implement General Plan land use designations to control development within flood hazard zones.

11.1.2 HAZARD MITIGATION PRIORITIZATION

The LHMP Project Management Team and the LHMP Planning Team discussed each mitigation action to identify priority, using the following as guidance:

- **High Priority:** Top organizational priority and is a well-detailed project idea. Protects population, resource, facility, or property at considerable risk. Uses feasible methods, techniques, or technology.
- **Medium Priority:** A promising idea that needs more information or is an action that addresses a moderate hazard.
- **Low Priority:** An idea that needs more information or will take a lot of preliminary action to build support.



MITIGATION STRATEGY AT A GLANCE

As part of this update, the LHMP Planning Team focused mitigation actions to include capital improvement projects and community engagement campaigns that make the community safer and establish eligibility for FEMA hazard mitigation grant programs.



54

Total Actions



14

New Actions



1

*Action
Removed*



20

*Hazards
Addressed*

7

*Completed
Mitigation Actions*

42

*Mitigation Actions
In Progress*

The hazard ranking exercise was completed as part of LHMP Planning Team Meeting #1. Additional discussion during focus group meetings and the LHMP Planning Team Meeting #2 influenced the ultimate priority and timeline of each hazard. The LHMP Planning Team considered the frequency and severity of the hazard; the vulnerability of critical facilities or infrastructure; the impacts the mitigation action would avoid or reduce; the benefits of the action on the community; the critical facilities that would benefit; the environmental benefits of the action; and the capability of the City to implement the action. For example, actions may require further study or information but were identified as a high priority because of current conditions (i.e., heightened risk of the hazard, probability of future occurrences, or lack of redundancy established in a specific portion of the community). Several actions were identified as high priority, while the nature and complexity of the action involves a “long-term” timeline of five or more years.

The LHMP Planning Team used the STAPLE/E (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) criteria, as described in [Table 5-1, STAPLE/E Review and Selection Criteria](#), when considering and prioritizing the most appropriate mitigation alternatives for the City. This methodology, as endorsed by FEMA, requires that social, technical, administrative, political, legal, economic, and environmental considerations be considered when reviewing potential actions. This process was used to help ensure that the most equitable and feasible actions would be undertaken based on the City’s unique capabilities.

11.1.3 HAZARD MITIGATION BENEFIT – COST REVIEW

**Table 5-1
STAPLE/E Review and Selection Criteria**

STAPLE/E Review	Selection Criteria
Social	<ul style="list-style-type: none"> • Is the proposed action socially acceptable to the jurisdiction and surrounding community? • Are there equity issues involved that would mean that one segment of the jurisdiction and/or community is treated unfairly? • Will the action cause social disruption?
Technical	<ul style="list-style-type: none"> • Will the proposed action work? • Will it create more problems than it solves? • Does it solve a problem or only a symptom? • Is it the most useful action considering other jurisdiction goals?
Administrative	<ul style="list-style-type: none"> • Can the jurisdiction implement the action? • Is there someone to coordinate and lead the effort? • Is there sufficient funding, staff, and technical support available? • Are there ongoing administrative requirements that need to be met?
Political	<ul style="list-style-type: none"> • Is the action politically acceptable? • Is there public support both to implement and to maintain the project?
Legal	<ul style="list-style-type: none"> • Is the jurisdiction authorized to implement the proposed action?

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STAPLE/E Review	Selection Criteria
	<ul style="list-style-type: none"> • Are there legal side effects? Could the activity be construed as a taking? • Will the jurisdiction be liable for action or lack of action? • Will the activity be challenged?
Economic	<ul style="list-style-type: none"> • What are the costs and benefits of this action? • Do the benefits exceed the costs? • Are initial, maintenance, and administrative costs considered? • Has funding been secured for the proposed action? If not, what are the potential funding sources (public, nonprofit, and private)? • How will this action affect the fiscal capability of the jurisdiction? • What burden will this action place on the tax base or local economy? • What are the budget and revenue effects of this activity? • Does the action contribute to other jurisdiction goals? • What benefits will the action provide?
Environmental	<ul style="list-style-type: none"> • How will the action affect the environment? • Will the action need environmental regulatory approvals? • Will it meet local and state regulatory requirements? • Are endangered or threatened species likely to be affected?

11.1.4 STATUS OF PREVIOUS PLAN ACTIONS

The previous 2019 LHMP identified 50 mitigation actions for the City of Seal Beach. The LHMP Project Management Team reviewed previous mitigation actions from the 2019 LHMP and determined that several listed mitigation actions were completed by the City; these mitigation actions are listed in [Table 5-2](#), with notes regarding action implementation. Because these mitigation actions were completed, these mitigation actions are not carried over into the plan update with the exception of Mitigation Actions P.13 and 1.4, which have been renewed in the LHMP update to expand upon the City’s progress on these projects. The Project Management Team determined that 42 mitigation actions from the 2019 LHMP should be carried over into this Plan update.

Additionally, one mitigation action from the 2019 LHMP was determined to be no longer relevant or too broad in nature and therefore was not carried over into the plan update. The LHMP Project Management Team determined that Mitigation Action 5.5, related to the replacement of exterior building components in favor of “more hazard-resistant materials”, was too broad in nature. Therefore, this action was deleted in favor of newer, more specific hazard mitigation actions. The remaining mitigation actions were carried over or revised and incorporated into the mitigation actions listed in [Table 5-3](#). As part of this update, the LHMP Planning Team focused mitigation actions to include capital improvement projects and community engagement campaigns that make the community safer and establish eligibility for FEMA hazard mitigation grant programs.

**Table 5-2
Completed 2019 LHMP Mitigation Actions**

Completed 2019 Mitigation Action	Notes
P.1: Update the Seal Beach Emergency Operations Plan to identify backup power and communications locations for critical facilities.	The City updated their EOP in 2023. Seal Beach Facilities and Transportation Unit will provide backup generators. Orange County Fire Authority Station 48 supports backup communications.
P.2: Identify an alternative operations location for City departments and other municipal facilities to ensure continuity of operations during a disaster.	The City's updated EOP identifies alternative City EOC locations & alternative City Hall Locations.
P.6: Facilitate improved communication between the City and the Naval Weapons Station regarding hazardous materials storage and transport, and enable first responders to adequately train and prepare for a potential release of hazardous materials.	Recent training with the NWS was conducted by the City on the following dates, covering numerous scenarios including hazardous materials spills: 08/2022, 12/2022, 02/2023, 06/2023, 08/2023, 12/2024, 08/2024, 01/2025, 02/2025. Future collaboration has been scheduled. NWS and Seal Beach PD have an MOU for law enforcement support.
P.13: Develop a targeted outreach program for residents living in high-priority hazard zones that identifies current steps undertaken by the City to mitigate hazards and provides guidance to residents on individual actions they can take.	The City has completed this action and maintains the Neighbor 4 Neighbor outreach program and distribution of door hangers.
1.4: Develop a hazard mitigation outreach program for the City's residents with targeted, specific plans for communities and neighborhoods at particular risk such as: Leisure World, Downtown, College Park East, and others as the City finds appropriate.	The City has distributed emergency information door hangers throughout the City. A second run of door hangers was just completed to update contact information, social media accounts, etc. The City will be printing for use at future community events, the lobby of PD, City hall, etc.
2.12: Follow up on the implementation of high-priority, medium-priority, and low-priority projects laid out in the City's storm drain master plan.	The City has addressed most of the identified areas in coordination with MWDOC.
5.3: Ensure the City's emergency water connections and agreements are sufficient to provide a short-term supply during a hazard event. Inspect the connection infrastructure to ensure it is resilient to emergency conditions and retrofit as needed.	The City has ensured that all interconnects are in operable condition. The City is working with GSWC on emergency interties along Lampson

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11.1.5 ADDITIONAL ACTIONS TAKEN BY SEAL BEACH TO INCREASE READINESS

The City of Seal Beach and community partners have initiated and completed a number of preparedness actions outside of hazard mitigation efforts to increase overall City readiness that have helped to reduce hazard risk to the local community. The City embodies the spirit of hazard mitigation into day-to-day activities and in good faith completed the following activities that were not established mitigation actions, but helped to reduce vulnerability in the City of Seal Beach:

- In 2020, the Seal Beach Police Department and Naval Weapons Station Seal Beach entered into a Memorandum of Understanding for shared support and services between jurisdictions.
- In 2020, the Leisure World Seal Beach Emergency Preparedness group prepared the “On Your Own” informational guide to help prepare residents in the event of an emergency or disaster.
- In 2022, the City prepared a Cyber Security Incident Response Plan, including the identification of measures to reduce risk and vulnerability to cyberattacks.
- In 2022, the City prepared the COVID-19 Event Summary and After-Action report, outlining lessons learned and opportunities to prepare for future pandemics.
- In 2022, the Seal Beach Animal Care Shelter prepared an update to the Emergency Plan, including an inventory of emergency supplies, evacuation procedures for both dogs and cats, and drill instructions for staff/volunteer training.
- In 2023, the City partnered with the Golden Rain Foundation on the Leisure World Seal Beach Community Resilience Initiative, to identify funding resources to enhance shelter-in-place options on Leisure World property.
- In [TBD], OCFA and Naval Weapons Station Seal Beach entered into a Memorandum of Understanding for shared firefighting support and services.
- Finally, on an ongoing basis, the City has updated emergency preparedness and other educational information on the Police Department website over the last five years

Many disaster preparedness activities outlined above have informed new mitigation actions to carry forward as part of this LHMP update.

11.2 HAZARD MITIGATION ACTIONS

The LHMP Planning Team worked together to identify mitigation actions and establish the responsible department, priority level, and timeline. The process used is outlined below:

- Review of the Vulnerability and Risk Assessment presented in [Section 4.0, *Hazards Assessment*](#);
- Review of the Capabilities Assessment presented in [Section 5.3, *Capabilities Assessment*](#);
- Review of the results of the community survey and feedback received as part of the community outreach; and,
- The LHMP Planning Team’s discussion of concerns/issues that need to be addressed to reduce hazards to critical facilities and the community.

[Table 5-3, *Hazard Mitigation Actions*](#), identifies the mitigation action, hazard(s) addressed, agency and/or department responsible for implementation, potential funding source(s), timeline for implementation, and priority. The timeline for implementation is defined as follows:

- Ongoing: currently in process; or 1-2 years and ongoing thereafter;
- Short-Term: 1 to 2 years;
- Medium-Term: 3 to 4 years; and
- Long-Term: 5+ years.

Mitigation actions below may be funded through the City budget, particularly mitigation actions identified as “ongoing.” However, the City will also explore funding for specific mitigation actions through local, State, or federal grant programs. Potential grant programs or funding mechanisms are identified for specific mitigation actions as applicable, below.

The City maintains and annually updates a Capital Improvement Project (CIP) budget that identifies priority City projects and major equipment purchases for all City departments. Identified capital improvement projects were integrated into the LHMP mitigation actions where appropriate for projects with a nexus to resilience or natural hazards. In addition, as part of the annual review and update of the CIP budget, mitigation actions will be reviewed and integrated.

All mitigation actions considered for the City were included in the LHMP and Table 5-3, Hazard Mitigation Actions. There were no mitigation actions considered but excluded from the LHMP. The mitigation action development process is documented in Appendix B, LHMP Planning Team Documentation and was a key area of focus during all focus group meetings and Stakeholder Meeting #2. Appendix B, LHMP Planning Team Documentation also documents revisions, comments, and feedback, from the LHMP Planning Team, Project Management staff and the City's consultant, Michael Baker International.



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**Table 5-3
Hazard Mitigation Actions**

Action #	Description	Hazards Adressed	Responsible Agency	Funding Sources	Timeline	Priority
All Hazard and Preparedness Activities						
P.1	Establish a network of directional public announcement speakers across the City to ensure all residents, visitors, and socially vulnerable populations are promptly informed of emergency situations and City announcements. Track emerging technology for announcement speakers, including cost-effectiveness. These systems should be capable of providing early alerts, warnings, and general notifications.	All Hazards	Internal: Police	FEMA: Next Generation Warning System Grant Program (NGWSGP), Safeguarding Tomorrow Revolving Loan Fund (RLF), Emergency Management Performance Grant (EMPG), Homeland Security Grant Program (HSGP) Staff Time, General Fund, Community Facilities Districts, Bonds	Long-Term	Medium
P.2	Explore the feasibility of connecting critical facilities, including City Hall, Police Station, Lifeguard HQ, and community fire stations, to a microgrid power-supply network.	All Hazards	Internal: Police External: OCFA	FEMA: Hazard Mitigation Grant Program (HMGP) Cal OES: Prepare CA – JumpStart, Prepare CA – Match SCE: Microgrid Incentive Program (MIP) LCI: Adaptation Planning Grant Program General Fund, Community Facilities Districts, Bonds	Long-Term	Medium
P.3	Continuously update response procedures and emerging technology for public safety agencies to properly address hazard events as they emerge, including battery storage concerns and associated firefighting.	All Hazards	Internal: Police External: OCFA	FEMA: Emergency Management Performance Grant (EMPG), Emergency Operations Center (EOC) Grant Program Staff Time, General Fund, Community Facilities Districts, Bonds	Ongoing	Medium
P.4	Install energy-efficient equipment to increase the longevity of the fuel supply for backup generators.	All Hazards	Internal: Police External: OCFA	CEC: Distributed Electricity Backup Assets (DEBA) Program DOE: Energy Efficiency and Conservation Block Grant (EECBG) Program General Fund, Community Facilities Districts, Bonds	Long-Term	Medium
P.5	Maintain a list of alternative fuel suppliers and develop a partnership with a reliable fuel supplier to contact in case baseline fuel for City-owned first responder vehicles is insufficient during a hazard event. Maintain a call list of reliable vendors to rent portable generators in the case of an emergency.	All Hazards	Internal: Police, Public Works	FEMA: Hazard Mitigation Grant Program (HMGP), Homeland Security Grant Program (HSGP) Cal OES: Prepare CA - Match Staff Time, General Fund	Ongoing	Medium
P.6	Renovate the City's secondary EOC (Marine Safety Building) to enhance operational readiness and address evolving human-caused hazards threatening the City. In the short term, upgrade EOC equipment to enhance operational readiness. Evaluate long-term solutions to harden the EOC and repair infrastructure.	All Hazards	Internal: Police, Marine Safety, Public Works	FEMA: Emergency Management Performance Grant (EMPG), Homeland Security Grant Program (HSGP) General Fund	Long-Term	Medium
P.7	Ensure that the City has an adequate supply of sandbags for residents and businesses, including prefilled sandbags for individuals who may be unable to fill them on their own.	All Hazards	Internal: Public Works	DWR: Flood Emergency Response Project Grants Staff Time, General Fund	Ongoing	Medium
P.8	Support Leisure World and Golden Rain Foundation leadership in identifying and constructing additional points of egress for use as emergency evacuation routes out of Leisure World. Promote awareness of both emergency evacuation and shelter-in-place procedures and preparedness for Leisure World residents.	All Hazards	Internal: Police External: OCFA, Leisure World/ Golden Rain Foundation	Staff Time	Long-Term	High

Action #	Description	Hazards Adressed	Responsible Agency	Funding Sources	Timeline	Priority
P.9	Coordinate with local and regional public safety agencies on upcoming security and emergency management considerations related to large special events in the Los Angeles metropolitan region, with particular focus on the Los Angeles 2028 Olympics	All Hazards	Internal: Police External: Neighboring/Regional Public Safety Agencies	Staff Time, General Fund	Medium-Term	High
P.10	Continue to support Seal Beach Police public safety programming such as Neighbor 4 Neighbor, West County Community Emergency Response Team (CERT), Citizens' Academy and Radio Amateur Civil Emergency Service (RACES) to build community capacity in hazard mitigation, disaster preparedness and response.	All Hazards	Internal: Police External: Neighbor 4 Neighbor, West County CERT and RACES	Staff Time, General Fund	Ongoing	High
P.11	Develop special evacuation routes and procedures for College Park West, which currently has only one point of egress through the City of Long Beach. The City's Emergency Management Coordinator will continue working with the community to identify alternative evacuation routes, potentially including the development of signage and mapping, to support safe and efficient evacuation.	All Hazards	Internal: Police External: OCFA, City of Long Beach	Staff Time, General Fund	Ongoing	High
(1) Multiple Hazards						
1.1	Conduct routine updates of the Facility Conditions Assessment for City-owned infrastructure, buildings, water pumps, and other utilities and coordinate with other agencies to ensure inspections of other important infrastructure. Evaluate opportunities for capital improvement projects and upgrades that may be eligible for FEMA HMGP funding.	Coastal flooding and storms, erosion, fire, flood, seismic hazards, severe weather, liquefaction	Internal: Public Works, Police	HUD: Community Development Block Grant (CDBG) Program FEMA: Hazard Mitigation Grant Program (HMGP) General Fund, Bonds	Ongoing	Medium
1.2	Promptly repair all major deficiencies discovered by inspections to prevent collapse, failure, or damage in the event of a natural disaster.	Coastal flooding and storms, erosion, fire, flood, seismic hazards, severe weather, liquefaction	Internal: Public Works	FEMA: Hazard Mitigation Grant Program (HMGP), Safeguarding Tomorrow Revolving Loan Fund (RLF) Cal OES: Prepare CA – JumpStart, Prepare CA – Match HUD: Community Development Block Grant (CDBG) Program California iBank: Infrastructure Loans and Bonds General Fund, Bonds	Ongoing	High
1.3	Coordinate with Emergency Services and the California Joint Powers Insurance Authority (JPIA) to modify existing risk assessment plans, policies, and documents to include hazards of concern identified in this Local Hazard Mitigation Plan.	All Hazards	Internal: Police, City Manager External: Joint Powers Insurance Authority	General Fund, Bonds	Ongoing	Medium
1.4	Coordinate with SoCalGas, Golden State Water Company, Rossmoor Community Services District, and other private gas, oil, and water utility companies to harden their lines passing through the city from potential breaches. Encourage adoption of supervisory control and data acquisition (SCADA) to allow instantaneous shut down of line breaches. Use mitigation grants to incentivize agencies to partner with the City to complete projects.	Coastal flooding and storms, fire, flood, hazardous materials release, seismic hazards	Internal: Police, Public Works External: SoCalGas, Golden State Water Company, Rossmoor Community Services District, other Utility Companies	FEMA: Hazard Mitigation Grant Program (HMGP), Safeguarding Tomorrow Revolving Loan Fund (RLF) General Fund, Community Facilities Districts, Bonds	Long-Term	Medium

Action #	Description	Hazards Addressed	Responsible Agency	Funding Sources	Timeline	Priority
1.5	Explore the feasibility of forming a Geologic Hazard Abatement District (GHAD) among property owners living adjacent to or within high priority geologic hazard zones (fault rupture, tsunami, coastal erosion, etc.).	Erosion, seismic hazards, tsunami	Internal: Public Works, Finance, City Manager	Staff Time, General Fund, Bonds	Long-Term	Low
1.6	Install and harden emergency backup generators at water pump stations, sewer lift stations, city hall, police department, and all other critical facilities as the City may determine necessary.	Coastal flooding and storms, fire, flood, seismic hazards, severe weather, tsunami	Internal: Public Works	FEMA: Hazard Mitigation Grant Program (HMGP), Homeland Security Grant Program (HSGP) Cal OES: Prepare CA - JumpStart General Fund, Community Facilities Districts, Bonds	Long-Term	High
1.7	Encourage the use of porous surfaces on new and significantly retrofitted residential and commercial developments to reduce runoff.	Coastal flooding and storms, drought, erosion, flooding	Internal: Community Development, Public Works	General Fund, Bonds	Ongoing	Medium
1.8	Adopt an update to the Seal Beach Safety Element, incorporating the LHMP Update by reference in accordance with AB2140 requirements. Adopt a new Environmental Justice Element to identify policies applicable to socially vulnerable populations within Seal Beach.	Flood, Fire, Hazardous Materials, Seismic Hazards and Climate Change Impacts	Internal: Community Development	Staff Time, General Fund	Short-Term	High
(2) Coastal and Flood Hazards (Flood, Coastal Storms, Coastal Flood, Sea-Level Rise and Coastal Erosion, Tsunami, Dam/Reservoir Failure)						
2.1	Reconstruct or retrofit critical facilities within the coastal zone to meet a building standard that ensures resiliency to flooding or tsunamis, such as the ASCE 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures or other building standard.	Flood, Coastal Storms, Coastal Flood, Sea-Level Rise and Coastal Erosion	Internal: Public Works	FEMA: Hazard Mitigation Grant Program (HMGP) Cal OES: Prepare CA - JumpStart HUD: Community Development Block Grant (CDBG) Program General Fund, Community Facilities Districts, Bonds	Long-Term	Medium
2.2	Develop a coastal erosion baseline map using GIS technology that will aid future monitoring and development processes.	Flood, Coastal Storms, Coastal Flood, Sea-Level Rise and Coastal Erosion	Internal: Community Development, Public Works	CCC: Local Assistance Grant Program OPC: SB1 Sea Level Rise Adaptation Planning Grant Program General Fund, Community Facilities Districts, Bonds	Long-Term	High
2.3	Install and harden emergency backup generators at water pump stations and sewer lift stations within coastal inundation areas. Ensure that pumps are capable of managing the loads of the 100-year and 500-year flood events.	Flood, Coastal Storms, Coastal Flood, Sea-Level Rise and Coastal Erosion, Dam/Reservoir Failure	Internal: Public Works External: OCWD, MWDOC	FEMA: Hazard Mitigation Grant Program (HMGP), Homeland Security Grant Program (HSGP) Cal OES: Prepare CA - JumpStart General Fund, Community Facilities Districts, Bonds	Medium-Term	High
2.4	Update the City's Master Plan of Drainage to capture and account for new vulnerabilities related to stormwater management.	Flood, Coastal Storms, Coastal Flood, Sea-Level Rise and Coastal Erosion	Internal: Community Development, Public Works	FEMA: Hazard Mitigation Grant Program (HMGP) General Fund, Community Facilities Districts, Bonds	Long-Term	Medium

Action #	Description	Hazards Addressed	Responsible Agency	Funding Sources	Timeline	Priority
2.5	Coordinate with the City of Los Alamitos on ongoing issues related to stormwater management. Discuss issues related to stormwater backup, including surface water flooding issues off of Lampson in College Park East. Continue to evaluate solutions and seek funding resources.	Flood, Coastal Storms, Coastal Flood, Sea-Level Rise and Coastal Erosion	Internal: Community Development, Public Works External: City of Los Alamitos	HUD: Community Development Block Grant (CDBG) Program CA Water Resources Control Board: Storm Water Grant Program (SWGPP) EPA: Sewer Overflow and Stormwater Reuse Municipal Grant Program (OSG) General Fund, Community Facilities Districts, Bonds	Long-Term	High
2.6	Monitor and implement sand replenishment measures for sand berms to ensure coastal protection and mitigate coastal and inland flooding.	Flood, Coastal Storms, Coastal Flood, Sea-Level Rise and Coastal Erosion	Internal: Marine Safety, Public Works, City Manager	CA State Parks: Public Beach Restoration Program, Shoreline Erosion Control Program General Fund, Community Facilities Districts, Bonds	Long-Term	Medium
2.7	Upgrade key water pump stations that have failed or have the potential to fail during a 100- or 500- year flood event.	Flood, Coastal Storms, Coastal Flood, Sea-Level Rise and Coastal Erosion, Dam/Reservoir Failure	Internal: Public Works External: OCWD, MWDOC	FEMA: Hazard Mitigation Grant Program (HMGP), Safeguarding Tomorrow Revolving Loan Fund (RLF) Cal OES: Prepare CA – JumpStart, Prepare CA – Match DWR: Water Management Grants California iBank: Infrastructure Loans and Bonds General Fund, Community Facilities Districts, Bonds	Long-Term	Medium
2.8	Retrofit critical structures in the coastal zone to elevate them above potential sea level rise projections	Flood, Coastal Storms, Coastal Flood, Sea Level Rise	Internal: Public Works, Community Development	FEMA: Hazard Mitigation Grant Program (HMGP), Safeguarding Tomorrow Revolving Loan Fund (RLF) Cal OES: Prepare CA – JumpStart, Prepare CA – Match HUD: Community Development Block Grant (CDBG) Program California iBank: Infrastructure Loans and Bonds General Fund, Community Facilities Districts, Bonds	Long-Term	Medium
2.9	Coordinate with NOAA to develop communications or outreach programs to inform homeowners in sea-level rise inundation areas about ways they can protect themselves and their property from floods, such as purchasing flood insurance.	Flood, Coastal Storms, Coastal Flood, Sea Level Rise	Internal: Police, Community Development, Public Works External: NOAA	FEMA: Hazard Mitigation Grant Program (HMGP) US EPA: Environmental Education Grants (EE) Cal OES: Prepare CA – JumpStart Staff Time, General Fund	Ongoing	Medium
2.10	Continue to periodically inspect drainage structures and clean and repair systems as needed. Remind property owners to maintain private drainage structures in order to ensure full capacity.	Flood, Coastal Storms, Coastal Flood, Sea-Level Rise and Coastal Erosion	Internal: Public Works	DWR: Flood Emergency Response Projects Grants HUD: Community Development Block Grant (CDBG) Program Staff Time, Community Facilities Districts, General Fund	Ongoing	High
2.11	Develop a Water Meter Retrofit Pilot Program to relocate or modify water meters that are currently below the water table.	Flood, Coastal Storms, Coastal Flood, Sea-Level Rise and Coastal Erosion	Internal: Public Works External: OCWD, MWDOC	USBR: WaterSMART Grant Program CA Water Resources Control Board: Small Community Drinking Water (SCDW) Funding, Drinking Water State Revolving Fund (DWSRF) General Fund, Community Facilities Districts, Bonds	Long-Term	Medium
2.12	Coordinate a program with county, state, and relevant federal agencies to keep all drains and culverts clear of debris to reduce the potential risk of flooding.	Flood, Coastal Storms, Coastal Flood, Sea-Level Rise and Coastal Erosion	Internal: Public Works External: County, state, and federal agencies	Staff Time, General Fund	Ongoing	Medium

Action #	Description	Hazards Addressed	Responsible Agency	Funding Sources	Timeline	Priority
2.13	Work with property owners that generate, store, or dispose of hazardous materials in the 100-year and 500-year flood zones to ensure facilities are adequately flood proofed/protected	Flood, Coastal Storms, Coastal Flood, Hazardous Materials Spill	Internal: Police, Community Development External: OCFA	FEMA: Hazard Mitigation Grant Program (HMGP) Cal OES: Prepare CA – JumpStart, Prepare CA – Match General Fund, Community Facilities Districts, Bonds	Long-Term	Medium
2.14	Continue coordination with the California Coastal Commission to approve and certify a Local Coastal Program (including Land Use Plan and Implementation Plan) for the Seal Beach Coastal Zone, including policy that reduces risk and vulnerability to coastal hazards.	Flood, Sea-Level Rise and Coastal Erosion	Internal: Community Development External: California Coastal Commission	CCC: Local Assistance Grants Staff Time, General Fund	Short-Term	High
2.15	Update the City’s Sea Level Rise Vulnerability Assessment once every ten years, in accordance with California Coastal Commission requirements for Coastal Act compliance.	Sea-Level Rise and Coastal Erosion	Internal: Community Development External: California Coastal Commission	CCC: Local Assistance Grants Staff Time, General Fund	Long-Term	Medium
2.16	Continue to participate in emergency preparedness exercises for regional dams, including Whittier Narrows and Santiago Creek Dam.	Dam/Reservoir Failure	Internal: Police	Staff Time, General Fund	Ongoing	Medium
(3) Landslide						
3.1	Evaluate the feasibility of a maintenance plan for Gum Grove Park and surrounding private property to mitigate potential landslides and surface sloughing in the Park due to erosion.	Landslide	Internal: Community Services, Community Development, Public Works	Staff Time, General Fund	Long-Term	Low Priority
(4) Seismic Hazards (Fault Rupture/Ground Motion, Liquefaction)						
4.1	In coordination with Caltrans, conduct a facilities condition assessment for bridges along evacuation routes to identify bridges that need seismic retrofitting. Consider pursuing highest standard improvement options (e.g., replacement instead of retrofitting) for bridges with seismic deficiencies.	Fault Rupture/Ground Motion, Liquefaction	Internal: Public Works External: Caltrans	DOT: Bridge Investment Program (BIP), Better Utilizing Investments to Leverage Development (BUILD) Transportation Discretionary Grants Program CTC: Local Bridge Seismic Retrofit Account (LBSRA) General Fund	Ongoing	High
4.2	Encourage the installation of seismically appropriate piping for new or replacement pipelines, in close coordination with local water, natural gas, and other providers.	Fault Rupture/Ground Motion, Liquefaction	Internal: Public Works	FEMA: Hazard Mitigation Grant Program (HMGP), Safeguarding Tomorrow Revolving Loan Fund (RLF) Cal OES: Prepare CA – JumpStart, Prepare CA – Match HUD: Community Development Block Grant (CDBG) Program California iBank: Infrastructure Loans and Bonds General Fund, Community Facilities Districts, Bonds	Ongoing	Medium
4.3	Pursue ground improvement projects, such as constructing a high strength capping layer, soil mixing, stone columns, soil wicks, chemical and pressure grouting, and other soil improvement techniques that reduce liquefaction susceptibility in the event of an earthquake.	Fault Rupture/Ground Motion, Liquefaction	Internal: Public Works	FEMA: Hazard Mitigation Grant Program (HMGP), Safeguarding Tomorrow Revolving Loan Fund (RLF) Cal OES: Prepare CA – JumpStart, Prepare CA – Match General Fund, Community Facilities Districts, Bonds	Ongoing	Medium

Action #	Description	Hazards Addressed	Responsible Agency	Funding Sources	Timeline	Priority
4.4	Conduct a seismic safety assessment on all City-owned critical infrastructure. Focus audits on potable water, sewer and life guard structures/buildings in need of seismic retrofits.	Fault Rupture/Ground Motion, Liquefaction	Internal: Community Development, Marine Safety, Public Works	FEMA: Hazard Mitigation Grant Program (HMGP), Safeguarding Tomorrow Revolving Loan Fund (RLF) Cal OES: Prepare CA – JumpStart, Prepare CA – Match General Fund, Community Facilities Districts, Bonds	Long-Term	Medium
4.5	Promote earthquake insurance coverage for local residents, increasing public awareness of insurance options to reduce seismic vulnerability. Continue to promote the Earthquake Brace + Bolt (EBB) retrofit program.	Fault Rupture/Ground Motion, Liquefaction	Internal: Community Development, Police	Cal OES: Prepare CA – JumpStart CEA: Earthquake Brace + Bolt (EBB) Program Staff Time, General Fund	Ongoing	Medium
4.6	Continue to partner with SoCal Gas on earthquake mitigation activities, tracking the upcoming installation of SoCal Gas methane detection sensors off of Lampson Avenue and along Gate Road.	Fault Rupture/Ground Motion, Liquefaction	Internal: Police External: SoCal Gas	Staff Time	Medium-Term	Medium
(5) Extreme Weather Hazards (Drought, Extreme Heat, Heavy Rains, Santa Ana Winds and Tornadoes, Public Safety Power Shutoff (PSPS))						
5.1	Collaborate with the Orange County Water District (OCWD) and Municipal Water District of Orange County (MWDOC), to pursue water efficiency best practices to reduce water demand and the need for imported water as feasible.	Drought	Internal: Public Works External: OCWD, MWDOC	USBR: WaterSMART Grant Program LCI: Adaptation Planning Grant Program US EPA: Environmental Education Grants (EE) Staff Time, General Fund	Ongoing	Medium
5.2	Develop a focused water leak pilot program to eliminate leaky water mains, sprinklers, and other water fixtures, focusing on areas of the City with the greatest water demand.	Drought	Internal: Public Works External: OCWD, MWDOC	USBR: WaterSMART Grant Program HUD: Community Development Block Grant (CDBG) Program LCI: Adaptation Planning Grant Program Staff Time, General Fund	Long-Term	Medium
5.3	Encourage xeriscaping, low-flow water fixtures, and daytime watering restrictions on properties throughout the City to reduce water consumption.	Drought	Internal: Public Works	HUD: Community Development Block Grant (CDBG) Program MWDOC: Water Rebates DWR: Water Use Efficiency Grants General Fund, Community Facilities Districts, Bonds	Long-Term	Low
5.4	Expand use of public facilities (libraries, community centers, etc.) as cooling centers for vulnerable populations during extreme heat events, and assess facility needs in order to automatically open these facilities as cooling centers when temperatures exceed approximately 90 degrees. Expand public awareness of such resources to socially vulnerable populations, such as senior citizens.	Extreme Heat	Internal: Community Services, Police	LCI: Adaptation Planning Grant Program, Extreme Heat and Community Resilience Program HUD: Community Development Block Grant (CDBG) Program Staff Time, General Fund, Proposition 4 Funding	Ongoing	Medium
5.5	Explore feasibility for undergrounding utility lines whose poles that could blow over during a severe wind event.	Santa Ana Winds and Tornadoes	Internal: Public Works External: SoCal Edison	FEMA: Hazard Mitigation Grant Program (HMGP), Safeguarding Tomorrow Revolving Loan Fund (RLF) DOE: Grid Resilience Grants General Fund, Community Facilities Districts, Bonds	Long-Term	Low

Action #	Description	Hazards Addressed	Responsible Agency	Funding Sources	Timeline	Priority
5.6	Implement a tree-planting program to diversify tree age and increase shaded areas in the City to reduce the effects of extreme heat events.	Extreme Heat	Internal: Public Works	LCI: Adaptation Planning Grant Program, Extreme Heat and Community Resilience Program USDA: Urban and Community Forestry Program Staff Time, General Fund, Proposition 4 Funding	Ongoing	Medium
5.7	Promote passive cooling design (brise soleil, long roof overhangs, locating windows away from southern facades, etc.) in new developments during the design review process.	Extreme Heat	Internal: Community Development	LCI: Adaptation Planning Grant Program, Extreme Heat and Community Resilience Program HUD: Community Development Block Grant (CDBG) Program General Fund, Community Facilities Districts, Bonds	Ongoing	Medium
5.8	Continue to partner and collaborate with SoCal Edison to bolster grid hardening strategies, mitigate the impacts of power loss, and promote community awareness in the event of power outages.	Public Safety Power Shutoff (PSPS)	Internal: Police, Public Works External: SoCal Edison	FEMA: Hazard Mitigation Grant Program (HMGP) Cal OES: Prepare CA – JumpStart, Prepare CA – Match SCE: Energy Savings Assistance (ESA) Program, Energy Assistance Fund (EAF) HUD: Community Development Block Grant (CDBG) Program General Fund	Ongoing	Medium
5.9	Promote SoCal Edison’s Critical Care Backup Battery Program to supply elderly or medical device-dependent residents with battery-powered backup generators for medical equipment in Leisure World. Support community awareness and education campaigns facilitated between SCE and Leisure World to enhance preparedness and reduce risk.	Public Safety Power Shutoff (PSPS)	Internal: Community Services, City Manager External: SoCal Edison, Leisure World	FEMA: Hazard Mitigation Grant Program (HMGP) Cal OES: Prepare CA – JumpStart, Prepare CA – Match Staff Time, General Fund	Ongoing	Medium
(6) Human-Caused Hazards (Hazardous Materials Spill, Terrorism/Cyberattacks, Civil Disturbance/Civil Unrest, Pandemic)						
6.1	Pursue full alignment with policies and actions outlined in state and regional plans such as the California Accidental Release Prevention (CalARP) Program and the Orange County Fire Authority Hazardous Materials Area Plan	Hazardous Materials	Internal: Police External: CalEPA, OCFA	US DOT: Hazardous Materials Safety Inspection Grant (HMSI) Staff Time, General Fund	TBD	TBD
6.2	Continuously inspect businesses and other properties storing hazardous materials. Create an inventory of old storage units that require updates, maintenance, or renovation.	Hazardous Materials	External: OCFA, Orange County Health Care Agency	FEMA: Hazard Mitigation Grant Program (HMGP), Safeguarding Tomorrow Revolving Loan Fund (RLF) US DOT: Hazardous Materials Safety Inspection Grant (HMSI) Cal OES: Prepare CA – JumpStart Staff Time, General Fund	TBD	TBD
6.3	Engage in regional coordination and emergency preparedness related to the nearby Alamitos Energy Center (formerly AES Alamitos), considering risks from both natural gas and battery energy storage systems. Participate in training exercises and maintain lines of communications. Utilize best-available data to mitigate local vulnerabilities, with consideration for nearby socially vulnerable populations (Leisure World).	Hazardous Materials	Internal: Police External: City of Long Beach Police, Fire and Disaster Preparedness; OCFA	Staff Time, General Fund	Ongoing	Medium
6.4	Coordinate with regional partners through the Orange County Operational Area to enhance communication and intelligence for political/social instances that could result in civil disturbance, terrorism, or cyberattacks.	Terrorism/ Cyberattacks, Civil Disturbance/ Civil Unrest	Internal: Police External: Orange County Sheriff’s Department, neighboring jurisdictions	Staff Time, General Fund	Ongoing	Medium

Action #	Description	Hazards Adressed	Responsible Agency	Funding Sources	Timeline	Priority
6.5	Continue to communicate with Orange County Department of Public Health and follow the most recent guidance to address future pandemic and planning.	Pandemic	Internal: Police External: Orange County Department of Public Health	Staff Time, General Fund	Ongoing	Low
(7) Wildfire and Urban Fire Hazards (Wildfire and Urban Fire, Wildfire Smoke)						
7.1	Promote the proper maintenance and separation of power lines and efficient response to fallen power lines.	Wildfire and Urban Fire, Wildfire Smoke	Internal: Public Works, Police External: OCFA, SoCal Edison	Staff Time, General Fund	Ongoing	High
7.2	Continue regular fuel modification projects to reduce fire hazard risks, such as clearing out dead vegetation in parks, open spaces, right-of-way embankments, and other areas that could become fuel for fires, such as within Gum Grove Park and surrounding neighborhoods.	Wildfire and Urban Fire, Wildfire Smoke	Internal: Public Works, Community Development External: OCFA	CAL FIRE: Wildfire Prevention Grants Staff Time, General Fund, Proposition 4 Funding	Ongoing	High
7.3	Promote the planting of fire-resistant landscaping in all new developments and significant landscape retrofits in accordance with CAL FIRE recommendations, such as high-moisture, lowresin trees, shrubs, and ground cover.	Wildfire and Urban Fire, Wildfire Smoke	Internal: Community Development, Public Works External: OCFA	CAL FIRE: Wildfire Prevention Grants Staff Time, General Fund, Proposition 4 Funding	Ongoing	Medium
7.4	Provide information, education, and resources to residents citywide related to communications and early warning in the event of a wildfire, including ways to improve resilience to home fires.	Wildfire and Urban Fire, Wildfire Smoke	Internal: Police External: OCFA	FEMA: Next Generation Warning System Grant Program (NGWSGP) Cal OES: Prepare CA – JumpStart US EPA: Environmental Education Grants Staff Time, General Fund, Proposition 4 Funding	Ongoing	Medium

11.3 CAPABILITIES ASSESSMENT

The capabilities assessment identifies existing local agencies, personnel, planning tools, public policy and programs, technology, and funding resources that can support the hazard mitigation measures in this Plan. This assessment helps determine the current ability of Seal Beach to reduce damage from hazard events, providing a foundation to develop, consider, and prioritize future hazard mitigation measures.

11.3.1 KEY RESOURCES

The City of Seal Beach has resources to support the implementation of mitigation actions including:

- Planning and regulatory capabilities are based on the implementation of ordinances, policies, local laws, and State statutes, and plans and programs that relate to guiding and managing growth and development.
- Administrative and technical capabilities refer to the staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. It also refers to the ability to access and coordinate these resources effectively.
- Financial capabilities are the resources that a jurisdiction has access to or is eligible to use to fund mitigation actions.
- Education and outreach capabilities are programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information.

Refer to [Table 5-4, *City of Seal Beach Capabilities Assessment*](#) below for a summary of City capabilities.

**Table 5-4
City of Seal Beach Capabilities Assessment**

Ordinance/Plan/ Policy/Program	Responsible Agency or Department	Description/Comments
<i>Planning and Regulatory</i>		
General Plan and Zoning Code	Planning Division	The City’s General Plan supports the implementation of the LHMP by integrating hazard mitigation strategies into broader land use and development planning. The General Plan provides a policy framework, allocates resources and facilitates implementation of mitigation strategies and risk reduction. The City’s Zoning Code also provides a framework for guiding land use in development in ways that minimize risk from natural hazards.
Local Coastal Program	Planning Division	The City’s Local Coastal Program (LCP) is a policy and regulatory document that establishes land use, development, natural resource protection, coastal access, and public recreation policies for the City of Seal Beach in a manner consistent with the Coastal Act within the Coastal Zone. The City’s LCP is currently being drafted and will reflect current City conditions in collaboration with the California Coastal Commission and is associated

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Ordinance/Plan/ Policy/Program	Responsible Agency or Department	Description/Comments
		with the hazard mitigation strategies outlined in the LHMP.
Cyber Security Incident Response Plan	Seal Beach Police Department	The City’s 2022 Cyber Security Incident Response Plan is designed to be utilized in conjunction with the City’s Emergency Operations Plan and is designed to contain recommendations to guide the City’s response to the cyber security threats outlined within the LHMP.
Naval Weapons Station Seal Beach Joint Land Use Study	Naval Weapons Station Seal Beach (NWSSB)	The Joint Land Use Study (JLUS) identifies key issues related to existing land use within the JLUS Study Area, consisting of the Naval Weapons Station, and proposed strategies to address these concerns. The JLUS is divided into three components: JLUS Background Report, JLUS Report, and the Executive Summary Brochure, and its land use considerations are directly applicable to those identified within the LHMP.
Water Shortage Contingency Plan	Public Works & Utilities Departments	The City’s 2020 Water Shortage Contingency Plan was created in partnership with the Municipal Water District of Orange County and other local jurisdictions.
Urban Water Management Plan (UWMP)	Public Works & Utilities Departments	The 2020 UWMP updates the City's 2015 water demand and supply analysis in accordance with the current California Water Code. It also includes a standalone Water Shortage Contingency Plan (WSCP) and an Addendum to the 2015 UWMP to demonstrate reduced reliance on Delta water supplies in accordance with Delta Policy WR P1.
Sea Level Rise Vulnerability Assessment (SLRVA)	Planning Division	The SLRVA identifies facilities and critical public infrastructure along the coast that may be at risk in the future with rising sea levels. The SLRVA was submitted to the California Coastal Commission as a final LCP Planning Grant deliverable in 2019.
Jurisdictional Runoff Management Plan	Public Works & Utilities Departments	The Seal Beach Jurisdictional Runoff Management Program (JRMP) details the City-wide programs and activities designed to prevent and reduce storm water pollution within City boundaries in compliance with its 2013 Municipal Separate Storm Sewer System (MS4) Permit.
Tsunami Response Plan Playbook	Seal Beach Police Department /Orange County Fire Authority	The Tsunami Response Plan Playbook outlines critical information and necessary decision-making steps in the event of a tsunami affecting the planning area. The Playbook also includes a quick-reference page for real time response activities.
Unified County of Orange and Orange County	Orange County Sherriff’s Department	The Unified County of Orange and Orange County Operational Area Tsunami Annex outlines estimated tsunami risk to the Orange County

Ordinance/Plan/Policy/Program	Responsible Agency or Department	Description/Comments
Operational Area Tsunami Annex	/Orange County Fire Authority	Operational Area. This Annex was utilized as a reference document in the formation of this updated LHMP.
County of Orange and Orange County Fire Authority Hazard Mitigation Plan	Orange County Sheriff's Department /Orange County Fire Authority	The County of Orange and Orange County Fire Authority Hazard Mitigation Plan identifies Orange County's natural hazards and presents a variety of actions and projects, proposed or in progress, which can help mitigate the risks these hazards pose. This Plan was utilized as a reference document in the formation of this updated LHMP.
Floodplain Management Ordinance	Community Development Department	The ordinance establishes additional standards for development activities in the floodplain, enforced by the Building and Safety Division staff. This ordinance can be amended to implement additional flood mitigation strategies from this Plan.
Building Code	Community Development Department	The building code specifies how all new construction in the City shall be built. These requirements can be amended to require new construction to be more resilient to emergency situations. Mitigation actions to construct buildings to safer standards to enhance resilience during hazard events could be considered as part of future building code updates.
Fire Code	Community Development Department	The fire code contains specific fire safety requirements for all structures. These requirements can be modified to require increased fire safety measures and support hazard mitigation actions identified in this Plan.
City Budget	Finance & Administrative Services Department	The Seal Beach City Council adopts a budget every fiscal year, which identifies sources of revenue for the City and how this money will be spent. The budget can direct funding toward hazard mitigation activities, including increased staffing, planning efforts, and capital improvements.
Municipal Code	Community Development Department	The code contains land use regulations, including requirements for all new construction. The code can be used to implement hazard mitigation measures related to land use and development.
Water Conservation Ordinance	Public Works Department	Seal Beach's Water Conservation ordinance establishes mandatory and permanent water conservation activities for all Seal Beach residents and businesses, as well as additional mandatory standards for various stages of water shortage events. These standards help mitigate the impact of drought-related emergency events. The tools and strategies of the Water

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Ordinance/Plan/ Policy/Program	Responsible Agency or Department	Description/Comments
		Conservation ordinance can be used to develop this Plan’s drought mitigation actions.
<i>Administrative and Technical</i>		
Police Services	Seal Beach Police Department	Staff provides police protection services and community programs and education campaigns. Police Staff are a key component of implementing mitigation actions, including but not limited to, coordinating, and communicating with the public and other agencies, ensuring safe and efficient evacuations, if necessary, and providing or participating in public education and preparedness activities that support mitigation of risks.
Fire Services	Orange County Fire Authority	The Orange County Fire Authority provides fire services to Seal Beach. The Fire Authority is a key component of implementing mitigation actions. Staff is responsible for conducting safety training and preparedness activities, responding to emergency situations, and supporting emergency recovery. Staff also responds to hazardous material emergencies and conducts activities to reduce the risk of hazardous material-related events.
Code Compliance Division Staff	Community Development Department	Staff maintains and improves the health, safety, and general welfare of the City by implementing the goals and policies of the General Plan and enforcing the Zoning Code related to land use and development. Mitigation actions related to ensuring development requirements, along with plans and programs, are updated to reflect most current hazard information.
Building and Safety Division staff	Community Development Department	Staff responsible for regulating the construction, alteration, use and occupancy of buildings. Staff reviews all proposals for new development in Seal Beach to ensure it meets all applicable laws and ordinances and complies with all hazard-related requirements. Mitigation actions related to ensuring development requirements, along with plans and programs, are updated to reflect most current hazard information.
Planning Commission	Community Development Department	The Seal Beach Planning Commission meets as needed to advise the City Council on land use policies and laws, and to make final decisions on certain kinds of development and use permits. The body can approve and guide development of new projects and make recommendations related to new land use policies, ensuring that developments are in accordance with mitigation actions.
City Council	City Council	The Seal Beach City Council is composed of five Council Members. The City Council meets twice a

Ordinance/Plan/ Policy/Program	Responsible Agency or Department	Description/Comments
		month and serves as the primary legislative body for the community. The City Council can establish and revise laws, approve plans and policy directions, and allocate funding. City Council will be responsible for adopting this Plan and implementing mitigation actions.
City Manager	City Manager Department	The City manager allocates and manages City resources to carry out City policy and operations as directed by the City Council, including allocating and managing staff and funding to support implementation of hazard mitigation activities. The Department also provides risk management, human resources services to City departments, as well as a variety of State compliance and general administrative activities.
Finance Department staff	Finance Department	The purpose of the Finance Department is to provide staff support to internal departments, assure financial accountability to the public, and to provide customer service to both internal and external clientele. Although the Finance Department does not implement mitigation actions, the department plays an important role in facilitating implementation by working with the various departments to ensure mitigation actions are incorporated into the City budget and to administer grant support.
Public Works Department Staff	Public Works Department	The Public Works Department is responsible for building and maintaining Seal Beach’s publicly owned infrastructure, including the City’s water service. The Public Works Department is a key lead for mitigation actions. Staff can construct and retrofit infrastructure to reduce hazard risks in the community, or to be more resilient to hazard events.
Community Development Department Staff	Community Development Department	The Community Development Department performs a variety of services intended to improve the built environment and the quality of life for current and future residents, businesses, and visitors. The Department is composed of Planning, Building and Safety, and Code Enforcement.
Community Services Department staff	Community Services Department	The Community Services Department strives to create community through various programs and recreational activity to the benefit of local residents. Community Services manages the programming of community facilities and parks, provides transportation options for seniors, and oversees special event permitting.
Human Resources Staff	City Manager Department	The Human Resources division includes administration of the City’s benefits programs; maintenance of personnel records for the City’s

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Ordinance/Plan/ Policy/Program	Responsible Agency or Department	Description/Comments
		employees; ensuring compliance with State and Federal employment mandates; coordination of employee safety and workers’ compensation programs; disciplinary and grievance procedures; interpretation and implementation of the Memoranda of Understanding with employee bargaining units; and recruitment, selection, hiring, and orientation of all new employees.
City Attorney	City Attorney	The City Attorney represents the municipality and handles civil cases, advising the City on legal matters and representing it in court.
Republic Services Staff	Republic Services	The City contracts with Republic Services to provide trash, recycling, and green waste collection for all City residents and commercial businesses. Additionally, commercial businesses are provided with food scraps collection to ensure compliance with state and local law. Staff can coordinate their efforts with the relevant mitigation actions outlined in this Plan.
Southern California Edison Staff	Southern California Edison	Southern California Edison is responsible for providing safe and reliable electricity to Seal Beach community members. Mitigation actions specific to the provision of these services will be implemented in coordination with the service provider. Staff responsibilities include restoring electrical service if it has been interrupted by an emergency situation and repairing and maintaining electrical infrastructure to reduce the risk of hazard events.
Southern California Gas Staff	Southern California (SoCal) Gas	SoCal Gas provides natural gas service in Seal Beach. Mitigation actions specific to the provision of this service will be implemented in coordination with SoCal Gas. Staff is responsible for maintaining the natural gas infrastructure in safe conditions to minimize the risk of leaks, fires, or explosions. This includes repairing natural gas infrastructure following emergency situations.
Financial		
General Fund	N/A	Serves as the main operating fund for the City and is used to finance the most common municipal functions (e.g., police, fire, parks, and recreation, etc.).
Capital Improvement Program	N/A	Long-range plan for individual capital improvement projects and funding sources. Projects are considered unique construction projects that provide improvements or additions such as land, buildings, and infrastructure. The Capital Improvement Program budget is an

Ordinance/Plan/Policy/Program	Responsible Agency or Department	Description/Comments
		important part of the City’s budget. The FY 2023/2024 budget presents numerous capital improvement projects with expenditures totaling over \$24 million. These projects provide funding for needed repairs, replacements, and improvements to streets, water infrastructure, drainage and sewage systems, parks and medians, public facilities, and other improvements.
<p>California Governor’s Office of Emergency Services</p>	<p>N/A</p>	<p>Cal OES is responsible for overseeing and coordinating emergency preparedness, response, recovery, and homeland security activities within California. Cal OES regularly dispatches team members to join first responders, emergency leaders and those affected by disasters that threaten public safety, to provide information essential to the public. Cal OES can assist in obtaining funding for mitigation actions identified in the plan and providing guidance on future plan updates. Additionally, Cal OES is responsible for administration and distribution of federal grant funding for the FEMA grant programs listed above.</p>
<p>Federal Emergency Management Agency – Hazard Mitigation Assistance Grants</p>	<p>N/A</p>	<p>FEMA is the federal agency responsible for hazard mitigation, emergency preparedness, and emergency response and recovery activities. It provides guidance to State and local governments on hazard mitigation activities, including best practices and how to comply with federal requirements. FEMA also provides funding for hazard mitigation actions through two grant programs: Hazard Mitigation Grant Program (HMGP) and Flood Mitigation Assistance (FMA) Grant. The HMGP requires a presidential hazard declaration before funding is available; after a hazard is declared, grant applications can be submitted on a rotating basis. FMA applications typically open during the fall. Outside of the Hazard Mitigation Assistance Grants, FEMA also administers Preparedness Grants and Resilience Grants that may be applicable to future City projects.</p>
<p>Department of Housing and Urban Development – Community Development Block Grants</p>	<p>N/A</p>	<p>The Community Development Block Grant (CDBG) Entitlement Program provides annual grants on a formula basis to entitled cities and counties to develop viable urban communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for low- and moderate-income persons. The program is authorized under Title 1 of the Housing and Community</p>

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Ordinance/Plan/ Policy/Program	Responsible Agency or Department	Description/Comments
		<p>Development Act of 1974, Public Law 93-383, as amended; 42 U.S.C. 5301 et seq.</p> <p>HUD awards grants to entitlement community grantees to carry out a wide range of community development activities directed toward revitalizing neighborhoods, economic development, and providing improved community facilities and services, which may be applicable to future City projects. Seal Beach is not an entitlement community, but instead is a sub-recipient of funds through the County of Orange. The City must apply through a competitive process to fund capital projects through CDBG.</p>
<i>Education and Outreach</i>		
American Red Cross	Coordination with Seal Beach Police /Orange County Fire Authority	Provide access to natural hazard information and resources, as well as educational and training programs. Promoting participation in American Red Cross educational and training programs would serve to mitigate hazards by increasing awareness and preparedness.
Staff Training	Coordination with Seal Beach Police/Orange County Fire Authority and other City Departments as relevant	The City provides staff training on emergency response and preparedness. Mitigation actions may include updating or enhancing staff training on emergency response and preparedness.
City Website (as related to hazard mitigation and public safety)	Seal Beach Police Department	The website provides news and announcements to the community, including community events related to safety and emergency preparedness and mitigation. The Emergency Preparedness Page of the Seal Beach Police website outlines the four phases of the emergency management cycle, resources for developing an emergency preparedness kit, access to City documents such as the City's Emergency Operations Plan and Evacuation Plan, the City's Neighbor 4 Neighbor program, and connections to local alert and warning systems such as AlertOC and Nixle. The City also posts reminders about annual preparedness events such as The Great Shakeout and Tsunami Preparedness Week. The City Website provides an opportunity to convey information and implement mitigation actions specific to educating and informing the community regarding all hazards and ways to reduce impacts from the hazards.
Environmental Response to Oil	Coordination with California	Environmental Response to Oil Spills (EROS) is a FREE in-person course provided to new oil spill responders, consisting of demonstrations,

Ordinance/Plan/Policy/Program	Responsible Agency or Department	Description/Comments
Spills (EROS) Course	Department of Fish & Wildlife	lectures by experienced response personnel, case studies, and interactive field trips. This free course is available to Seal Beach staff.

How can these capabilities be expanded upon and improved to reduce risk?
 Multiple mitigation measures are priority projects to expand Seal Beach’s capabilities, including new plans and programs. Examples of opportunities to expand capabilities include the following mitigation actions:

Planning/Regulatory: Mitigation Actions 1.8, 2.4, 2.14, 2.15

Administrative/Technical: Mitigation Actions 1.7, 2.2, 3.1, 6.3, 6.4, 6.5

Financial: Mitigation Actions 2.5, 4.1, 4.2, 4.5, 5.9

Education/Outreach: Mitigation Actions P.1, P.10, 2.9, 2.16, 5.4, 6.3

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HIGHTIDE		LOWTIDE	SUNRISE	SUNSET	WATER TEMP	SURF	SWELL	WIND	AIR TEMP	GAUWION	DATE	SPECIAL EVENTS
AM	10:15 (6.4)	6:12 (1.4)	6:05	7:35	58°	1-2		3-10 MPH	59° 67°		4/30	



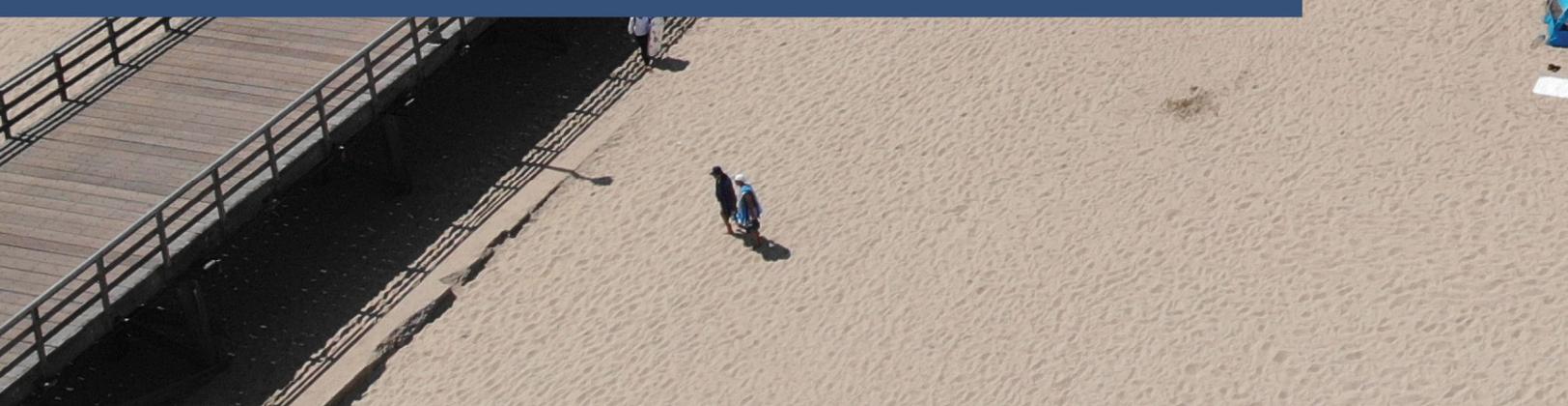
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 Amanda @Ginnis.ca @ginnis.com
 YTD



12

PLAN MAINTENANCE





WHAT'S DIFFERENT IN THE 2025 PLAN?

- Renewed focus on efforts to complete established mitigation actions.
- Renewed emphasis on continuous public involvement throughout the planning horizon of the LHMP.

SECTION 12: PLAN MAINTENANCE

This section identifies the formal process by which that City can ensure the LHMP remains an active and relevant document for the City of Seal Beach. The LHMP maintenance process includes a schedule for monitoring and evaluating the LHMP annually and producing an update every five years to ensure the City maintains eligibility for federal and State hazard mitigation funding. This section of the LHMP also describes how the City can integrate public participation throughout LHMP maintenance and implementation process. Finally, this section describes how City staff can incorporate the mitigation actions outlined in this LHMP into existing planning mechanisms and programs and future actions and decision-making.

12.1 PURPOSE OF THE LHMP AND AUTHORITY

Under the direction of the LHMP Project Management Team (comprised of City of Seal Beach Police and Community Development Department staff), the LHMP Planning Team will be responsible for the ongoing maintenance of this LHMP. The Project Management Team will take the lead in LHMP maintenance by coordinating with the Planning Team, including undertaking the formal review process and future updates.

Key City departments are identified below:

- City Manager Department
- Police Department
- Community Development Department
- Marine Safety Department
- Public Works Department
- Finance Department
- Community Services Department
- Orange County Fire Authority (OCFA)

In addition to City staff and representatives from OCFA and OCSD, the following partner agencies who were part of the LHMP Planning Team should be included in the maintenance and update activities:

- City of Long Beach
- City of Los Alamitos
- City of Westminster
- City of Huntington Beach
- City of Cypress
- City of Garden Grove
- Seal Beach Naval Weapons Station
- Joint Forces Training Base
- Los Alamitos Unified School District
- Orange County Sheriff's Department
- Orange County Fire Authority
- Metropolitan Water District of Southern California
- Water Emergency Response Organization of Orange County
- Orange County Water District
- Southern California Edison
- SoCal Gas
- Orange County Transportation Authority (OCTA)

Although specific LHMP Planning Team and Project Management members may change, the City staff positions, departments and other partner agencies and organizations should continue to be included in the LHMP implementation and maintenance process.

The LHMP Project Management Team will facilitate the LHMP Planning Team meetings and will assign tasks such as updating and presenting the Plan to other departments, stakeholder groups, and/or elected officials. The LHMP Planning Team will be responsible for maintaining and updating the LHMP and will coordinate implementation through their respective positions and agencies. LHMP implementation and evaluation will be a shared responsibility among all LHMP Planning Team members.

12.1.1 EVALUATION

At a minimum, the ongoing annual LHMP Planning Team meeting will evaluate the progress of the LHMP and incorporate the actions into other planning documents. This review will include the following:

- Summary of any hazard events that occurred during the prior year and their impacts on the community.
- Review of successful mitigation initiatives identified in the Plan.
- Brief discussion about why targeted mitigation strategies were not completed.
- Reevaluation of the mitigation actions to determine if the timeline for identified projects needs to be amended (such as changing a long-term project to a short-term project due to funding availability).
- Recommendations for new mitigation actions.
- Changes in, or potential for, new funding options/grant opportunities.
- Integration of new GIS data and maps that can be used to inform the Plan.

- Evaluation of any other planning programs or initiatives within the City that involve hazard mitigation.

The purpose of the annual evaluation will be to ensure consideration and implementation of the LHMP and document progress to inform the future LHMP update.

12.2 METHOD AND SCHEDULE FOR UPDATING THE PLAN WITHIN FIVE YEARS

Title 44 of the Code of Federal Regulations, Section 201.6(d)(3), requires that local hazard mitigation plans be reviewed, revised, and resubmitted to FEMA for approval to remain eligible for the benefits awarded under the DMA.

Monitoring the progress of the mitigation actions will be on-going throughout the five-year period between the adoption of the LHMP and the next update effort. The LHMP Planning Team will meet on an annual basis to monitor the status mitigation action implementation and develop updates, as necessary.

The City intends to update the Plan on a five-year cycle from the date of its adoption. It is anticipated that this update process will occur one year prior to expiration of the existing LHMP. This cycle may be accelerated to less than five years based on the following triggers:

- A state or presidential disaster declaration that impacts the City.
- A hazard event that causes loss of life.

Should a significant disaster occur within the City, the LHMP Planning Team will reconvene to review and update the LHMP, as appropriate. The City Council will adopt written updates to the LHMP.

12.2.1 PROCESS

The intent of the update process will be to add new planning process methods, community profile data, hazard data and events, vulnerability analyses, mitigation actions, and goals to the adopted Plan so that the LHMP will always be current and up to date. Based on the needs identified by the LHMP Planning Team, the update will, at a minimum, include the elements below:

1. The update process will be convened through the LHMP Planning Team and will include representatives from the Community Development Department and other participating departments to ensure consistency with other relevant City planning documents.
2. The hazard risk assessment will be reviewed and updated using best available information and technologies on an annual basis.
3. The evaluation of critical structures and mapping will be updated and improved as funding becomes available.
4. The mitigation actions will be reviewed and revised to account for any actions completed, deferred, or changed to account for changes in the risk assessment or new City policies identified under other planning mechanisms, as appropriate (such as the City's General Plan).
5. The draft update will be sent to appropriate agencies for comment.
6. The public will be given an opportunity to comment prior to adoption.
7. The Seal Beach City Council will adopt the updated LHMP.

The LHMP Planning Team will coordinate with responsible City departments and agencies/organizations identified for each mitigation action. These responsible departments and agencies/organizations will monitor and evaluate the progress made on the implementation of mitigation actions and report to the LHMP Planning Team on an annual basis. Working with the LHMP Planning Team, these responsible departments and agencies/organizations will be asked to assess the effectiveness of the mitigation actions and modify the mitigation actions as appropriate. The LHMP Mitigation Action Progress Report worksheet will assist mitigation leads in reporting on the status and assessing the effectiveness of the mitigation actions.

Information gathered from the City departments and external partners will be used to monitor mitigation actions and annual evaluation of the LHMP. The following questions will be considered as criteria for evaluating the Plan's effectiveness:

- Has the nature or magnitude of hazards affecting the City changed?
- Are there new hazards that have the potential to impact the City?
- Do the identified goals and actions address current and expected conditions?
- Have mitigation actions been implemented or completed?
- Has the implementation of identified mitigation actions resulted in expected outcomes?
- Are current resources adequate to implement the LHMP?
- Should additional local resources be committed to address identified hazards?

An Annual LHMP Review Questionnaire worksheet will be used to provide guidance to the LHMP Planning Team on what should be included in the evaluation. Future updates to the LHMP will account for any new hazard vulnerabilities, special circumstances, or new information that becomes available. Issues that arise during monitoring and evaluating the LHMP, which require changes to the risk assessment, mitigation strategy and other components of the Plan, will be incorporated into the next update of the LHMP in 2029. The questions identified above will remain valid when preparing the 2029 Plan update.

12.3 LOCAL ADOPTION

Cal OES and FEMA are responsible for initial review and approval of the LHMP. After the plan check review process concludes, the Seal Beach City Council is responsible for adopting the LHMP. This formal adoption should take place every five years. Once the LHMP has been finalized, the City Project Management Team will be responsible for final submission to the California Office of Emergency Services (Cal OES). Cal OES will then submit the Plan to FEMA for final review and approval.

12.4 IMPLEMENTATION THROUGH EXISTING PROGRAMS AND PLANNING MECHANISMS

LHMP effectiveness depends on the implementation of the mitigation actions, and incorporating these actions into other City plans, policies, and programs. These mitigation actions provide the framework for activities that the City can implement over the next five years. The City has prioritized the actions in this LHMP, which will be implemented through existing plans, policies, and programs as resources become available.

The City of Seal Beach Police Department has taken on the responsibility for overseeing the Plan's implementation and maintenance through the City's existing programs. The Emergency Services Coordinator, or designated appointee, will assume lead responsibility for facilitating LHMP implementation and maintenance meetings. Although City of Seal Beach Police Department will have primary responsibility for review, coordination, and promotion, plan implementation and evaluation will be a shared responsibility among all departments identified as lead departments in the mitigation action plan.

The LHMP can also build upon related planning efforts and mitigation programs that are already occurring within the City. This will also facilitate applying for funding opportunities as they become available. Progress on implementing mitigation actions through other City planning programs and mechanisms should be monitored and integrated into future updates.

By adopting a resolution to approve this LHMP, the City agrees to reference and incorporate the document into planning documents, programs, decisions, processes, and regulations. The LHMP will be reviewed and considered by internal City departments, as applicable plans or programs are created or updated in the future. Upon creating or updating new plans, programs or policies, City staff will review this LHMP and consider the following:

- What hazard and/or vulnerability information should be considered and/or integrated into this plan?
- Are there opportunities for this plan to support and/or implement mitigation actions?
- What mitigation actions can and should be integrated into this plan?
- Are there other community mechanisms that mitigation can be integrated?
- Is there information from this plan that can be integrated into the next LHMP update?

Opportunities for the City to integrate information from this LHMP into planning mechanisms are described below.

Planning and zoning law require California cities to adopt a comprehensive, long-term general plan for the physical development of the City. General plans are required to address natural hazards that could impact the jurisdiction and prepare for the impact of natural hazards. The City's General Plan identifies land use patterns, future development, and growth within the planning area. The LHMP update process has allowed the City to review the policies contained in the General Plan Safety Element and identified mitigation actions that will further implement these policies. The City views the General Plan and LHMP as complimentary planning documents that work together to achieve the goal of the reduction of risk exposure to the citizens of the City. Once the LHMP is adopted by FEMA, the City will update the Safety Element to incorporate the LHMP and vulnerability assessment by reference to comply with California Assembly Bill 2140.

In addition, the City is currently in the process of preparing a Local Coastal Program in accordance with the California Coastal Act. Findings from the approved Sea Level Rise Vulnerability Assessment and Land Use Plan were integrated into the LHMP update. As the City works toward preparing the Implementation Plan, the LHMP can serve as a reference and guide for relevant hazard information and mapping. Ongoing coordination with the California Coastal Commission may yield additional projects and actions from the City that could serve as new mitigation actions

for the next LHMP update process. Additionally, the California Coastal Commission grant funding mechanisms can support mitigation actions identified in this LHMP.

The City's Capital Improvement Program (CIP) identifies capital projects and major equipment purchases for all City departments. The CIP links both the annual general plan and annual budget. Identified CIP projects were integrated into the LHMP mitigation actions where appropriate, for projects with a nexus to resilience or natural hazards. In addition, as part of the annual review and update of the CIP, mitigation actions identified will be reviewed and integrated. The City anticipates utilizing this LHMP to apply for Hazard Mitigation Assistance (HMA) grant funding such as Building Resilient Infrastructure and Communities, Hazard Mitigation Grant Program and Flood Mitigation Assistance Grant Program, for key capital improvement and infrastructure projects related to landslide, coastal erosion, and wildfire.

Other opportunities for integration of this LHMP include education programs and continued coordination between the City and the identified external partners such as the Golden Rain Foundation/Leisure World, Lions Club, and Save Our Beach. Expansion of community capacity and education programs is discussed in [Table 5-4](#) in the previous section.

12.5 2019 LHMP PAST INTEGRATION EFFORTS

The City was successful in implementing several mitigation actions from the 2017 LHMP, as outlined in [Section 5](#). Overall, the City strives to maintain a culture of preparedness and ongoing hazard mitigation. The findings of the 2019 LHMP were used to inform multiple City planning documents, such as the City's 2020 Water Shortage Contingency Plan, 2022 Cyber Response Plan, and the 2022 COVID-19 After Action Report.

In addition to the mitigation activities promoted and completed by the City, the City of Seal Beach has demonstrated a commitment to hazard mitigation and resilience through a variety of emergency management projects, policies, and programs. See [Section 11](#) for full details on the City's ongoing commitment to emergency management and preparedness in addition to its hazard mitigation efforts. Thus, this LHMP update documents years of work toward resilience in alignment with hazard mitigation planning principles. The City anticipates integrating this LHMP into the studies and planning mechanisms listed above and applying for FEMA grant funding to implement key mitigation actions.

12.6 CONTINUED PUBLIC INVOLVEMENT

The City is dedicated to involving the public in LHMP review and updates throughout the five-year planning period. The public, including socially vulnerable populations, will continue to be informed of the LHMP actions through regular updates to the City's website. The City will continue provide in-person educational events and activities to further inform the community regarding natural hazard risk and mitigation. Where feasible, these educational opportunities will be co-located with other safety related community events such as National Night Out.

Additionally, continued public involvement will be achieved through the promotion of hazard mitigation/emergency preparedness, trainings, interagency-coordinated outreach efforts and other hazard awareness campaigns. These are included in [Section 5.0](#) as Mitigation Actions [Pending feedback from LHMP Stakeholder Committee]. The listed mitigation actions include

outreach and communication mechanisms designed with the “whole community” approach, ensuring that socially vulnerable populations will receive messaging. The City will also inform LHMP Planning Team participants of relevant updates at the annual LHMP evaluation meeting.

The adopted LHMP will remain permanently available for review on the City’s website, with contact information for interested parties to direct comments and concerns. All public feedback will be reviewed and considered for incorporation (if deemed appropriate) into the next LHMP update.

Upon initiation of the LHMP update process, a new public involvement strategy will be developed based on guidance from the LHMP Planning Team. This strategy will be based on the needs and capabilities of the City at the time of the update. At a minimum, this strategy will include the use of the City website, email distribution lists and local media outlets within the planning area. At this time, a re-evaluation of local socially vulnerable populations will be conducted for improved understanding of how to reach and engage these groups.

12.7 POINT OF CONTACT

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