

# HAZARDS

# AND

# CLIMATE

# RESILIENCE

# PLAN

EXECUTIVE SUMMARY



THE CITY AND COUNTY  
OF SAN FRANCISCO

**ONESF**  
Building Our Future



**City and County of San Francisco  
Hazards and Climate Resilience Plan  
Executive Summary**

Copies of this document can be found at <http://onesanfrancisco.org>  
or through the Office of Resilience and Capital Planning

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San Francisco, CA 94102



# Hazards and Climate Resilience Plan

In compliance with the Stafford Act and Disaster Mitigation Act, we are pleased to submit the City and County of San Francisco's Hazards and Climate Resilience Plan. In addition to serving as the five-year update to the 2014 Local Hazard Mitigation Plan, this plan also serves as the foundation for San Francisco's Community Safety Element and Climate Action Strategy updates. We took this opportunity to improve our understanding of San Francisco's vulnerabilities to natural hazards and develop a comprehensive approach to reducing risk. We sought to better understand not just the earthquake risk that has been a facet of life in San Francisco since the Great Earthquake of 1906, but also the climate change impacts that are bringing unprecedented challenges to San Francisco and across the State.

The Hazards and Climate Resilience Plan demonstrates San Francisco's commitment to creating and supporting resilient infrastructure, buildings, and communities in the face of increasing risks. Like San Francisco's previous hazard mitigation plans, the Hazards and Climate Resilience plan has a strong commitment to reducing damage to buildings and infrastructure. But with this update, we also emphasized supporting healthy homes and neighborhoods before, during, and after a hazard event. To achieve that, we involved more stakeholders than ever before, including adding the Public Health Department to the plan's leadership and conducting workshops with organizations that serve San Francisco's populations that are more vulnerable to hazards. We also made equity a key principle of how we develop the plan, the types of strategies we pursue, and how we implement them.

While this plan represents a commitment to reducing risks over the next five years and beyond, it also represents a civic conversation that will continue as we monitor the science and impacts of climate change and earthquakes. The ultimate goal is to enable our communities to project, adapt, and thrive regardless of the hazards we face.

We look forward to working with the Mayor and Board of Supervisors to advance and implement the important strategies in this plan.



Sincerely,

A handwritten signature in blue ink that reads "Naomi M. Kelly".

Naomi Kelly  
**City Administrator**



Sincerely,

A handwritten signature in blue ink that reads "Mary Ellen Carroll".

Mary Ellen Carroll  
**Executive Director**  
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# Acknowledgements

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# Executive Summary



## Introduction

Greater uncertainty resulting from climate change as well as the increasing likelihood of a large earthquake mean that there is no time to waste to secure the places and communities that make San Francisco such an incredible place to live, work, and visit. Preparing for earthquakes, has long been part of our psyche, but unfortunately, we now need to be equally vigilant against the growing threat of climate related disasters that will likely worsen in the years to come due to greenhouse gas emissions. More severe droughts and floods along with sea level rise, extreme heat, and unhealthy air quality require strong actions on how we manage urban systems to protect the health and well-being of all San Franciscans. By capturing all of San Francisco's mitigation and adaption

efforts in one place, the Hazards and Climate Resilience Plan (HCR) is a major step toward preserving the places that matter and ensuring a safer and more resilient future for us all.

## Purpose

The City and County of San Francisco’s Hazards and Climate Resilience Plan (HCR) is a combined hazard mitigation and climate adaptation plan. In addition to serving as an update to the 2014 Hazard Mitigation Plan, it will also underpin the next update to the Community Safety Element and Climate Action Strategy. The HCR is the City’s action plan for reducing the impacts of hazards that have long been a part of life in San Francisco, such as earthquakes and landslides, and hazards that are becoming more frequent and severe due to climate change, including flooding, drought, and extreme heat. It includes goals and strategies to increase the resilience of San Francisco’s buildings, infrastructure, and communities. The HCR will also be a living document with on-going engagement and regular updates.

## Resilience Vision

The overall vision of the HCR is to make San Francisco resilient to immediate and long-term threats of climate change and natural hazards through actions to mitigate risks, adapt built and natural assets, and build a more equitable and sustainable city. This includes ensuring systems are in place so that individuals, communities, institutions and businesses survive, adapt, and thrive no matter the kinds of chronic stresses and acute shocks they experience. The HCR also coordinates with and supports the City’s Climate Action Strategy, which outlines urgent strategies needed to reduce greenhouse gas emissions and minimize the severity of climate change and its associated impacts.

## Guiding Principles

The following principles guided how the City developed the HCR, from scoping the assessment to evaluating strategies.

- **Equity & health:** Proactively work to eliminate racial disparities in the impacts of hazards and distribution of resilience benefits
- **Community cohesion:** Empower people and partnerships to reduce vulnerability and promote resilience at the building, block, and neighborhood level

- **Affordability & economic viability:** Help residents and business stay and thrive in San Francisco
- **Climate mitigation:** Eliminate the greenhouse gas emissions that drive climate change and worsen climate hazards
- **Biodiversity & connection to nature:** Leverage local ecosystems to mitigate hazards and support climate adaptation while helping all residents access green spaces, parks, and natural habitats
- **Science-grounded innovation:** closely monitor evolving science of hazards and modify approaches appropriately
- **Good governance:** Provide dependable and actionable information to foster transparency and openness

## Planning Process

The City and County of San Francisco developed a comprehensive approach to incorporate the feedback of departments and the greater San Francisco community to the greatest extent possible given time and resource constraints. A Technical Working Group met every other week and a Steering Committee met monthly. These two committees contained representatives of core agencies working on hazard mitigation issues such as the Office of Resilience and Capital Planning (lead), City Administrator, Planning, Public Health, Emergency Management, Environment, Public Works, and the Mayor's Office,.

A broader Planning Team, consisting of staff from 28 departments, met six times to provide information and feedback on hazards, assets, vulnerabilities, and strategies contained in this document. Additional meetings with subject matter experts internal and external to the City filled in gaps the Planning Team could not cover. Finally, over two dozen meetings took place with department heads, the Board of Supervisors, and the Mayor's Office during the strategy development phase to ensure their alignment with current and future priorities.



# Community Engagement

To gather and understand community perspectives, the City engaged over 70 organizations in five workshops. The workshops were organized around the following themes:

1. Businesses and Commercial Property Owners
2. Older Adults + People w/ Access & Functional Needs
3. Children, Youth, and Families
4. Housing Managers and Developers (with a focus on affordable housing)
5. Environmental, Racial, and Social Justice Organizations

In addition to the workshops, a community survey asking about people’s experience with hazards facing San Francisco was made available in six languages. A total of 597 surveys were submitted. The following are highlights from the stakeholder workshops and survey.

**Solutions Need to be Diversified, Multi-Pronged, and Coordinated.** The most common theme from the community engagement process was that people recognize there is no “one-size-fits all” solution to addressing any of the hazards that may affect San Francisco

**Most Concerning Hazards.** The vast majority of survey and workshop participants reported being the most concerned about earthquakes and poor/unhealthy air quality

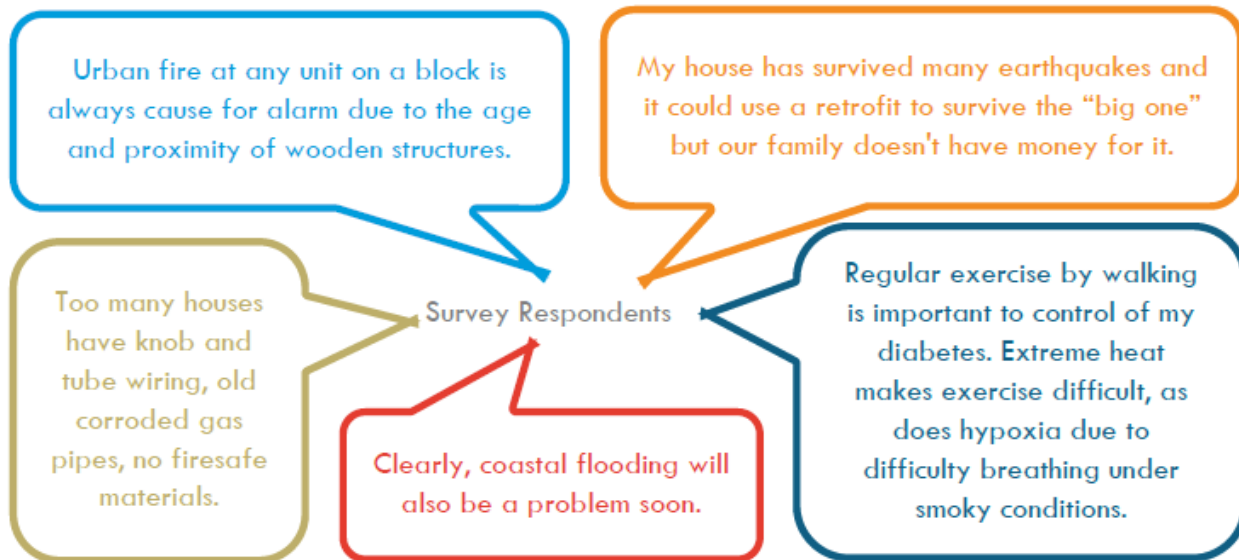
**Support for Improving Resilience of Key City Assets.** Nearly all survey and workshop participants agreed that it is important for the City & County of San Francisco to improve the resilience of infrastructure (e.g., utilities and transportation), buildings (including housing, existing buildings, and new development), and communities (e.g., community connections, neighborhood preparedness)

**Importance of Community Cohesion.** Workshop participants emphasized the importance of strengthening relationships and interactions within individual neighborhoods, at the block-by-block level, within large multi-unit buildings, and through face-to-face social networks. Only half of survey participants said they know their neighbors well enough to help each other in an emergency

**Information about Hazards and Emergency Preparedness.** Most survey participants get information about hazard events from AlertSF and/or social media, while some rely on television, radio, and personal contacts (i.e., friend, family member, neighbor, etc.). Workshop participants also identified specific methods and types of media that will be especially effective at reaching specific populations

**Level of Preparedness.** Most survey respondents believe that they and the people they live with are prepared for extreme heat days, earthquakes, and poor/unhealthy air quality days, while fewer are prepared for flooding. At the same time, more survey respondents felt that their housing in San Francisco would be a safe place to stay during flooding and extreme heat while fewer felt it would be safe place during a poor/unhealthy air quality day or earthquake. Workshop participants requested more concise information about how the organizations, businesses, and facilities in which they work should prepare for emergencies with specific recommendations based on location in the city and the people served














### FIGURE ES 1: SAMPLE SURVEY RESPONSES



# Hazards Analysis

The HCR focuses on 13 natural hazards that impact San Francisco, as listed in Figure ES-1 below and discussed in Chapter 04. The hazards are grouped into four categories; geological, weather, combustion, and biological/toxic.

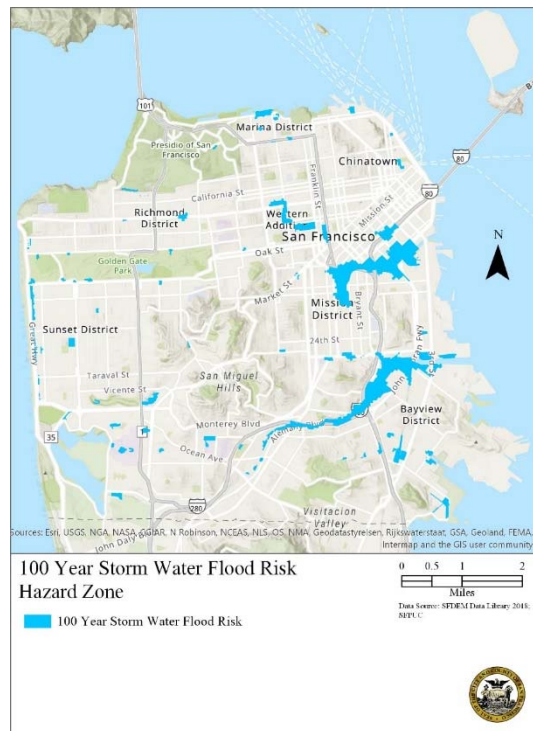
**FIGURE ES-2: HAZARDS ANALYZED IN HCR**

Earthquake	Tsunami	Landslide	Dam or Reservoir Failure	Flooding	High Wind	Extreme Heat	Drought	Large Urban Fire	Wildfire	Poor Air Quality	Pandemic	Hazardous Materials
												
<b>Geological</b>				<b>Weather-related</b>				<b>Combustion-related</b>			<b>Biological / Toxic</b>	

Each hazard profile captures the potential impact from the hazard, such as damage to infrastructure and/or health impacts. It also includes the history of the hazard occurring in San Francisco, the location it is expected to occur, as well as the severity and probability of future events. It also discusses how climate change drives more severe and frequent hazards, such as flooding, wildfires, and extreme heat events.

Figure ES-2 is a sample hazard map from the Flooding profile. It shows the geographic extent of the 100-Year Stormwater Flood Risk.

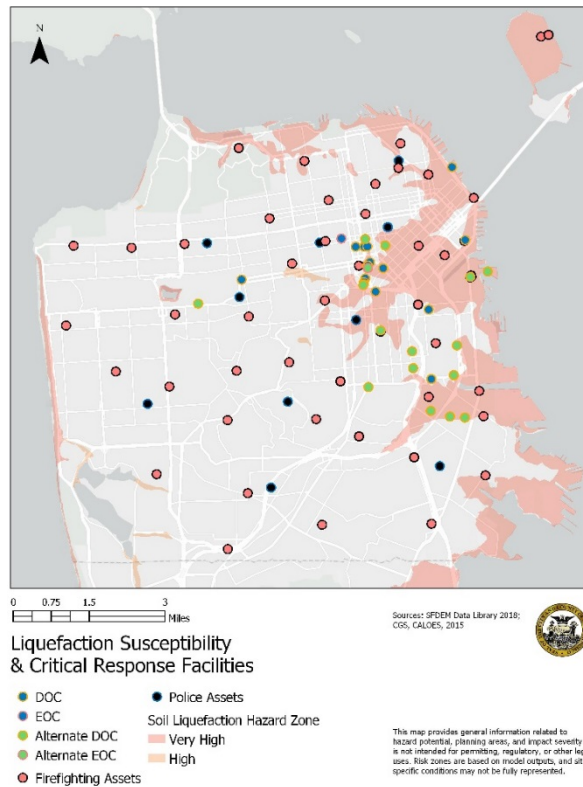
**FIGURE ES-3: SAMPLE HAZARD MAP**



# Vulnerability and Consequences Assessment

The Vulnerability and Consequences Assessment in Chapter 05 and Appendix A includes profiles for 29 asset classes, such as vulnerable populations, building types, and infrastructure. The profiles include an exposure analysis performed using GIS and characterize vulnerability by identifying how an asset class will be affected by a hazard and the ability to adjust. The consequences assessment identifies broader impacts to society and equity, the economy, and the environment. The findings from the Vulnerability and Consequences assessment are summarized into Key Planning Issues that highlight significant or near-term vulnerabilities that require coordination between multiple agencies and/or stakeholders.

FIGURE ES-4: SAMPLE EXPOSURE MAP



**The Waterfront and Adjacent Neighborhoods:** San Francisco’s waterfront communities may be exposed to multiple hazards, including flooding, liquefaction, tsunami and extreme heat. These areas include a mix of densely populated neighborhoods (existing and planned), vulnerable populations, and critical infrastructure, including transit, shoreline protection, and stormwater/wastewater that could have citywide or regional consequences if impacted by a hazard event.

**New Development:** Major development projects are planned in areas that may be exposed to hazards, including coastal flooding and liquefaction. While new construction is built to modern building codes and is therefore more resilient than older buildings, codes do not take into account future climate hazards and seismic codes are designed for life safety rather than recovery. Even if new development projects are more resilient to hazards, surrounding public assets such as transportation, utilities, and parks may remain vulnerable, potentially impacting current and future residents and businesses.



**Existing Buildings:** San Francisco has an aging building stock with nearly half of housing units constructed before 1940 and barriers to improving its resilience. The City is working to address seismically vulnerable buildings through the Earthquake Safety Implementation Program (ESIP). In addition, many older buildings were not designed to be resilient to climate hazards, such as extreme heat, poor air quality, and flooding and the City does not have policies in place to address improvements.

**Housing:** Hazards and climate change will put additional stress on San Franciscans that are already under pressure from the housing crisis (affordability, crowding, and displacement) and the overall high cost of living. This is particularly acute for people who are unsheltered, in unstable housing situations, and renters. Some residents also have limited resources for coping with disruptions in housing, employment, childcare, and transportation, many of which could occur following a hazard event.

**Transportation:** On a daily basis and when recovering from a hazard event, San Franciscans depend on reliable, affordable, and accessible transportation. In addition, the functionality of many City and community assets depends on transportation access. Critical transportation assets are vulnerable to current and future hazards and disruption could have citywide and regional consequences. In addition, the City has ambitious climate goals of achieving 80% sustainable trips (walking, biking, public transit) in a world with more frequent climate hazard events.

**Utilities:** Utilities are critical for daily needs of households and businesses and disruption can have significant consequences for public health and the economy. In addition, utility restoration following a disaster is critical for recovery. The SFPUC has made significant improvements and more are planned/underway through the Sewer System Improvement Program (SSIP), Water System Improvement Program (WSIP), and the Emergency Firefighting Water System (EFWS). Even with major improvements, elements of these utility systems may remain vulnerable to hazards. For some systems, there are limited alternatives and redundancies so reducing damage and disruption is critical.

## Capabilities

Chapter 06 describes the roles that the City and County of San Francisco plays with respect to how it develops and implements measures to increase resilience to hazards. These roles are organized into five categories listed below.

1. Funding and Finance
2. Public Asset Owner
3. Community Services Delivery
4. Research, Planning, and Guidance
5. Adopts & Enforces Regulations.

## Strategy

The most critical element of the HCR is how San Francisco is using its capabilities to respond to the hazards and challenges found in the Vulnerability and Consequences Assessment. Using the goals described below, the HCR proposes over 95 strategies that are either underway or will be moving forward increase its resilience to natural disasters. See Chapter 07 for this of strategies.

## Goals

The goals for the HCR expanded from previous hazard mitigation plans to include a greater emphasis on equity, partnerships, and public engagement. These are in addition to San Francisco's previous commitments to reducing damage and disruption from hazards. The revised goals are listed below.

- **Protect the public health, safety, quality of life, environment, and economic and social capital of San Francisco** by reducing the risk of damage and disruption from hazards
- **Build and support the capacity of City government and the greater San Francisco community**, to prevent, protect against, respond to, mitigate, and recover from hazards

- **Advance local, regional, state, federal, private, and community collaboration and partnerships** to deliver actionable, effective, innovative risk reduction solutions and data to support decisions
- **Proactively seek to address racial, health, and economic inequities of hazard impacts and advance equity** through the just distribution of risk reduction and resilience benefits
- **Increase public awareness of hazards, risks, and city action to build resilience** through education, empowerment, and engagement

## Strategy Snapshots

The HCR strategies came from numerous departments, organizations that serve vulnerable communities, and other stakeholders. The strategies are organized into three areas that comprise a resilient city: infrastructure, buildings, and communities. A sample strategy for each of these areas is listed below. See Chapter 07 for all of the strategies.

### SAMPLE INFRASTRUCTURE STRATEGY

<b>IN-2.01</b>		<b>Develop projects to address flooding around Islais Creek</b>	
<b>KEY PLANNING ISSUES:</b> Waterfront		<b>VULNERABILITY ADDRESSED:</b> Numerous transportation assets in the vicinity of Islais Creek would be subjected to flooding from urban precipitation and sea level rise in the future.	
<b>LEAD:</b> Planning	<b>STRATEGY SUMMARY:</b> In coordination with the Port, SFMTA, and other partners, the Planning Department will create designs for priority projects that address current and future flooding concerns while addressing other neighborhood and citywide goals, as identified through the ISMAS process. These designs will come from extensive public process and benefit an underserved neighborhood, as well as citywide infrastructure and biodiversity by incorporating ecosystem services.		
<b>PARTNERS:</b> Port, SFMTA			
<b>COST:</b> Medium: \$500K to \$5M		<b>SF GOVERNMENT ACTIVITY:</b> Public Assets Owner	<b>STATUS:</b> Sustaining

## SAMPLE BUILDINGS STRATEGY

B-1.01.01 Assess and seismically retrofit municipal buildings		
<b>KEY PLANNING ISSUES:</b> Existing Buildings	<b>VULNERABILITY ADDRESSED:</b> Community members rely on services provided by the City. The consequences of municipal building disruption are more severe for residents who are resource-constrained.	
<b>LEAD:</b> ORCP <b>PARTNERS:</b> BOS, ADM, MYR, Budget Office, Public Works, all impacted	<b>STRATEGY SUMMARY:</b> ORCP uses seismic hazard ratings, HAZUS, and other analytical tools to assess risk and prioritize seismic-strengthening projects within the public facilities portfolio. This strategy allows for effective prioritization that ensures retrofits first work to reduce life safety risk and then to minimize potential interruptions to essential services for San Francisco's most vulnerable populations. Known priority buildings at the time of the HCR's publication include 170 Otis, Kezar Pavilion, the Hall of Justice, the City's homeless shelters, as well as the City's temporary shelters.	
<b>COST:</b> High: \$5M and above	<b>SF GOVERNMENT ACTIVITY:</b> Public Assets Owner	<b>STATUS:</b> New

## SAMPLE COMMUNITIES STRATEGY

C-5.01 Identify and create Clean Air/Cooling Hub (CACH) Public Respite Facilities		
<b>KEY PLANNING ISSUES:</b> Existing Buildings	<b>VULNERABILITY ADDRESSED:</b> Climate change is expected to increase the frequency and severity of extreme heat events. By 2100, the number of extreme heat days is projected to increase by 1.5 orders of magnitude to 90 days per year, up from around six currently.	
<b>LEAD:</b> ORCP <b>PARTNERS:</b> SFPL, DEM, RPD, ADM, Public Works, DPH	<b>STRATEGY SUMMARY:</b> As part of the Mayoral Directive on Air Quality Emergencies, this strategy relates to performing a feasibility assessment and subsequent implementation plan for improvements to publicly- and privately-owned buildings, in order for their operation as public respite facilities during future poor air quality or extreme heat events. Measures identified in the SF Fellows preliminary report will be the main focus of the feasibility assessment and the implementation plan.	
<b>COST:</b> Medium: \$500K to \$5M	<b>SF GOVERNMENT ACTIVITY:</b> Public Assets Owner	<b>STATUS:</b> Sustaining



## Plan Maintenance

Following plan approval, the HCR will shift to an active plan maintenance process involving the Planning Team, as convened by ORCP and DEM. This process will monitor, evaluate, and update the HCR, incorporate the requirements of the HCR Plan into other existing planning mechanisms, and continue to engage communities around implementation of the HCR. Departments responsible for the implementation of the HCR strategy will submit progress reports, identify impediments, and advance solutions through annual HCR reports and the five-year hazard mitigation plan update process.

In addition to serving as a valuable resource to instruct policymakers, commissions, and departments on their own planning and budgeting efforts, the HCR will be integrated into the following planning efforts.

- Climate Action Strategy
- General Plan Updates including the Community Safety Element and other elements of the plan including a new Environmental Justice Element
- Department specific strategic plans and programs
- Capital Planning
- Emergency Management Planning