

Chapter 07

Strategy



The strategy chapter represents San Francisco’s blueprint to reduce vulnerabilities identified in the Vulnerability and Consequences Assessment and increase its resilience to hazards. The approach is more comprehensive than previous Hazard Mitigation Plans, as the number of mitigation strategies has more than doubled, from 40 to over 95. The strategy development process has also been more rigorous, consisting of the following components that are described in detail in the subsequent sections:

- Hazards and Climate Resilience Goals
- Developing strategies, including evaluation
- Strategies for near-term implementation
- Additional strategies for consideration

7.1 Hazards and Climate Resilience Goals

The goals build upon related citywide planning documents, including the 2014 Hazard Mitigation Plan. The goals in the 2019 HCR include a greater emphasis on equity, partnerships, and public engagement in addition to San Francisco's ongoing commitment to reducing damage and disruption from hazards.

- **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 collaborations and partnerships** to deliver actionable, effective, and 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.

7.2 Developing Strategies

The Planning Team in partnership with numerous departments developed the HCR development strategies over the course of several months (see Chapter 02: Planning Process). Planning Team members and their colleagues submitted strategies that reflect existing departmental plans and priorities, as well as forward-looking ways to address the vulnerabilities identified through the Vulnerability and Consequences Assessments (see Appendix A for details). To ensure that strategies build upon the City's existing actions and capabilities for implementation, the Team referenced the Capabilities Assessment from Chapter 06. Additionally, as described in Chapter 02, community-based organizations (CBOs) were consulted during the stakeholder engagement process to gather feedback from organizations that directly serve the public, with an emphasis on vulnerable communities that are more at risk from the

effects of natural hazards. Recommendations and insights from this stakeholder engagement process have been integrated into existing strategies or as added new strategies.

Evaluation Criteria

The draft strategies submitted by the Planning Team were evaluated across six criteria types: environment, society and equity, economic, feasibility, governance, and disaster lifecycle. Table 7.1 describes the criteria. The purpose of the evaluation was to help develop multi-benefit strategies and ensure that all strategies consider the key lenses of equity, sustainability, and governance/implementation. The evaluation process also provided an opportunity to revise, clarify, and improve the strategies.

TABLE 7-1: STRATEGY EVALUATION CRITERIA

TYPE	CRITERIA	GUIDING QUESTIONS
Environment	Greenhouse gas emissions	Does the strategy reduce, eliminate, or sequester GHG emissions?
	Energy use	Does the strategy reduce energy use, such as through energy efficiency or conservation of resources?
	Water use	Does the strategy reduce water use, especially potable water?
	Ecological function	Does the strategy improve air, water, or soil quality, or enhance habitat health and biodiversity?
Society & Equity	Public health	Does the strategy improve health outcomes, such as reduced hospitalizations and chronic illnesses and increased life expectancy?
	Safety	Does the strategy reduce the risk of injury or death?
	Benefits targeted to vulnerable populations	Does the strategy benefit populations that are more sensitive to hazards and climate change or disproportionately impacted? For example, does the strategy reduce existing socio-economic disparities?
	Community cohesion and capacity	Does the strategy enhance connections between neighbors and organizations and their ability to work together to achieve common goals?
	Public awareness of hazards	Does the strategy enhance public awareness of current and future hazards and climate change and City/community resources available?
	Community stabilization	Does the strategy help residents and businesses stay in their neighborhood for the long term?
Economic	Household costs	Does the strategy lower household costs, such as housing, transportation, energy, and childcare?
	Service disruptions	Does the strategy reduce disruption to utilities, transportation, and social services (e.g., schools)?
	Buildings and infrastructure damage	Does the strategy reduce damage to buildings and infrastructure (e.g., either acute damage or longer-term stress to buildings and systems)?

TYPE	CRITERIA	GUIDING QUESTIONS
	Job creation	Does the strategy create good jobs; e.g., jobs at a range of education/skill levels and at a living wage with benefits?
Feasibility	Existing staff/administrative capacity and skills	Does the City have existing staff with the needed capacities, skills, and knowledge to undertake this strategy and/or access to needed technical support?
	Political support	Is there political will and leadership (e.g., elected officials, community-based, executives) for this strategy to succeed?
	Existing funding capacity	Are there existing means/capacity to fund this strategy?
	Legal/existing authority and jurisdiction	Does the legal authority exist to undertake this strategy?
Governance	Diverse representation	Is the planning and implementation of this strategy inclusive of the range of populations and stakeholders that would be affected by it?
	Partnerships & collaboration	Does the implementation of the strategy leverage and enhance partnerships and collaboration?
Disaster Lifecycle	Disaster recovery	Does the strategy support the community's or City's efforts to rebuild better after a disaster and revitalize effected systems, including housing, health, economy, and natural and cultural resources?
	Disaster response	Does the strategy support response during or immediately following a hazard event to save lives and prevent further property damage?
	Disaster preparedness	Does the strategy support individuals, households, or communities in developing plans for what to do or where to go during a hazard event and/or improve their chances of successfully dealing with an emergency?
	Mitigates multiple hazards	Does the strategy prevent or reduce the impacts of multiple hazards?

7.3 Strategies

As mentioned above, the 2019 HCR addresses a wide range of vulnerabilities. The Plan includes over 95 near-term strategies that contribute to a more resilient city. The strategies are organized into three domains:

(IN) Resilient infrastructure covers all transportation and utility systems, public ways, and built infrastructure, such as the seawall, natural areas, open spaces, and the associated biological and ecological resources; often, referred to as “horizontal” development.

(B) Resilient Buildings covers all public and private residential, commercial, and institutional buildings; often referred to as “vertical” development.

(C) Resilient Communities covers all residents, workers, and visitors including the various communities, associations, neighborhoods, and districts that make up San Francisco. A resilient community enhances the probability that people can withstand hazard impacts and thrive after experiencing shocks and stresses.

The strategies are then further organized by primary hazard groups. While many them address more than one hazard, each strategy is assigned to groups based on the predominant hazard the strategy addresses. If a strategy equally addresses all hazards, then the strategy is placed in the all-hazards group. The hazard groups are as follows:

1. Geological

- a. Earthquake
- b. Tsunami
- c. Landslide
- d. Dam or reservoir failure

2. Weather-Related

- a. Flooding
- b. High Wind
- c. Extreme Heat
- d. Drought

3. Combustion-Related

- a. Large Urban Fire
- b. Wildfire
- c. Poor Air Quality

4. Biological & Toxic

- a. Pandemic
- b. Hazardous Materials

5. All-Hazards

Each strategy is assigned a code/number that identifies its domain and primary hazard group. Some strategies are assigned a sub-strategy number, if they are closely associated with other strategies and/or are considered a specific instance or sub-strategy of an overall umbrella strategy.

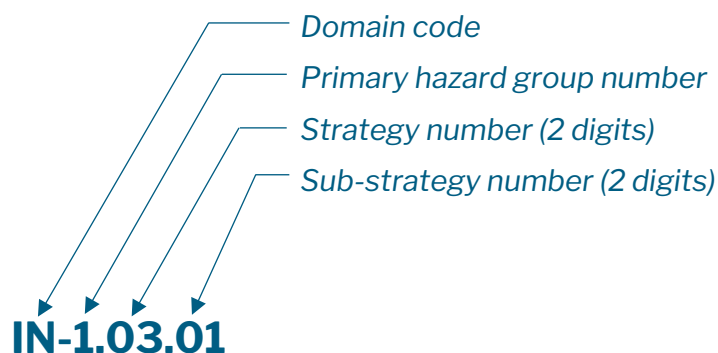


Table 7-2 outlines the comprehensive set of HCR strategies, including the strategy number (domain and hazard), title, and lead department(s). The strategies are clustered by domain and organized within each domain by primary hazard group.

TABLE 7-2: STRATEGIES TABLE OF CONTENTS
IN: RESILIENT INFRASTRUCTURE

1. GEOLOGICAL		LEAD
IN-1.01	Conduct a seismic assessment of critical City assets along the Southern Waterfront	Port
IN-1.02	Conduct a research project for earthquake mitigation of marine structure piles	Port
IN-1.03.01	Develop technologies, systems, and capacity to treat sanitary sewage at SFO	SFO
IN-1.03.02	Develop redundant and resilient electrical power capacity and distribution at SFO	SFO/SFPUC
IN-1.04	Conduct a Risk and Resilience Assessment and Emergency Response Plan for the City's water infrastructure system	SFPUC
IN-1.05	Complete the Lifelines Restoration Performance Project and implement recommendations	ORCP
IN-1.06	Increase the resilience of the Municipal Fiber Optic Network	SFDT
IN-1.07	Increase the resilience of the 911 Radio System	SFDT
IN-1.08	Implement multi-hazard mitigation improvements for harbor dock infrastructure	Port/RPD
IN-1.09	Develop a hazard mitigation and emergency response evacuation plan for SF Zoo	SF Zoo/RPD
IN-1.10	Implement the East Harbor Renovation Project	Port/RPD
IN-1.11	Implement a Security Strategy for SFMTA	SFMTA

IN: RESILIENT INFRASTRUCTURE (CONTINUED)

2. WEATHER-RELATED		LEAD
IN-2.01	Develop projects to address flooding around Islais Creek	Planning
IN-2.02	Develop a process to move utilities from under pier structures	Port
IN-2.03	Continue to implement the Ocean Beach Master Plan	SFPUC
IN-2.04	Adapt shoreline parks to sea level rise and salt water intrusion, using marshes and plant diversity	RPD
IN-2.05	Assess the current stormwater catchment potential of open space managed by the Recreation and Parks Department	RPD
IN-2.06	Expand the StreetTreeSF Climate Resilient Tree Planting Initiative	Public Works
IN-2.07	Complete the Extreme Precipitation Study	SFPUC
IN-2.08	Complete a comprehensive assessment of combined flood risks for San Francisco	SFPUC
IN-2.09	Develop multi-hazard resilience design guidelines for capital planning that addresses climate action goals	Port
IN-2.10	Explore increasing tree canopy and shade structures in parks	RPD
IN-2.11	Assess current plant palettes and tree canopy needs to increase consideration of future climate conditions in the selection options	RPD
IN-2.12	Diversify water supply options year-round by improving the use of new water sources and drought management	SFPUC
IN-2.13	Develop a strategy to conserve and monitor water use by capital projects	Public Works/SFPUC
IN-2.14	Develop a Long-term Vulnerability Assessment and Adaptation Plan for the Hetch Hetchy Regional Water System	SFPUC
IN-2.15	Implement a Coastal Multimodal Resilience Strategy	SFMTA
IN-2.16	Strengthen citywide efforts to conserve, restore, and steward biodiversity	SFE
3. COMBUSTION-RELATED		LEAD
IN-3.01	Complete studies, analysis, and capital projects to improve and expand the Emergency Firefighting Water System (EFWS)	SFPUC
IN-3.02	Improve the capacity of the Portable Water Supply System to fight fires following earthquakes and other large urban fires	SFFD
IN-3.03	Continue to mitigate wildfire hazards in SFPUC-owned watersheds to protect source water quality and minimize risk to SFPUC water and power infrastructure	SFPUC
IN-3.04	Improve Fire Prevention in Recreation Areas	RPD

IN: RESILIENT INFRASTRUCTURE (CONTINUED)

4. ALL HAZARDS		LEAD
IN-5.01	Conduct a system-wide multi hazard vulnerability and operational assessment for Muni	SFMTA
IN-5.02	Reduce seismic and flood risk along three miles of the San Francisco Waterfront from Fisherman's Wharf to Mission Creek	Port
IN-5.03	Continue to advance Sewer System Improvement Program (SSIP) projects to meet level-of-service objectives	SFPUC
IN-5.04	Implement the Pipe Replacement Prioritization Program	SFPUC
IN-5.05	Continue to improve power distribution infrastructure to support new development and increase resilience	SFPUC
IN-5.06	Enhance flood and earthquake resilience of regional dams and ancillary facilities	SFPUC/DSOD
IN-5.07	Develop a Citywide Climate Resilience Framework	ORCP
IN-5.08	Implement SFMTA Communications & IT Strategy	SFMTA
IN-5.09	Implement SFMTA Asset Management & State of Good Repair Strategy	SFMTA
IN-5.10	Implement SFMTA Transit Fixed Guideway Strategy	SFMTA

B: RESILIENT BUILDINGS

1. GEOLOGICAL		LEAD
B-1.01.01	Assess and seismically retrofit municipal buildings	ORCP
B-1.01.02	Seismically improve the Port's Department Operations Control Center, Headquarters, and Joint Operations Control facilities	Port
B-1.02	Develop an earthquake risk improvement program for non-structural components of municipal buildings	ORCP
B-1.03	Develop a voluntary program for seismic retrofits of one- to four-unit wood frame, soft-story buildings	ORCP/DBI
B-1.04	Implement the Tall Building Strategy to address the seismic vulnerability of buildings taller than 250 feet	ORCP/DBI
B-1.05	Extend and improve the Building Occupancy Resumption Program (BORP)	DBI
B-1.06	Complete the Mandatory Soft-Story Retrofit program (pre-1978 buildings with 5+ units and 2+ stories)	DBI
B-1.07.01	Develop a program (standards and guidance) to screen, evaluate, and retrofit older steel buildings	ORCP/DBI
B-1.07.02	Develop a program to screen, evaluate, and retrofit non-ductile concrete buildings	ORCP/DBI
B-1.08	Implement the SFMTA Parking Strategy	SFMTA
2. WEATHER-RELATED		LEAD
B-2.01	Develop multi-hazard resilience design guidelines for municipal buildings	ORCP
B-2.02	Review the Guidance for incorporating sea level rise into capital planning	ORCP
B-2.03	Develop a program to analyze, identify, and evaluate properties at risk of stormwater flooding	SFPUC
B-2.04	Implement floodproofing and elevation projects for properties at risk of stormwater flooding citywide	SFPUC
3. COMBUSTION-RELATED		LEAD
B-3.01	Study emergency clean air and cooling capacity at key community facilities	DPH
B-3.02	Increase privately-owned building weatherization rates	SFE
B-3.03	Support increased building electrification (fuel switching) and mechanical upgrades	SFE

B: RESILIENT BUILDINGS (CONTINUED)

5. ALL HAZARDS		LEAD
B-5.01	Amend the capital improvement program for transportation facilities to consider hazard mitigation opportunities	SFMTA
B-5.02	Install solar + storage systems at critical facilities	Public Works
B-5.03	Secure a resilient public safety training facility for SFFD	SFFD
B-5.04	Increase resilience and operation efficiency of maintenance yards	Public Works
B-5.05	Explore options to use Recreation Centers as public respite facilities	RPD
B-5.06	Develop comprehensive and coordinated code amendments for multi-hazard resilience of private development	Planning

C: RESILIENT COMMUNITIES

1. GEOLOGICAL		LEAD
C-1.01	Address seismic retrofit needs within San Francisco's affordable housing stock	MOHCD
C-1.02	Develop a Downtown Recovery Strategy	ORCP
C-1.03	Improve San Francisco's Implementation of the State's Safety Assessment Program	ORCP/DBI
C-1.04	Develop a post-hazard Open for Business campaign	OEWD
C-1.05	Continue to meet housing production goals	MOHCD
C-1.06	Develop a public outreach campaign and wayfinding plan for tsunami awareness and evacuation procedures	DEM
C-1.07	Assess vertical evacuation options in high-hazard areas and guidance for large-building refugees	DBI/DEM
4. BIOLOGICAL & TOXIC		LEAD
C-4.01	Expand household hazardous waste collection efforts	SFE
C-4.02	Replace mercury-containing lighting in preschools and daycare centers	SFE
C-4.03	Explore toxins abatement workforce development programs	OEWD

C: RESILIENT COMMUNITIES (CONTINUED)


5. ALL HAZARDS		LEAD
C-5.01	Identify and create Clean Air/Cooling Hub (CACH) Public Respite Facilities	ORCP
C-5.02	Develop a Homelessness Disaster Response Plan	HSH
C-5.03	Support volunteer emergency preparedness, response, and recovery programs, including the Neighborhood Emergency Response Team (NERT) and Auxiliary Law Enforcement Response Team (ALERT)	SFFD/SFPD
C-5.04	Create a program to coordinate existing City programs providing in-home and resident-facing services related to hazard and climate mitigation	DEM/DPH
C-5.05	Develop a Preparedness Equipment Purchase Program to direct and fund the purchase of climate preparedness equipment	DEM/DPH
C-5.06	Expand the Neighborhood Empowerment Network (NEN) Empowered Communities Program (ECP) to additional neighborhoods	NEN
C-5.07	Perform gap analysis of vulnerable populations (i.e., Access and Functional Needs) and available City services	MOD
C-5.08	Develop a community-based capacity building initiative	MOD
C-5.09	Establish an Evacuation Strategy for people with access and functional needs	DAAS/MOD
C-5.10	Continue Small Business COOP Assistance	OEWD
C-5.11	Support the Small Business Development Center	OEWD
C-5.12	Establish disaster relief funding and small business resilience fund	OEWD
C-5.13	Expand layoff outplacement services	OEWD
C-5.14	Expand Women's Entrepreneurship Fund	OEWD
C-5.15	Study the overlap between vulnerable populations and vulnerable buildings	Planning/ DPH/ORCP
C-5.16	Develop and manage a system for hazard and climate resilience data	ORCP/SFDT
C-5.17	Develop a communications strategy for citywide climate resilience efforts	ORCP
C-5.18	Improve San Francisco's climate health research capacity	DPH
C-5.19	Develop and implement a Centralized Air Quality and Extreme Heat Preparedness campaign	DPH
C-5.20	Implement SFMTA's Traffic Signals Strategy	SFMTA
C-5.21	Improve and prepare behavioral health services for hazard events	DPH
C-5.22	Continue to build trust between the Police Department and the communities they serve	SFPD

7.4 Strategy Descriptions

The strategy descriptions in the following section identify the vulnerabilities the strategy addresses, lead agency and potential partners, SF government activity, estimated costs, and key planning issue(s) associated with the strategy. The strategies in this section are near-term strategies that the City aims to make progress on in the next five years.

Strategy Key

The example table and associated text below describe the different components and level of detail that can be found in each strategy description.

CODE #		Strategy Name	
KEY PLANNING ISSUES: <i>Connection to one of six key planning issues from Chapter 05</i>		VULNERABILITY ADDRESSED: <i>Describes the issue from the vulnerability and consequences assessment that the strategy seeks to address</i>	
LEAD: <i>Agency in charge of implementing</i> PARTNERS: <i>Agencies or other groups as potential partners</i>		STRATEGY SUMMARY: <i>Short description of the strategy</i>	
COST: <i>Low / Med / High (described below)</i>		SF GOVERNMENT ACTIVITY: <i>Public Assets Owner (described below)</i>	STATUS: <i>New / Scaling / Sustaining (described below)</i>
Applicable hazards: 			

Cost

The costs indicated for the strategies represent the rough order-of-magnitude resources that may be required to implement the strategy. For ongoing strategies, the cost of implementation may be fully or partially funded. For new or proposed strategies,

funds may not be committed and are subject to approval through the City’s capital planning and budgeting process.

Strategy costs are indicated at one of the following three levels:

- Low: \$0–\$500K
- Medium: \$500K to \$5M
- High: \$5M and above

SF Government Activity

Each strategy is associated with a type of government activity that refers to how it is put into action in relation to San Francisco’s capabilities to influence resilience. See Chapter 06 for a description of these activities. The activities included the following:

- Funding and Financing
- Public Assets Ownership
- Community Services Delivery
- Research, Planning & Guidance
- Adoption & Enforcement of Regulations

Strategies that encompass more than one government activity are assigned to the activity that most directly engages or impacts stakeholders. For example, a new regulation that might require research before implementation, is assigned to “Adopt & Enforce Regulations” because of the impact that a regulation has on the applicable population.

Strategies that involve the planning, design, construction, and/or operation of public facilities are assigned to the “Public Assets Owner” activity, even though, to a great extent, the ownership of a facility could be considered a subset of the activity “Community Services Delivery”.

Status

This section of the strategy description indicates whether the strategy is a completely new initiative (new), an activity that the City will be scaling up or expanding (scaling), or an existing activity that the City is sustaining (sustaining).

Applicable Hazards (Icons)














Table 7-3 shows the legend for the 13 hazard icons shown at the bottom of each strategy. Hazards that are applicable to the specific strategy are shown in color whereas non-applicable hazards are faded out. The color coding matches the primary hazard groups. The “All Hazards” group is indicated by displaying icons in color for all thirteen hazards and by the green color bar around the strategy code.


TABLE 7-3: HAZARD ICON LEGEND

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

DOMAIN: RESILIENT INFRASTRUCTURE (IN)













Primary Hazard Group: Geological














IN-1.01		Conduct a seismic assessment of critical City assets along the Southern Waterfront	
KEY PLANNING ISSUES: Waterfront		VULNERABILITY ADDRESSED: A number of critical Port, industrial, shoreline protection, and emergency response facilities and services may be damaged and disrupted in a seismic event, including the freight rail, Piers 80–96, and Pier 50.	
LEAD: Port	STRATEGY SUMMARY: The Port of San Francisco has many facilities in the area south of Mission Bay, providing critical services to the community, City, and Port. The Port has conducted a broad assessment of seismic risks in the area from Fisherman’s Wharf to Mission Bay and is currently refining that assessment under the Seawall Earthquake Safety Program. However, there is a need for assessment of the area from Mission Bay to Heron’s Head Park.		
PARTNERS: Planning, SFMTA, SFPUC, OCRP			
COST: Low: \$0–500K		SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
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IN-1.02		Conduct a research project for earthquake mitigation of marine structure piles	
KEY PLANNING ISSUES: Waterfront		VULNERABILITY ADDRESSED: Most of the Port assets and services sit on piers over the Bay. These assets and services: historic districts, areas of significant assembly, critical emergency response, and local and regional transportation infrastructure are vulnerable to earthquake damage.	
LEAD: Port PARTNERS: UC System, other west coast cities/ports, FEMA		STRATEGY SUMMARY: Many ports and military installations located along the U.S. west coast have been identified as national critical infrastructure by DHS FEMA. These nationally significant ports are vulnerable to impacts from seismic events. Mitigation measures for restoration of piles after an earthquake requires increased understanding of this infrastructure. This strategy would establish a research program to explore the weaknesses and best practice repair methods for this infrastructure.	
COST: High: \$5M and above		SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
			

DOMAIN: RESILIENT INFRASTRUCTURE (IN)














Primary Hazard Group: Geological














IN-1.03.01 Develop technologies, systems, and capacity to treat sanitary sewage at SFO		
KEY PLANNING ISSUES: Utilities, Waterfront		VULNERABILITY ADDRESSED: Sanitary sewer conveyance has reached its 40-year useful life and will hit threshold capacity. There is no redundant system in the event of a failure.
LEAD: SFO PARTNERS:	STRATEGY SUMMARY: San Francisco International Airport's (SFO) long-term plan is to have the technologies, systems, and capacity to treat sanitary sewage for the SFO's growth through 2040, and to comply with current and upcoming State of California sewage treatment requirements.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
            		

IN-1.03.02 Develop redundant and resilient electrical power capacity and distribution at SFO		
KEY PLANNING ISSUES: Utilities		VULNERABILITY ADDRESSED: Sanitary sewer conveyance has reached its 40-year useful life and will hit threshold capacity.
LEAD: SFO, SFPUC PARTNERS:	STRATEGY SUMMARY: The long-term plan for SFO is to have fully redundant 12 kilovolt electrical power feeds from two separate sources with the capacity to provide power to SFO through 2040. The two substations feeding SFO will have redundant transformer capacity and cabling into SFO. Planning will occur in 2019–2020 and design/construction in phases from 2021–2025. This strategy is part of the SFO's FY19/20 Infrastructure Capital Improvement Program.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
            		

DOMAIN: RESILIENT INFRASTRUCTURE (IN)














Primary Hazard Group: Geological














IN-1.04 Conduct a Risk and Resilience Assessment and Emergency Response Plan for the City's water infrastructure system		
KEY PLANNING ISSUES: Utilities		VULNERABILITY ADDRESSED: SFPUC Water Enterprise critical assets and infrastructure, regionally and in-city, might face risks and gaps in the system and processes, from natural and malevolent hazards.
LEAD: SFPUC PARTNERS:	STRATEGY SUMMARY: SFPUC will comply with EPA's America's Water Infrastructure Act by conducting an all-hazards Risk and Resiliency Assessment (RRA) and exploring risks and gaps in the systems and processes, from natural and malevolent hazards. SFPUC will analyze resilience of pipes, physical barriers, source water, raw water collection and intake; pretreatment, treatment, storage and distribution facilities; and electronic, computer, and other automated systems. SFPUC will evaluate monitoring practices, financial infrastructure, storage and handling of chemicals, and operation and maintenance of the system. Emergency Response Plans will be updated based on recommendations from the RRA.	
COST: Medium: \$500K to \$5M	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
            		

IN-1.05 Complete the Lifelines Restoration Performance Project and implement recommendations		
KEY PLANNING ISSUES: Utilities		VULNERABILITY ADDRESSED: Depending on severity and building type, damages can lead from short-to long-term closure. The shutdown of financial institutions and other global companies might have economic impacts that are felt worldwide.
LEAD: ORCP PARTNERS: DEM, SFPUC, Public Works, private utilities	STRATEGY SUMMARY: Following a disaster, the timely restoration and recovery of hospitals, homes, businesses, non-profit organizations and government of San Francisco depend on lifeline systems such as transportation, communication, water and wastewater, electricity, natural gas, and fuel. The Lifelines Restoration Performance Project will develop a simple infrastructure resilience assessment framework to establish performance goals—that is, desired targets for system recovery timelines following a scenario earthquake event, evaluate the current state of performance for specific systems in that earthquake, and recommendation actions to achieve desired restoration times.	
COST: Low: \$0–500K	SF GOVERNMENT ACTIVITY: Research, Planning, & Guidance	STATUS: Sustaining
            		

DOMAIN: RESILIENT INFRASTRUCTURE (IN)














Primary Hazard Group: Geological














IN-1.06 Increase the resilience of the Municipal Fiber Optic Network			
KEY PLANNING ISSUES: Utilities		VULNERABILITY ADDRESSED: Damage and disruption to San Francisco's commercial buildings can disrupt residents' work and workplace social networks, and can prompt widespread short-term unemployment	
LEAD: SFDT PARTNERS: SFMTA, SFPUC, SFFD, Joint Pole Assoc., PG&E		STRATEGY SUMMARY: The City has a fiber network connecting almost all critical facilities and systems. A breakdown of this system due to a hazard event could result in a breakdown of communication between City departments, buildings, and the public for several days; severely affecting disaster response. Presently, there are no staff authorized to maintain or repair the fiber network. Authorizing two fiber crews consisting of ten employees to install redundant fiber paths and a well-designed backup microwave link will ensure enhanced reliability and resilience for fiber infrastructure in case of a major disaster.	
COST: High: \$5M and above		SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
            			

IN-1.07 Increase the resilience of the 911 Radio System			
KEY PLANNING ISSUES: Utilities		VULNERABILITY ADDRESSED: 911 Radio System is the primary means of communication for law enforcement agencies and for field staff of City departments. The Radio System has several critical components that are vulnerable to major disasters that will severely impact 911 dispatch and response.	
LEAD: SFDT PARTNERS: SFMTA, SFPUC, SFFD, Joint Pole Assoc., PG&E		STRATEGY SUMMARY: The 911 Radio System consists of ten widely distributed, interconnected, fixed radio sites that are vulnerable to hazards. A power failure will shut the system down if the emergency generators are not promptly refueled. Acquiring additional fuel trucks will increase the fuel capacity of the system. Adding fixed and mobile radio sites will also ensure enhanced reliability and resiliency of the system in case of disaster.	
COST: High: \$5M and above		SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
            			

DOMAIN: RESILIENT INFRASTRUCTURE (IN)















Primary Hazard Group: Geological

IN-1.08		Implement multi-hazard mitigation improvements for harbor dock infrastructure	
KEY PLANNING ISSUES: Waterfront		VULNERABILITY ADDRESSED: San Francisco’s “worst-case” tsunami scenario, ranging from 22 feet above mean sea level at Ocean Beach to 6 feet at Candlestick Point, will severely impact people and infrastructure located in low-lying coastal areas.	
LEAD: Port, RPD PARTNERS: DEM, TIDA, California Tsunami Program		STRATEGY SUMMARY: The California Tsunami Program has developed harbor-specific analyses and improvement reports that identify where improvements might be needed. These measures would reduce vessels from becoming dislodged during high wave/current events and reduce docks being jammed, damaged, and free floating during high wave/current events. Installation of dock pile reinforcement and extenders will reduce floating docks from becoming loose during high/rising water events (including tsunamis, King tides, and long-term sea level rise). Increased strengthening of wharf/pier connectors will reduce the failure of these structures during high-water events.	
COST: Medium: \$500K to \$5M		SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
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IN-1.09		Develop a hazard mitigation and emergency response evacuation plan for SF Zoo	
KEY PLANNING ISSUES: Waterfront, Existing Buildings		VULNERABILITY ADDRESSED: Tsunami mapping indicates that flooding might impact large portions of the San Francisco Zoo. Such flooding could cause loss of life of people and animals, and damage to Zoo facilities.	
LEAD: SF Zoo, RPD PARTNERS: DEM, SFE, CA Tsunami Program	STRATEGY SUMMARY: The combined factors of coastal flooding from sea level rise, King tides, and tsunamis could put the San Francisco Zoo at risk of flooding. Hazards could be compounded by having to evacuate patrons, animals, and Zoo personnel with only hours to complete the process. The City should develop a plan for response and evacuation of visitors and animals alike. Planning and hard counter-measures could greatly reduce the exposure to flooding and potential complications of tsunami events.		
COST: Medium: \$500K to \$5M		SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
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DOMAIN: RESILIENT INFRASTRUCTURE (IN)














Primary Hazard Group: Geological














IN-1.10		Implement the East Harbor Renovation Project	
KEY PLANNING ISSUES: Waterfront		VULNERABILITY ADDRESSED: Tsunami scenarios, ranging from 22 feet above mean sea level at Ocean Beach to 6 feet at Candlestick Point, might severely impact maritime facilities at the Port, the East Marina Small Craft Harbor (a.k.a. Gas House Cove) and West Marina San Francisco Yacht Harbor, Pier 1 on Treasure Island, and South Beach Harbor Marina.	
LEAD: Port, RPD PARTNERS: SFPUC, DEM, TIDA, CA Tsunami Program	STRATEGY SUMMARY: Reinforce harbor and marina fuel and sewage docks with pump-out stations, where they exist, in San Francisco maritime areas. Add protective measures—such as automatic fuel or sewage shutoff valves, hardened but flexible fuel/sewage transmission pipes, and floating debris protection devices—to reduce the potential for damage and dispersal of hazardous substances.		
COST: High: \$5M and above		SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
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IN-1.11		Implement San Francisco Metropolitan Transportation Agency (SFMTA) Security Strategy	
KEY PLANNING ISSUES: Transportation		VULNERABILITY ADDRESSED: Transit stations rely on electric power, communications systems, and the sewer system to operate. There are typically no redundancies in regards to these external services.	
LEAD: SFMTA PARTNERS:		STRATEGY SUMMARY: This strategy maintains the crucial security and emergency management systems that make the City’s transportation system safe, reliable, and more resilient in the face of natural disasters. The San Francisco Metropolitan Transportation Agency (SFMTA) seeks to ensure the safety and security of its passengers and operational facilities through on-going monitoring and surveillance, implementation of security projects, and coordination with the City’s Department of Emergency Management. This strategy will implement short-term projects that improve security and reduce risks from natural disasters and other emergency situations. Funding for this strategy is included in the FY2019–FY2023 Capital Improvement Program.	
COST: Medium: \$500K to \$5M		SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
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DOMAIN: RESILIENT INFRASTRUCTURE (IN)














Primary Hazard Group: Weather-Related














IN-2.01 Develop projects to address flooding around Islais Creek		
KEY PLANNING ISSUES: Waterfront		VULNERABILITY ADDRESSED: Numerous transportation assets in the vicinity of Islais Creek would be subjected to flooding from urban precipitation and sea level rise in the future.
LEAD: Planning PARTNERS: Port, SFMTA	STRATEGY SUMMARY: 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.	
COST: Medium: \$500K to \$5M	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
            		

IN-2.02 Develop a process to move utilities from under pier structures		
KEY PLANNING ISSUES: Waterfront		VULNERABILITY ADDRESSED: The Port has a number of piers with under-pier utilities that are at risk from storm events and sea level rise. As water levels rise, the window for maintenance and replacement work decreases, while damage to and disruption of the utilities increases.
LEAD: Port PARTNERS:	STRATEGY SUMMARY: Many ports and military installations located along the U.S. west coast have been identified as nationally critical infrastructure by FEMA. These nationally important ports are vulnerable to impacts from seismic events. Mitigation measures for restoration of piles after an earthquake requires increased understanding of this infrastructure. This strategy would establish a research program to explore the weaknesses and best practice repair methods for this infrastructure.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
            		

DOMAIN: RESILIENT INFRASTRUCTURE (IN)














Primary Hazard Group: Weather-Related














IN-2.03 Continue to implement the Ocean Beach Master Plan		
KEY PLANNING ISSUES: Waterfront		VULNERABILITY ADDRESSED: Climate-induced sea level rise and severe erosion are threatening the southern portion of Ocean Beach, with implications for recreation amenities and major infrastructure that reduces risk to water quality and the environmental and public health for the City and County of San Francisco
LEAD: SFPUC PARTNERS: Public Works, SFMTA, RPD, GGNRA, SF Zoo	STRATEGY SUMMARY: The SFPUC will serve as the lead agency for the Ocean Beach Climate Change Adaptation Project addressing sea level rise, erosion, and shoreline protection at the southern end of Ocean Beach. Each partner agency will be responsible for funding the components of the project that fall within their jurisdiction. The main strategies include managed retreat, asset protection through grey infrastructure, and natural adaptation measures that improve public access and habitat quality. The project is divided into short-and long-term improvements. The short-term improvements are meant to improve interim conditions while the long-term project is under development.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
            		

IN-2.04 Adapt shoreline parks to sea level rise and salt water intrusion, using marshes and plant diversity		
KEY PLANNING ISSUES: Waterfront		VULNERABILITY ADDRESSED: Coastal flooding due to sea level rise could eventually drown shoreline habitats resulting in the loss of critical ecosystem services and biodiversity. Flooding can negatively impact planted areas and trees and saltwater flooding is especially damaging to planted areas.
LEAD: RPD PARTNERS: Port, USACE	STRATEGY SUMMARY: Develop a framework for making vegetation throughout the park system, including shoreline parks with marshes, better able to cope with future climate and sea level rise conditions, including repetitive salt water exposure. Some elements are already in place as the Recreation and Parks Department (RPD) plants wind- and salt-tolerant plants near the coast; however, this approach needs to be formalized. Additionally, co-benefits to biodiversity should be considered.	
COST: TBD	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
            		

DOMAIN: RESILIENT INFRASTRUCTURE (IN)














Primary Hazard Group: Weather-Related














IN-2.05 Assess the current stormwater catchment potential of open space managed by the Recreation and Parks Department		
KEY PLANNING ISSUES: Utilities		VULNERABILITY ADDRESSED: Planted areas and sports fields are sensitive to flooding and extremely sensitive to saltwater flooding. Damage due to flooding will increase operations and maintenance costs.
LEAD: RPD PARTNERS: SFPUC	STRATEGY SUMMARY: Open space, especially in vegetated park land, offers existing stormwater catchment for the city. This strategy will measure and catalogue how much water is absorbed at RPD sites, consequently contributing to a better understanding of the value of park spaces in stormwater runoff mitigation. Additionally, it will formalize the installation of new permeable hardscapes where stormwater could be reduced. Washington Square Park, Alamo Square, Alta Plaza, and Jefferson Square are all examples where this approach has been pursued, benefiting water conservation. Models of hardscape projects that have been converted to water infiltration projects include the Crocker Amazon Soccer parking lot and Golden Gate Park Dog Training Facility.	
COST: TBD	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
            		

IN-2.06 Expand the StreetTreeSF Climate Resilient Tree Planting Initiative		
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: Extreme heat can damage vegetation over extended periods, impacting the function of ecosystems and, thereby, reducing the efficacy of the ecosystem services they provide.
LEAD: Public Works PARTNERS: OEWD, City agencies with streetscape projects, Non-Profit	STRATEGY SUMMARY: SFPW's Bureau of Urban Forestry (BUF) maintains the City's 125,000 street trees. The StreetTreeSF Climate Resilient Tree Planting Initiative will reduce neighborhood vulnerability to climate threats while meeting the San Francisco Urban Forest Plan's goal of growing the street tree population by half. Tree planting will prioritize neighborhoods with low tree canopy rates, those most vulnerable to extreme heat, and public health/air quality disparities. Species will be selected with a climate adaptation and mitigation focus to promote carbon sequestration, pest and disease resilience, drought tolerance, urban heat island reduction, and stormwater filtration.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Scaling
            		

DOMAIN: RESILIENT INFRASTRUCTURE (IN)


Primary Hazard Group: Weather-Related


IN-2.07 Complete the Extreme Precipitation Study			
KEY PLANNING ISSUES: Utilities		VULNERABILITY ADDRESSED: Modeling the effects of climate change on intensifying mid-latitude cyclone and atmospheric storm events is essential to understanding future impacts to critical infrastructure in the San Francisco Bay Area.	
LEAD: SFPUC PARTNERS: Port, SFO, ORR		STRATEGY SUMMARY: One of Lawrence Berkeley National Laboratory's (LBNL's) missions is to perform innovative research that enhances understanding of a broad range of scientific disciplines, including climate change related modeling. To advance their modeling expertise, LBNL is collaborating with San Francisco via the SFPUC to help advance their high-resolution models. The improved models will help answer the question of how much more intense future precipitation events will be in a warmer world.	
COST: Medium: \$500K to \$5M		SF GOVERNMENT ACTIVITY: Research, Planning & Guidance	STATUS: Sustaining
            			

IN-2.08 Complete a comprehensive assessment of combined flood risks for San Francisco			
KEY PLANNING ISSUES: New Development		VULNERABILITY ADDRESSED: Understanding and planning for combined flood risk from coastal flooding (including sea level rise), extreme precipitation, stormwater, and groundwater is important for San Francisco. There is no current effort to assess combined flood risk.	
LEAD: SFPUC PARTNERS: ORCP, Public Works, SF Planning (Pending scope)		STRATEGY SUMMARY: Flood risk in San Francisco takes several forms, including coastal flooding from extreme tides/storms and sea level rise, extreme precipitation, stormwater, and groundwater. A combined flood risk analysis and assessment could result in a more comprehensive understanding of current and future flood risks and consequences, and the best strategies to reduce risk. It would be beneficial to conduct combined flood risk analysis within the next three years, in advance of strategies being developed in coastal flood risk projects. There is no current effort to assess combined flood risk. Stakeholders engaged in HCR strategy review stated the importance of including groundwater in this analysis process as well.	
COST: Medium: \$500K to \$5M		SF GOVERNMENT ACTIVITY: Research, Planning & Guidance	STATUS: Sustaining
            			

DOMAIN: RESILIENT INFRASTRUCTURE (IN)


Primary Hazard Group: Weather-Related


IN-2.09 Participate in US Army Corps of Engineers (USACE)/Port Flood Study			
KEY PLANNING ISSUES: Waterfront		VULNERABILITY ADDRESSED: San Francisco's waterfront and shoreline currently floods in several locations of the southern waterfront and areas around the Ferry Building, which impacts numerous community services.	
LEAD: Port PARTNERS: City Depts, regional agencies, businesses and Non-Profits		STRATEGY SUMMARY: The US Army Corps of Engineers (USACE)/Port of San Francisco Flood Study will identify the flood risks to the San Francisco waterfront from Aquatic Park to Heron's Head Park and determine the federal economic interest at risk from flooding in the study area. The three- to five-year study funds the assessment of the flood risk and the identification of alternatives that become eligible for federal funding. The goals of the Flood Study include understanding the flood risk and identifying flood risk reduction alternatives; identifying community, stakeholder, and resource agency priorities and issues; developing alternatives to meaningfully reduce flood risk up to 2080, considering flood risk to 2130; identifying critical assets and services in the federal Interest; and identifying local priorities.	
COST: High: \$5M and above		SF GOVERNMENT ACTIVITY: Research, Planning & Guidance	STATUS: Sustaining
			

IN-2.10 Explore increasing tree canopy and shade structures in parks			
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: Many open-air park amenities might be subjected to exposure to uncomfortable temperatures during extreme heat events. This situation can lead to reduced use of parks during extreme heat events.	
LEAD: RPD PARTNERS: Friends of Urban Forest, Capital Planning		STRATEGY SUMMARY: Many park open spaces do not offer areas of respite from extreme heat events that are increasingly more frequent due to climate change. RPD will develop procedures during the planning phase of capital projects to examine, analyze, and incorporate shading elements (where applicable) to ensure some shade is available for park uses if desired. Examples could include built shade structures or trees of a certain size, growth, and placement that provides shade over time in specific locations (e.g. children's play areas, plazas, DPAs, etc.)	
COST: TBD		SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
			

DOMAIN: RESILIENT INFRASTRUCTURE (IN)














Primary Hazard Group: Weather-Related














IN-2.11 Assess current plant palettes to consider future climate conditions in plant selection		
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: Maintaining park tree canopies will be increasingly difficult as the climate changes and weather becomes more extreme.
LEAD: RPD PARTNERS: Public Works Bureau of Urban Forestry	STRATEGY SUMMARY: This strategy focuses on maintaining existing tree canopy within recreation areas and ensuring that all vegetation selection in parks is informed by the changing climate. In order for RPD to sustain its current canopy, it will need to examine what planting palettes work for the next 100 years of a changing climate condition. There are currently replanting programs that exist, but they must explicitly consider future climate conditions and prioritize maintaining a robust tree canopy.	
COST: TBD	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
		

IN-2.12 Diversify water supply options year-round by improving the use of new water sources and drought management		
KEY PLANNING ISSUES: Utilities		VULNERABILITY ADDRESSED: The majority of San Francisco's water is brought to the city from the Hetch Hetchy watershed located in the Sierra Nevada Mountains through a complex series of reservoirs, tunnels, pipelines, and treatment systems. A significant body of climate research indicates that extended periods of drought followed by increased precipitation are more likely to occur in the future.
LEAD: SFPUC PARTNERS: DPH, DBI, specific stakeholders served by alternative water supplies	STRATEGY SUMMARY: The SFPUC's Water Supply Improvement Program (WSIP) is a \$4.8 billion, multi-year, capital program to upgrade the Regional Water System (RWS). The SFPUC undertook the WSIP to ensure the ability of the RWS to meet Level of Service (LOS) goals for water quality, seismic reliability, delivery reliability, and water supply. The Water Supply LOS goal stated in WSIP is to meet customer water needs in non-drought and drought periods.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
		

DOMAIN: RESILIENT INFRASTRUCTURE (IN)














Primary Hazard Group: Weather-Related














IN-2.13 Develop a strategy to conserve and monitor water use by capital projects		
KEY PLANNING ISSUES: Utilities		VULNERABILITY ADDRESSED: Drought can impact Public Works' core services. Without ensuring activities that support core services of Public Works do not contribute to the increasing scarcity of water resources, the Department contributes to this risk.
LEAD: Public Works, SFPUC PARTNERS: IDC/BDC clients, City agency building operators	STRATEGY SUMMARY: The Public Works Water Conservation Strategy aims to promote water conservation among Public Works' capital projects and ongoing operations and maintenance. This strategy includes monitoring and auditing of existing water usage in landscape maintenance, street cleaning operations, and building operations. Water conservation techniques are incorporated into landscape, building, and infrastructure design; promoting climate appropriate and native plant selection that promotes biodiversity; high-efficient irrigation infrastructure; low-water fixtures in building design; and expanding existing infrastructure for grey water or recycled water systems.	
COST: Medium: \$500K to \$5M	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
            		

IN-2.14 Develop a Long-term Vulnerability Assessment and Adaptation Plan for the Hetch Hetchy Regional Water System		
KEY PLANNING ISSUES: Utilities		VULNERABILITY ADDRESSED: The water supply of the Hetch Hetchy Regional Water System (RWS) is vulnerable to drought, climate change, water demand, new regulations, and infrastructure failure.
LEAD: SFPUC PARTNERS: Bay Area Water Supply & Conservation Agency (BAWSCA)	STRATEGY SUMMARY: The SFPUC Water Enterprise is conducting a long-term vulnerability assessment to its Levels of Service (LOS) for the Hetch Hetchy Regional Water System (RWS). To address the challenge of planning for uncertain factors and risks, a vulnerability-based planning approach will explore a range of future conditions to identify vulnerabilities, assess the risks associated with these vulnerabilities, and later develop an adaptation plan that is flexible and robust to a wide range of future outcomes. The plan will guide water supply decisions of the RWS over the next 50 years or longer.	
COST: Medium: \$500K to \$5M	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
            		

DOMAIN: RESILIENT INFRASTRUCTURE (IN)

Primary Hazard Group: Weather-Related














IN-2.15 Implement a Coastal Multimodal Resilience Strategy		
KEY PLANNING ISSUES: Transportation	VULNERABILITY ADDRESSED: This strategy seeks to increase the resilience of critical response facilities, municipal facilities, municipal yards, roadways, parking, and the public transit network.	
LEAD: SFMTA PARTNERS: Port, Planning, ORCP, Public Works	STRATEGY SUMMARY: This strategy is a capital facility improvement program area that assesses, studies, plans, and implements improvements to the multimodal transportation system that are vulnerable to flooding. This strategy includes technical studies and vulnerability and risks assessments that reduces flood risk to the multimodal transportation system. Examples of this work include implementing the Ocean Beach Master Plan and coastal planning efforts such as the Flood Study and Islais Creek Adaptation Study.	
COST: Medium: \$500K to \$5M	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
            		

IN-2.16 Strengthen citywide efforts to conserve, restore, and steward biodiversity		
KEY PLANNING ISSUES: N/A	VULNERABILITY ADDRESSED: As a result of historic undervaluing in planning and decision making, biodiversity is in crisis. Biodiversity provides vital ecosystem services that the City relies on and must be more fully integrated into decision making processes for effective stewardship.	
LEAD: SFE PARTNERS: Various public and private agencies	STRATEGY SUMMARY: The Inter-Agency Biodiversity Working Group (IBWG), convened by SFE, will continue to implement the San Francisco Biodiversity Policy. The working group created a citywide biodiversity vision with five supporting goals. One of the goals is Resilience in a Living City, leveraging natural ecosystems to conserve water, prevent flooding, manage pests, and improve air quality. The IBWG has identified potential new initiatives that will promote local nature, ecosystem restoration, and biodiverse greening while also advancing climate resilience. These key opportunity efforts will be further refined and prioritized for incorporation into department work plans.	
COST: Low: < \$500k	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
            		

DOMAIN: RESILIENT INFRASTRUCTURE (IN)














Primary Hazard Group: Combustion-Related














IN-3.01 Complete studies, analysis, and capital projects to improve and expand the Emergency Firefighting Water System (EFWS)		
KEY PLANNING ISSUES: New Development, Utilities		VULNERABILITY ADDRESSED: San Francisco faces seismic risk and urban conflagrations that could occur following a seismic event. Without reliable fire suppression water systems, the City could be vulnerable to major damage from fires after a large seismic event and non-earthquake, multiple-alarm fires.
LEAD: SFPUC PARTNERS: SFFD, Public Works, DEM, ADM	STRATEGY SUMMARY: Working collaboratively, the San Francisco Public Utilities Commission (SFPUC), San Francisco Fire Department (SFFD), and San Francisco Public Works (Public Works) are completing studies and analysis, and implementing capital projects, to improve and expand the Emergency Firefighting Water System (EFWS). For upcoming EFWS capital investments, the three agencies are placing an emphasis in areas of the City where there is limited access to the EFWS. One potential conceptual project includes over 13 miles of seismically resilient pipeline connected to two new pump stations, for the purpose of providing high-pressure fire suppression to underserved areas.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Scaling
            		

IN-3.02 Improve the capacity of the Portable Water Supply System to fight fires following earthquakes and other large urban fires		
KEY PLANNING ISSUES: Utilities		VULNERABILITY ADDRESSED: Fires following an earthquake have the potential to cause severe damage to buildings and infrastructure.
LEAD: SFFD PARTNERS: DEM, SFPUC	STRATEGY SUMMARY: Portable Water Supply System (PWSS) hose tenders are key pieces of equipment that allow the Fire Department to provide high-pressure and high-volume water to fight large fires from any water source, even when the potable or auxiliary water pumps and pipes are damaged or not functioning due to loss of power. This is especially important for fighting fires following earthquake and fires in tall buildings. PWSS is an important resource for areas that are not served by the Emergency Firefighting Water System (EFWS) or in areas where the EFWS might be damaged after an earthquake (e.g., liquefaction zones). A 2011 analysis recommended that the City have 20 hose tenders.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: New
            		

DOMAIN: RESILIENT INFRASTRUCTURE (IN)














Primary Hazard Group: Combustion-Related














IN-3.03				Continue to mitigate wildfire hazards in SFPUC-owned watersheds to protect source water quality and minimize risk to SFPUC water and power infrastructure			
KEY PLANNING ISSUES:			VULNERABILITY ADDRESSED:				
Utilities			Significant portions of the Hetch Hetchy Regional Water System in San Mateo, Alameda, Santa Clara, San Joaquin, and Tuolumne counties are located in State-designated high- or very high-fire hazard areas. Wildfire could damage potable water infrastructure and/or degrade source quality, and potentially risk drinking water delivery operations.				
LEAD:		STRATEGY SUMMARY:					
SFPUC		SFPUC staff and contractors regularly manage vegetation in SFPUC watershed and right of way (ROW) lands in an effort to mitigate fire hazards and protect water quality. In addition to vegetation management to mitigate fire hazards, SFPUC staff also coordinate internally with federal, State, and local first responders to refine and practice fire-related response procedures and protocols. SFPUC is currently updating its Wildfire Mitigation Plan that describes efforts related to electrical infrastructure only, to reflect new jurisdiction under the California Public Utilities Commission.					
PARTNERS:							
National Forest Service, CalFire, county agencies							
COST:			SF GOVERNMENT ACTIVITY:			STATUS:	
Medium: \$500K to \$5M			Public Assets Owner			Sustaining	
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IN-3.04		Improve fire prevention in recreation areas	
KEY PLANNING ISSUES: Existing Buildings		VULNERABILITY ADDRESSED: Wildland open space, particularly Glen Canyon, Presidio, and other grassland open space, are vulnerable to direct fire.	
LEAD: RPD PARTNERS: SFFD, DEM		STRATEGY SUMMARY: Creating defensible space around structures is a strong, proactive management tool to use in fire prevention. This strategy would focus on reducing fire fuel on RPD property that is within 30 feet of structures. Continuing this strategy and enforcing this policy creates defensible spaces around built structures. RPD already maintains properties in line with State law and the California Department of Forestry and Fire best practices.	
COST: TBD		SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
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DOMAIN: RESILIENT INFRASTRUCTURE (IN)















Primary Hazard Group: All Hazards















IN-5.01 Conduct a system-wide, multi-hazard vulnerability and operational assessment for Muni		
KEY PLANNING ISSUES: Transportation		VULNERABILITY ADDRESSED: This strategy seeks to minimize the impact of a number of hazard and climate stressors to ensure resiliency of critical infrastructure and maintenance of SFMTA/Muni-delivered public transportation service.
LEAD: SFMTA PARTNERS: Public Works, SFPUC, Planning, regional - agencies	STRATEGY SUMMARY: This strategy proposes a system-wide, multi-hazard vulnerability and operational assessment for the Muni-operated public transportation system. This strategy would include technical studies and vulnerability and risks assessments to better understand the threat and impact of various hazards to critical infrastructure and services, identifying key actions, capital improvements, and service delivery strategies to mitigate these risks. Stakeholders engaged in HCR strategy review expressed that not all neighborhoods are well-served by public transit and/or do not have accessible or affordable transportation options; this isolation increases vulnerability.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
            		

IN-5.02 Reduce seismic and flood risk along three miles of the San Francisco Waterfront from Fisherman's Wharf to Mission Creek		
KEY PLANNING ISSUES: Waterfront		VULNERABILITY ADDRESSED: The Embarcadero Seawall is over 100 years old and is at significant risk from a seismic event and future flooding. Significant damage could result in loss of service for major citywide and regional transportation and utilities, economic centers, and emergency response facilities, and cause loss of life.
LEAD: Port PARTNERS: City depts., regional planning agencies	STRATEGY SUMMARY: The estimated cost to reduce the seismic and current and future flood risks to the Embarcadero Seawall portion of the San Francisco Waterfront is approximately \$5 billion. The first phase of the Embarcadero Seawall Program includes program development, vulnerability and consequences assessment, robust engagement, alternatives development, and the delivery of a first project or suite of projects designed to reduce risk to life safety and emergency response. The Embarcadero Seawall Program is a 30-year program of safety improvements as part of a port-wide resilience framework.	
COST: Low: \$0-500K	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
            		

DOMAIN: RESILIENT INFRASTRUCTURE (IN)















Primary Hazard Group: All Hazards















IN-5.03 Continue to advance Sewer System Improvement Program (SSIP) projects to meet level of service objectives		
KEY PLANNING ISSUES: Utilities		VULNERABILITY ADDRESSED: The combined sewer system has a high exposure to seismic hazards. Coastal flooding will increasingly become an issue as sea level rises, particularly for sensitive assets in low-lying coastal areas, including outfalls, pump stations, and force mains.
LEAD: SFPUC PARTNERS: Public Works, Port, SFMTA	STRATEGY SUMMARY: The SFPUC is implementing the Sewer System Improvement Program (SSIP), a 20-year, citywide investment starting in 2012 to upgrade aging infrastructure to address challenges including seismic vulnerability, climate change, localized flooding, and water quality. These improvements achieve LOS objectives for a five-year, three-hour storm event and seismic resilience, ensuring treatment of flows within 72 hours of a major earthquake or a catastrophic event. New facilities will be built using a climate change design criterion and using green infrastructure. The first phase includes 70 projects around the City that represent a \$2.9-billion investment.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
             		

IN-5.04 Implement the Pipe Replacement Prioritization Program		
KEY PLANNING ISSUES: Utilities		VULNERABILITY ADDRESSED: The Bay Area is vulnerable to significant seismic, landslide, tsunami, and extreme storm events. The aged nature of infrastructure can leave many of the City's pipes and underground infrastructure vulnerable to these events.
LEAD: SFPUC PARTNERS: SFFD, DPH, DEM, NERT, Bay Area Peninsula agencies	STRATEGY SUMMARY: The SFPUC prioritizes water pipelines for replacement based on risk scores and condition assessments. San Francisco's distribution system pipes are categorized by risk and consequence of failure, and larger transmission mains are seismically hardened when replaced. San Francisco's Emergency Fire Water System (EFWS) is prioritized for expansion or replacement with seismically reliable pipelines based on post-seismic, fire-fighting demand analysis. Large regional transmission water mains undergo rigorous condition assessment to prioritize replacement; these pipes are seismically strengthened when replaced or upgraded.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
             		

DOMAIN: RESILIENT INFRASTRUCTURE (IN)














Primary Hazard Group: All Hazards







IN-5.05 Continue to improve power distribution infrastructure to support new development and increase resilience		
KEY PLANNING ISSUES: Utilities		VULNERABILITY ADDRESSED: Underground distribution systems and substations can be difficult to replace in the event of a catastrophic failure and might require very expensive specialized parts, making them more difficult to restore.
LEAD: SFPUC PARTNERS: PG&E	STRATEGY SUMMARY: By building a new electric distribution infrastructure backbone (electric distribution duct bank and transmission level substation), the City can avoid costly upgrades to PG&E's system and provide reliable power to new developments along the central and southeast waterfront. New investments will ensure the City can provide resilient customer service by incorporating on-site distributed resources and through redundancy of the system. This strategy provides SFPUC with the ability to implement various City objectives independent of PG&E, including environmental objectives. Stakeholders engaged in HCR strategy review stated the importance of addressing power demands, brownouts, and outages.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Scaling
             		

IN-5.06 Enhance flood and earthquake resilience of regional dams and ancillary facilities		
KEY PLANNING ISSUES: Utilities		VULNERABILITY ADDRESSED: With extreme storms increasing from climate change and the consistent seismic vulnerability of the west coast, dam/embankment failure caused by over topping from probable maximum flood (PMF) or embankment failure caused by maximum credit earthquake (MCE) are current risks.
LEAD: SFPUC, DSOD PARTNERS: Downstream municipalities	STRATEGY SUMMARY: The State's Division of Safety of Dams (DSOD) classifies downstream hazard potential based on loss of life, economic loss, and environmental damage resulting from a hypothetical dam failure. For dams classified as "High" and "Extremely High," SFPUC will update seismic stability analysis against the maximum credible earthquake (MCE) and evaluate the hydraulic adequacy against the probable maximum flood (PMF) for embankment and spillway. The analysis will identify deficiencies to be addressed through the Capital Improvement Program (CIP).	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
             		

DOMAIN: RESILIENT INFRASTRUCTURE (IN)














Primary Hazard Group: All Hazards














IN-5.07		Develop a Citywide Climate Resilience Framework	
KEY PLANNING ISSUES: All		VULNERABILITY ADDRESSED: Climate change impacts every aspect of society, requiring a cross-disciplinary, coordinated approach to building effective resilience. This situation can be challenging given the range of departments working on the issue.	
LEAD: ORCP PARTNERS: Planning, SFE, SFPUC, DBI, Port		STRATEGY SUMMARY: This Climate Resilience Framework will connect synergistic climate adaptation (Hazard and Climate Resilience Plan) and mitigation strategies (Climate Action Strategy) and establish coordinated goals, principles, and evaluation criteria that enables implementation to maximize co-benefits and avoid conflicts. Through strategic financial analysis and stakeholder engagement it will provide a policy framework for staff coordination and executive consensus around prioritizing City climate resilience actions and identifying funding sources. This strategy will also establish a set of benchmarks and a public dashboard that tracks and reports progress.	
COST: TBD		SF GOVERNMENT ACTIVITY: Research, Planning, & Guidance	STATUS: New
            			

IN-5.08		Implement SFMTA Communications and IT Strategy	
KEY PLANNING ISSUES: Transportation		VULNERABILITY ADDRESSED: This strategy seeks to increase the resilience of critical response facilities, municipal facilities, municipal yards, roadways, parking, and the public transit network.	
LEAD: SFMTA PARTNERS:		STRATEGY SUMMARY: This strategy enables the SFMTA to recover quickly from natural disasters that affect the SFMTA's communications and information technology assets. The SFMTA maintains a wide array of critical communications and IT assets across the City, from Wi-Fi and telephone systems at worksites to the fiber network comprising the internal communication backbone of the Muni Metro system. This strategy will implement short-term projects that bolster the resiliency of SFMTA Communications and IT assets. Funding for this strategy is included in the FY2019–FY2023 Capital Improvement Program.	
COST: High: \$5M and above		SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
            			

DOMAIN: RESILIENT INFRASTRUCTURE (IN)

Primary Hazard Group: All Hazards


IN-5.09 Implement SFMTA Asset Management and State of Good Repair Strategy		
KEY PLANNING ISSUES: Transportation	VULNERABILITY ADDRESSED: Pavement and track exposed to high temperatures over long periods of time can deform, affecting rail lines and overhead catenary system poles. Additionally, exposure of streetcar cable lines will also likely accelerate corrosion.	
LEAD: SFMTA PARTNERS:	STRATEGY SUMMARY: The SFMTA developed a 10-Year Asset Management Strategy in 2018 to incorporate asset management into capital, operation, and maintenance activities. The purpose of this strategy is to maintain SFMTA's assets in a State of Good Repair, thereby bolstering the resilience of the City's transportation system to climate change and natural disasters. Since 2010, the SFMTA has made a commitment to spend an average of \$250 million per year on State of Good Repair needs that are essential to ensuring the safe and reliable functioning of the transportation system. Funding for this strategy is included in the FY2019–FY2023 Capital Improvement Program.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
            		

IN-5.10 Implement SFMTA Transit Fixed Guideway Strategy		
KEY PLANNING ISSUES: Transportation	VULNERABILITY ADDRESSED: Pavement and track exposed to high temperatures over long periods of time can deform, affecting rail lines and overhead catenary system poles.	
LEAD: SFMTA PARTNERS:	STRATEGY SUMMARY: This strategy ensures that SFMTA's Transit Fixed Guideway system is well-built, maintained and resilient to hazard events. Muni's Transit Fixed Guideway light rail, streetcar, and historic cable car services are a crucial component of transportation in San Francisco. Projects in the Transit Fixed Guideway capital program include: investing in new train control technology, track replacement, maintenance facility upgrades, and maintaining Muni's 163 miles of overhead wires. Funding for this strategy is included in the FY2019–FY2023 Capital Improvement Program.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
            		

DOMAIN: RESILIENT BUILDINGS (B)















Primary Hazard Group: Geological















B-1.01.01				Assess and seismically retrofit municipal buildings			
KEY PLANNING ISSUES:		VULNERABILITY ADDRESSED:					
Existing Buildings		Community members rely on services provided by the City. The consequences of municipal building disruption are more severe for residents who are resource-constrained.					
LEAD:		STRATEGY SUMMARY:					
ORCP		ORCP uses seismic hazard ratings, HAZUS, and other analytical tools to assess risk and prioritize seismic-strengthening projects within the public facilities portfolio.					
PARTNERS:		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.					
BOS, ADM, MYR, Budget Office, Public Works, all impacted							
COST:		SF GOVERNMENT ACTIVITY:			STATUS:		
High: \$5M and above		Public Assets Owner			New		

B-1.01.02 Seismically improve the Port's Department Operations Control Center, Headquarters, and Joint Operations Control facilities			
KEY PLANNING ISSUES: Existing Buildings, Waterfront		VULNERABILITY ADDRESSED: The Port has significant exposure to seismic hazards. Damage to Port facilities would impact many people at the time of the event and after the event if the Department Operations Centers (DOCs) and Joint Operations Center (JOC) are not functioning.	
LEAD: Port PARTNERS: DEM, SFPD, SFFD, CPC	STRATEGY SUMMARY: The Port oversees two DOCs and one JOC facility on its properties. It is important to reduce damage and disruption to these facilities due to the role that the Port plays in emergency response, and the number of people that work, live, and travel through the waterfront. Implementation of seismic improvements to Pier 1, which serves at the headquarters for the Port and the Department Operations Center, will ensure seismic performance of the building after a seismic event, as well as explore opportunities for sea level rise adaptation.		
COST: Medium: \$500K to \$5M		SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
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DOMAIN: RESILIENT BUILDINGS (B)




Primary Hazard Group: Geological














B-1.02		Develop an earthquake risk improvement program for non-structural components of municipal buildings	
KEY PLANNING ISSUES: Existing Buildings		VULNERABILITY ADDRESSED: The California Building Code is designed to protect lives, not to protect against damage that would cause business interruption. Non-structural failures have accounted for the majority of earthquake damage in several recent U.S. earthquakes.	
LEAD: ORCP PARTNERS: Public Works, RPD, RPD, Port, SFPUC, SFO, SFMTA	STRATEGY SUMMARY: San Francisco has proactively worked to reduce the risk posed by future earthquakes through policies, program, and regulations, but these actions have not comprehensively addressed “nonstructural components,” including architectural features and mechanical, electrical, plumbing, and data systems. A non-structural earthquake risk improvement program will focus on reducing risk within the City’s portfolio of buildings. Non-structural improvements are relatively simple and low cost but significantly reduce damage and improve the likelihood of rapid re-occupancy following an earthquake.		
COST: High: \$5M and above		SF GOVERNMENT ACTIVITY: Public Assets Owner	Status: New
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B-1.03		Develop a voluntary program for seismic retrofits of one- to four-unit wood frame, soft-story buildings	
KEY PLANNING ISSUES: Housing, Existing Buildings		VULNERABILITY ADDRESSED: Wood frame, multi-family buildings built before 1995 with parking or retail on the ground floor (a.k.a. soft-story buildings) are known to experience ground floor collapse or tilt in an earthquake.	
LEAD: ORCP, DBI PARTNERS: OEWD, Office of Small Business, private owners & tenants		STRATEGY SUMMARY: To reduce risks from earthquakes, the City will encourage or require owners to evaluate and retrofit one–four unit soft-story, wood frame buildings. The Department of Building Inspection will perform outreach to educate homeowners and contractors about the risks, responsibilities, and opportunities through this program. A permit tracking tool will be developed in order to ensure compliance and track outcomes for those that have opted to participate. (This strategy is related to ESIP Tasks A.1.c, B.3.b, and B.2.c)	
COST: Low: \$0–500K		SF GOVERNMENT ACTIVITY: Research, Planning, & Guidance	STATUS: New
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DOMAIN: RESILIENT BUILDINGS (B)













Primary Hazard Group: Geological














B-1.04 Implement the Tall Building Strategy to address seismic vulnerability of buildings taller than 250 feet		
KEY PLANNING ISSUES: Existing Buildings		VULNERABILITY ADDRESSED: Depending on severity and building type, damage can lead to short- to long-term closures. Shutdown of financial institutions and other global companies can have economic impacts that are felt worldwide.
LEAD: SFMTA PARTNERS: DBI, DEM Planning, SFE, SFPUC	STRATEGY SUMMARY: This strategy would include technical studies and vulnerability and risks assessments to better understand the threat and impact of various hazards to critical infrastructure, operations, and services. This strategy would also include development of a hazard mitigation plan, which would identify key actions, capital improvements, and service delivery strategies, and an implementation plan for delivery of priority actions and strategies.	
COST: Medium: \$500K to \$5M	SF GOVERNMENT ACTIVITY: Research, Planning & Guidance	STATUS: New
            		

B-1.05 Extend and improve the Building Occupancy Resumption Program (BORP)		
KEY PLANNING ISSUES: Existing Buildings		VULNERABILITY ADDRESSED: Damage and disruption to San Francisco's commercial buildings can disrupt residents' work and workplace social networks and can prompt widespread short-term unemployment.
LEAD: DBI PARTNERS: ORCP, Public Works, building owners & tenants	STRATEGY SUMMARY: BORP allows for building owners to arrange in advance for post-earthquake safety inspections using their own contracted inspectors. Participation is currently voluntary. The Department of Building Inspection (DBI) approves each participating building's application and pre-certifies the owner's inspection team. Most BORP participants are downtown office buildings. BORP addresses many of the problems associated with applying the general Safety Assessment Program to tall or otherwise complex or recovery-critical buildings. (This strategy is related to Tall Buildings Recommendations 3B)	
COST: Medium: \$500K to \$5M	SF GOVERNMENT ACTIVITY: Research, Planning & Guidance	STATUS: Scaling
            		

DOMAIN: RESILIENT BUILDINGS (B)














Primary Hazard Group: Geological











B-1.06 Complete the Mandatory Soft-Story Retrofit Program (pre-1978 buildings with 5+ units and 2+ stories)		
KEY PLANNING ISSUES: Existing Buildings		VULNERABILITY ADDRESSED: Multi-family housing buildings vulnerable to damage in earthquake shaking.
LEAD: DBI PARTNERS: ORCP	STRATEGY SUMMARY: The San Francisco Mandatory Soft-Story Retrofit Ordinance applies to wood frame buildings of three or more stories (or two stories over a basement that extends above grade) containing five or more residential dwelling units, where the permit to construct was applied for prior to January 1978 and the building has not yet been seismically strengthened. Currently, 4,921 buildings are subject to the program. Seventy-six percent of applicable buildings are in compliance as of October 2019. (This strategy is related to ESIP Task A.3.a)	
COST: Low: \$0–500K	SF GOVERNMENT ACTIVITY: Adopt & Enforce Regulations	STATUS: Sustaining
            		

B-1.07.01 Develop a program (standards and guidance) to screen, evaluate, and retrofit older steel buildings		
KEY PLANNING ISSUES: Existing Buildings		VULNERABILITY ADDRESSED: Older steel frame buildings constructed prior to 1990s have known deficiencies, including welded steel connections that can fracture in strong shaking and contribute to building damage or collapse.
LEAD: ORCP, DBI PARTNERS: SFO, building owners & tenants	STRATEGY SUMMARY: Steel buildings built between the mid-1960s and 1990s might be constructed using weld detailing techniques that can contribute to significant damage or collapse in an earthquake. Other types of older steel buildings are also known to be vulnerable to damage in earthquakes as well.	
COST: Medium: \$500K to \$5M	SF GOVERNMENT ACTIVITY: Adopt & Enforce Regulations	STATUS: New
            		

DOMAIN: RESILIENT BUILDINGS (B)

Primary Hazard Group: Geological

B-1.07.02 Develop a program to screen, evaluate, and retrofit non-ductile concrete buildings			
KEY PLANNING ISSUES: Existing Buildings		VULNERABILITY ADDRESSED: Some older concrete buildings constructed prior to 1980 have non-ductile detailing and other deficiencies that have resulted in building collapse in previous earthquakes. These buildings tend to be mid-rise buildings. Approximately 3,400 such buildings exist in San Francisco.	
LEAD: ORCP, DBI PARTNERS: SFO, building owners & tenants, engineering firms		STRATEGY SUMMARY: Some older concrete buildings constructed prior to 1980 have non-ductile detailing and other deficiencies that have resulted in building collapse in previous earthquakes around the world. These buildings tend to be mid-rise buildings. Approximately 3,400 such buildings exist in San Francisco (residential and nonresidential), but it is not yet known what percentage of these pose a collapse risk in an earthquake. To address this issue, mandatory screening, evaluation, and retrofit of older concrete buildings should begin in 2020. (This strategy is related to ESIP Task B.2.a and C.2.a).	
COST: Medium: \$500K to \$5M		SF GOVERNMENT ACTIVITY: Adopt & Enforce Regulations	STATUS New
            			

B-1.08 Implement the SFMTA Parking Strategy			
KEY PLANNING ISSUES: Transportation		VULNERABILITY ADDRESSED: Many parking structures were constructed prior to 1975 and have not been seismically retrofitted. However, some of the oldest, most heavily used structures have received some manner of retrofitting.	
LEAD: SFMTA PARTNERS:		STRATEGY SUMMARY: The purpose of this strategy is to ensure that SFMTA parking and street assets are structurally sound, accessible, well-ventilated, and can withstand earthquake activity. The SFMTA manages on- and off-street public parking facilities that serve San Francisco residents, visitors, and businesses. This strategy will implement short-term upgrades and improvements, including a multi-hazard vulnerability and operational assessment, to its public parking garages to make them seismically sound. Funding for this strategy is included in the FY2019–FY2023 Capital Improvement Program.	
COST: Medium: \$500K to \$5M		SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
            			

DOMAIN: RESILIENT BUILDINGS (B)














Primary Hazard Group: Weather-Related














B-2.01 Develop multi-hazard resilience design guidelines for municipal buildings		
KEY PLANNING ISSUES: New Development		VULNERABILITY ADDRESSED: There is a lack of information and guidance on how municipal buildings and facilities should address a range of climate hazards in their planning and design, including cost-benefit methodology.
LEAD: ORCP PARTNERS: Public Works, Planning, SFPUC, Port, SFMTA, SFO, etc.	STRATEGY SUMMARY: Developing multi-hazard capital planning guidelines, rooted in the current and future needs of a climate resilient city, is essential to meet the sustainability and climate action goals of the city. This strategy includes performance guidelines for climate and seismic hazards, including flooding, extreme heat, and drought. The strategy might also include risk analysis and adaptation, architectural/engineering standards (building electrification systems, solar and energy storage, heating, venting, and air conditioning system coordination across units in large buildings, etc.), and inform capital priorities for adaptation. The guidelines should offer a cost-benefit analysis process to help project managers decide what resilience strategies to pursue, including non-capital-	
COST: Low: \$0-500K	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New

B-2.02 Review the Guidance for incorporating sea level rise into capital planning		
KEY PLANNING ISSUES: New Development		VULNERABILITY ADDRESSED: As sea level rises, temporary coastal flooding will be more frequent and will inundate larger areas at greater depths and for longer durations. Coastal flooding can cause physical damage to municipal buildings and infrastructure, resulting in disruption to critical services.
LEAD: ORCP PARTNERS: CPC, Planning, Public Works, SFPUC, SFMTA, Port	STRATEGY SUMMARY: The Sea Level Rise Capital Planning Guidance was developed in 2014 and updated in 2015. The Guidance is being updated in 2019 with the latest State-produced sea level rise science. Project managers for capital projects over \$5 million will continue to use the Guidance and checklist, ensuring that sea level rise projections are incorporated into asset design and that vulnerability, risk, and adaptive capacity of the asset are taken into consideration. The City will continue to improve implementation of the guidance, provide training for project managers, and analyze data collected from the effort. This strategy will inform the development of multi-hazard, climate resilience guidelines to be adopted citywide.	
COST: Low: \$0-500K	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining

DOMAIN: RESILIENT BUILDINGS (B)

Primary Hazard Group: Weather-Related

B-2.03 Develop a program to analyze, identify, and evaluate properties at risk of stormwater flooding		
KEY PLANNING ISSUES: Existing Buildings	VULNERABILITY ADDRESSED: Numerous residential and commercial buildings throughout San Francisco are at risk due to flooding that occurs when heavy precipitation generates runoff that exceeds the capacity of the City's stormwater system.	
LEAD: SFPUC PARTNERS: Planning, DBI, Assessor	STRATEGY SUMMARY: SFPUC is considering a program through which property owners affected by stormwater management would receive grants to reduce risk of flood damage. This proposed strategy will develop the framework for the grant program. The strategy will include analysis, identification, and evaluation of potential floodproofing and elevation projects. Preliminary cost-benefit analyses will also be performed. Specific projects will be separately implemented, based on interest from property owners.	
COST: Low: \$0-500K	SF GOVERNMENT ACTIVITY: Research, Planning & Guidance	STATUS: New
            		

B-2.04 Implement floodproofing and elevation projects for properties at risk of stormwater flooding citywide		
KEY PLANNING ISSUES: Existing Buildings	VULNERABILITY ADDRESSED: Numerous residential and commercial buildings throughout San Francisco are at risk due to flooding that occurs when heavy precipitation generates runoff that exceeds the capacity of the City's stormwater system.	
LEAD: SFPUC PARTNERS: Assessor, DBI, Planning, SFO	STRATEGY SUMMARY: SFPUC is considering a program through which property owners affected by stormwater management would receive grants to reduce risk of flood damage. This strategy includes the implementation of floodproofing, elevation, and acquisition projects based on interest from property owners. The City will work with interested property owners to assess eligibility for the program; evaluate options; develop the scope and cost; and, if federal funding is being contemplated, perform the required cost-benefit analysis and environmental impact analysis reviews.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Adopt & Enforce Regulations	STATUS: New
            		

DOMAIN: RESILIENT BUILDINGS (B)

Primary Hazard Group: Combustion-Related

B-3.01 Study emergency clean air and cooling capacity at key community facilities		
KEY PLANNING ISSUES: Existing Buildings		VULNERABILITY ADDRESSED: In non-weatherized buildings without adequate cooling systems, vulnerable populations are at increased risk of health impacts. The vast majority of these community facilities do not have air conditioning, and only certain sites have mechanical ventilation.
LEAD: DPH PARTNERS: SFUSD, DCYF, ORCP, HSA, MOHCD, RPD, SFE, LIB	STRATEGY SUMMARY: The study and eventual deployment of emergency clean air and cooling capacity at primary care clinics, in a common room of multi-unit housing developments (and especially those buildings that house populations vulnerable to health impacts of extreme heat and wildfire smoke) and in auditoriums/community space at schools and daycare facilities. San Francisco is particularly vulnerable to extreme heat, most heat-related health impacts happen at home, and there are significant barriers (transportation, messaging, and programming) that limit the effectiveness of cooling or clean air centers. The vast majority of San Francisco Unified School District facilities do not have air conditioning, and only certain sites have mechanical ventilation.	
COST: Medium: \$500K to \$5M	SF GOVERNMENT ACTIVITY: Research, Planning & Guidance	STATUS: New

B-3.02 Increase privately-owned building weatherization rates		
KEY PLANNING ISSUES: Housing, Existing Buildings		VULNERABILITY ADDRESSED: Older buildings not well-insulated or air-sealed expose inhabitants (especially vulnerable populations) to constant levels of local air pollution and increased risks during poor air quality and extreme heat days.
LEAD: SFE PARTNERS: DPH, SFPUC, BayREN, PG&E, ORCP	STRATEGY SUMMARY: Building weatherization reduces energy use and greenhouse gas emissions while providing health and resilience benefits. Providing the general public with more information connecting weatherization to protection from hazards and more technical/financial assistance can increase rates of weatherization. Currently, vulnerable populations might face barriers to weatherizing their living spaces. A cross-departmental study can identify and strategically prioritize sites where weatherization investments will result in widespread improvements for underserved and/or vulnerable populations. Stakeholders engaged in HCR strategy review stated the importance of financial assistance for sites that cannot easily afford these building improvements.	
COST: Low: \$0–500K	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: Scaling



DOMAIN: RESILIENT BUILDINGS














Primary Hazard Group: Combustion-Related

B-3.03 Support increased building electrification (fuel switching) and mechanical upgrades		
KEY PLANNING ISSUES: Existing Buildings	VULNERABILITY ADDRESSED: Loss of utility service due to catastrophic events will result in loss of building functionality, including heating and cooling, lighting, refrigeration, and plug loads (devices). It is likely that gas outages will take much longer to bring back online than electric power outages (weeks compared to days). Both power supplies can cause or exacerbate urban fires; buildings and infrastructure that use natural gas might be prone to explosions as well.	
LEAD: SFE PARTNERS: Public Works, SFO, SFUSD, SFPUC, OEWD, DPH	STRATEGY SUMMARY: Building electrification (generally, switching from fossil fuel combustion for building uses such as space and water heating to high-efficiency refrigeration-based technologies such as heat pumps) supports resilience in multiple ways. High-performance all-electric buildings can come back online quicker than mixed-fuel buildings, following catastrophic events. For critical facilities, electric buildings might be better able to take advantage of on-site solar energy stored in batteries (see Solar and Storage Strategy). Older buildings in San Francisco might not have mechanical cooling systems, and more frequent extreme heat days in the future would increase the need for mechanical cooling. Stakeholders engaged in HCR strategy review stated the importance of financial assistance for building upgrades, such as fuel switching.	
COST: Low: \$0–500K	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: Scaling

DOMAIN: RESILIENT BUILDINGS (B)















Primary Hazard Group: All Hazards















B-5.01 Amend the capital improvement program for transportation facilities to consider hazard mitigation opportunities		
KEY PLANNING ISSUES: Transportation, Existing Buildings	VULNERABILITY ADDRESSED: The majority of buildings in municipal yards are un-retrofitted, and many structures were built during the 1940's and 50's.	
LEAD: SFMTA PARTNERS: Public Works, SFPUC, Planning, RPD, MOHCD,	STRATEGY SUMMARY: This strategy is a capital facility improvement program assessing, studying, planning, and implementing improvements to SFMTA's capital facilities. Improvements range from near-term workspace improvements, to long-term, comprehensive redevelopment of SFMTA's real property. This strategy includes mitigations from various hazards, implemented during the design phase of facility improvements. Projects are also prioritized based on a combination of factors relevant to SFMTA needs. In addition, SFMTA might consider exploring options that co-locate Paratransit assets to shift more of their fleet locally as opposed to being sited in	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Scaling
            		

B-5.02 Install solar and storage systems at critical facilities		
KEY PLANNING ISSUES: Existing Buildings	VULNERABILITY ADDRESSED: Following an earthquake, flood, or other disaster, continued operation of shelters and critical emergency management facilities is essential. Currently, gas and electric networks can require days or weeks to recover from a disaster.	
LEAD: Public Works/varies PARTNERS: ORCP, SFE, SFPUC, public building owners/operators (Port, SFMTA, RPD, DBI), DPH	STRATEGY SUMMARY: This strategy seeks funding to install solar and storage systems at studied critical facilities. Previous studies conducted for the San Francisco Department of the Environment (SF Environment) Solar and Storage for Resilience Project examined the use of stand-alone solar electric generation with battery storage to provide resilient post-disaster power to critical facilities. The project team created representative emergency power profiles for 67 shelters, and visited 18 buildings, spanning 11 supervisor districts. To address the high capital cost of deploying this large resource, the project team investigated various financing options, with a public-private partnership, which was found to be a viable pathway.	
COST: Medium: \$500K to \$5M	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Scaling
            		

DOMAIN: RESILIENT BUILDINGS (B)














Primary Hazard Group: All Hazards

B-5.03 Secure a resilient public safety training facility for San Francisco Fire Department (SFFD)		
KEY PLANNING ISSUES: N/A	VULNERABILITY ADDRESSED: Several emergency response facilities may be vulnerable to coastal flooding due to their location, including the San Francisco Fire Department (SFFD) Training Center located on Treasure Island.	
LEAD: SFFD PARTNERS: SFPD, SHF	STRATEGY SUMMARY: Currently, training for SFFD is split between one facility in the Mission District and another facility located on Treasure Island. With the future vulnerability of the Treasure Island site to impacts of sea level rise, SFFD would be without an adequate amount of space for its training needs by as early as 2024, unless a new facility is constructed. The City is exploring sites to develop, meeting these evolving training needs. By constructing a state of the art, seismic and climate resilient facility, SFFD can continue to train professionals skilled in mitigating the impacts of hazards within the City.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
             		

B-5.04 Increase resilience and operation efficiency of maintenance yards		
KEY PLANNING ISSUES: Existing Buildings	VULNERABILITY ADDRESSED: Lack of information and guidance on how municipal buildings and facilities should address a range of climate hazards in their planning and design.	
LEAD: Public Works PARTNERS: RPD, SFMTA, SFE, SFPUC, Port	STRATEGY SUMMARY: Public Works maintenance yards are outdated, centralized, and in need of replacement. Replacement with new facilities equipped for climate and seismic resilience will modernize maintenance yards for the challenges of the 21st century. These improvements include design specifications for on-site solar and battery systems, on-site water recycling/storage, high-performance building systems allowing operations in line with net-zero carbon commitments, as well as resilient landscaping for stormwater management. Decentralizing yards to smaller satellites across the City also increases staff and fleet fuel efficiencies. This strategy provides resiliency along short-term, long-term, and crisis timelines.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
             		

DOMAIN: RESILIENT BUILDINGS














Primary Hazard Group: All Hazards









B-5.05 Explore options to use Recreation Centers as public respite facilities		
KEY PLANNING ISSUES: Existing Buildings		VULNERABILITY ADDRESSED: In non-weatherized buildings without cooling capabilities, services could shut down during high heat events. High heat events can also cause power outages for centers without backup power sources.
LEAD: RPD PARTNERS: DEM, DPH, ORCP	STRATEGY SUMMARY: The changing climate has meant a changing role for departments across the city. This strategy develops a cohesive framework, with City partners, for how Recreation and Park facilities (recreation centers, pools, plazas) should act as emergency and weather event refuges. The goal will be to establish the role of park open spaces and indoor facilities in an emergency event and during extreme weather events. Elements to consider range from installing air filtration for poor air quality days, misters in plazas for extreme heat events, offering free pools during extreme heat events, and designing future centers for enhanced seismic resilience.	
COST: TBD	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: New
            		

B-5.06 Develop comprehensive and coordinated code amendments for multi-hazard resilience of private development		
KEY PLANNING ISSUES: New Development		VULNERABILITY ADDRESSED: Private buildings (residential, commercial, and industrial) are not necessarily designed to accommodate flooding, extreme heat impacts, poor air quality, and other natural and climate hazards.
LEAD: Planning PARTNERS: DBI, SFE, Port, SFO, private property owners	STRATEGY SUMMARY: In coordination with SFE and DBI, the Planning Department will develop multi-hazard Planning and Building Code amendments for new construction, additions, and substantial renovations in identified hazard areas. This strategy will include opportunities for new development to include dedicated storage space for emergency equipment and supplies, include solar + storage, function as a temporary shelter or respite facility, enhance biodiversity, and/or include climate resilience initiatives within community benefit agreements. The feasibility study will include a cost-benefit analysis regarding housing costs and supply, as well as potential benefits or impacts to low-	
COST: Low: \$0-500K	SF GOVERNMENT ACTIVITY: Adopt & Enforce Regulations	STATUS: New
            		

DOMAIN: RESILIENT COMMUNITY (C)

Primary Hazard Group: Geological

C-1.01 Address seismic retrofit needs within San Francisco's affordable housing stock		
KEY PLANNING ISSUES: Housing	VULNERABILITY ADDRESSED: Much of San Francisco's housing stock is in need of structural retrofits and life/safety improvements. Loss of affordable housing due to damage from an earthquake would have a severe impact on vulnerable populations.	
LEAD: MOHCD PARTNERS: DBI, community development organizations	STRATEGY SUMMARY: The San Francisco Mayor's Office of Housing and Community Development (MOHCD) manages acquisition and rehabilitation programs that provide funding to non-profit organizations to acquire older, rent-controlled properties, rehabilitate them, and preserve them as permanent affordable housing. This strategy will use FEMA hazard mitigation funding to subsidize these developers to perform necessary retrofits, thereby reducing potential displacement of renters of damaged housing following earthquake events and reducing the necessity of landlords raising rents for building improvements.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: New
            		

C-1.02 Develop a downtown recovery strategy		
KEY PLANNING ISSUES: Existing Buildings, New Development	VULNERABILITY ADDRESSED: Damage to downtown high-rise structures can lead to long-term disruption of whole neighborhoods. This situation could have impacts on housing, employment, and economic opportunity for thousands of	
LEAD: ORCP PARTNERS: Public Works, DBI, DEM, Port, Planning, SFE, SFPUC	STRATEGY SUMMARY: The work that the City has done around tall buildings focuses on the buildings themselves, with little consideration for how the building fits into the surrounding neighborhood. This work does not consider how tall buildings interact with other structures around them and the relationships between businesses, residents, workers, and the critical infrastructure that allow the Financial District and adjacent neighborhoods to thrive. To this end, this strategy calls for the creation of a downtown recovery strategy for these areas to address the interconnection between tall buildings and their surrounding neighborhoods.	
COST: TBD	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: New
            		

DOMAIN: RESILIENT COMMUNITY (C)














Primary Hazard Group: Geological














C-1.03 Improve San Francisco's implementation of the State Safety Assessment Program		
KEY PLANNING ISSUES: Existing Buildings		VULNERABILITY ADDRESSED: Damage and disruption to San Francisco's commercial buildings can disrupt residents' work and workplace social networks, and even prompt widespread short-term unemployment. The shutdown of many financial institutions and other global companies in the event of severe shaking and liquefaction might have serious economic impacts.
LEAD: ORCP, DBI PARTNERS:	STRATEGY SUMMARY: The Safety Assessment Program (SAP) is run by the California Office of Emergency Services (CalOES). DBI is charged with implementing San Francisco's participation in the program. The City should develop its own procedures suited to San Francisco's tall buildings, develop a plan to use specially qualified SAP volunteers for certain complex buildings, and clarify and update roles and responsibilities for post-earthquake emergency response and safety inspection (This strategy is related to Tall Buildings Recommendations 3A and 3C)	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: Sustaining
            		

C-1.04 Develop a post hazard Open for Business campaign		
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: Damage and disruption to San Francisco's commercial buildings can disrupt residents' work and workplace social networks, and even prompt widespread short-term unemployment. The shutdown of many financial institutions and other global companies in the event of severe shaking and liquefaction might have serious economic impacts.
LEAD: OEWD PARTNERS: DPH, business associations	STRATEGY SUMMARY: San Francisco should work with stakeholders to identify partners and potential funding sources that will allow the City to implement a public information campaign after a disaster. Target audiences can include regional tourists, national and international tourists, conventions and business meetings, and business leaders. This campaign will reduce the economic damages and impacts of large-scale hazard events.	
COST: TBD	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: New
            		

DOMAIN: RESILIENT COMMUNITY (C)


Primary Hazard Group: Geological

C-1.05 Continue to meet housing production goals		
KEY PLANNING ISSUES: Housing		VULNERABILITY ADDRESSED: San Franciscans are already under pressure from the housing crisis and overall high cost of living. This is particularly acute for people who are unsheltered, in unstable housing situations, and renters. It increases community vulnerability to hazards and climate change.
LEAD: MOHCD PARTNERS: OCII, DBI, Planning, non-profit housing developers	STRATEGY SUMMARY: The City has a goal to create 30,000 housing units, 30 percent of which are permanently affordable and 50 percent of which are middle income by 2020. These homes serve families, seniors, essential City workers, and people formerly experiencing homelessness. Living in an affordable home increases one's ability to cope with impacts of a hazard event. Stakeholders engaged in HCR strategy review stressed the importance of building housing that meets the needs of San Francisco's vulnerable populations.	
COST: High: \$5M and above	SF GOVERNMENT ACTIVITY: Research, Planning & Guidance	STATUS: Sustaining
            		

C-1.06 Develop a public outreach campaign and wayfinding plan for tsunami awareness and evacuation procedures		
KEY PLANNING ISSUES: Waterfront		VULNERABILITY ADDRESSED: San Francisco's "worst-case" tsunami scenario produced an estimated maximum tsunami wave run-up elevation of 22 feet above mean sea level at Ocean Beach.
LEAD: DEM PARTNERS: Port, RPD, Public Works, SFMTA, CA Tsunami Program,	STRATEGY SUMMARY: New scientific information and maps showing increased coastal flood potential from separate and combined factors, including sea level rise, King tides, and tsunamis. The areas at greatest risks include low-lying, waterfront areas with a relatively high vulnerability. Public awareness is key to saving lives during extreme events. Visible signage on kiosks, sidewalks, and streets will help direct egress and save lives during these events.	
COST: Low: \$0-500K	SF GOVERNMENT ACTIVITY: Research, Planning & Guidance	STATUS: New
            		

DOMAIN: RESILIENT COMMUNITY (C)














Primary Hazard Group: Geological

C-1.07 Assess vertical evacuation options in high-hazard areas and guidance for large-building refuges			
KEY PLANNING ISSUES: Waterfront, Existing Buildings		VULNERABILITY ADDRESSED: San Francisco's "worst-case" tsunami scenario produced an estimated maximum tsunami wave runup elevation of 22 feet above mean sea level at Ocean Beach.	
LEAD: DBI, DEM PARTNERS: MOD, DPH, Public Works, NEN, SFFD, CA Tsunami Program, BOMA, BART, NERT,	STRATEGY SUMMARY: The combined factors of coastal flooding from sea level rise, King tides, and tsunamis indicate residents, visitors, and businesses are at risk during extreme weather events. Low-lying areas are particularly at risk (Market Street area in the Financial District, Treasure Island, etc.). In areas where high ground is not immediately available, vertically evacuating and seeking refuge in tall buildings might be the best option. Where horizontal evacuation is not possible, vertical evacuation facilities will be necessary for life safety, especially for people with disabilities or access and functional needs.		
COST: Medium: \$500K to \$5M		SF GOVERNMENT ACTIVITY: Research, Planning & Guidance	STATUS: New
			

DOMAIN: RESILIENT COMMUNITIES (C)













Primary Hazard Group: Biological & Toxic

C-4.01 Expand household hazardous waste collection efforts		
KEY PLANNING ISSUES: N/A	VULNERABILITY ADDRESSED: If household hazardous waste is disposed of improperly, these products end up in the landfill or down the drain where they can leach toxic chemicals and heavy metals into soil and groundwater.	
LEAD: SFE PARTNERS: Recology SF, Public Works, DEM, DPH	STRATEGY SUMMARY: This strategy expands education of San Francisco residents about the importance of removing Household Hazardous Waste (HHW) prior to (and in preparation for) a hazard event and promotes San Francisco's established programs for proper management of HHW. The focus of this outreach campaign is expected to be the HHW Home Collection Service that is currently underutilized by SF residents.	
COST: Low: \$0-500K	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: Scaling
            		

C-4.02 Replace mercury-containing lighting in preschools and daycare centers		
KEY PLANNING ISSUES: Existing Buildings	VULNERABILITY ADDRESSED: Most, if not all, San Francisco preschool and daycare facilities use fluorescent lighting. In a major earthquake or other disaster, mercury-containing lights can break and expose small children, one of the most vulnerable populations, to the long-term effects of mercury.	
LEAD: SFE PARTNERS: DCYF, DPH, Recology SF, First 5 San Francisco, SFUSD	STRATEGY SUMMARY: Most, if not all, of the 350 preschool and daycare facilities licensed by the State of California in San Francisco use fluorescent lighting. Fluorescent lighting contains mercury, a well-known and potent neurotoxin. In a major earthquake or other disaster, an unpredictable number of these mercury-containing lights can be expected to break, subjecting children to the long-term effects of mercury exposure. This strategy would remove this lighting from identified day care and pre-schools and replace them with LEDs, therefore reducing risk and helping the City meet its greenhouse emissions goals. This strategy can serve as a pilot program to evaluate the costs and other barriers to replacing mercury-containing lighting in elementary and high schools, and other institutional locations where children are present.	
COST: Low: \$0-500K	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: New
            		














DOMAIN: RESILIENT COMMUNITIES (C)














Primary Hazard Group: Biological & Toxic

C-4.03 Explore toxins abatement workforce development programs		
KEY PLANNING ISSUES: N/A	VULNERABILITY ADDRESSED: In some instances, the presence of toxic material spills following hazard events can disrupt the ability of individuals to shelter in place. This situation can create more dangerous situations for community members in their homes.	
LEAD: OEWD PARTNERS: Public Works, DPH	STRATEGY SUMMARY: Pursuing development of a workforce training programs for lead/asbestos, or other toxic waste abatement targeting properties impacted by floods, sea level rise, and fires will offer opportunities to gain economic empowerment to communities as they simultaneously grapple with increasing weather-related impacts as these events become more frequent with climate change.	
COST: TBD	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: New
            		

DOMAIN: RESILIENT COMMUNITIES (C)














Primary Hazard Group: All Hazards














C-5.01 Identify and create Clean Air/Cooling Hub (CACH) Public Respite Facilities		
KEY PLANNING ISSUES: Existing Buildings	VULNERABILITY ADDRESSED: 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.	
LEAD: ORCP PARTNERS: SFPL, DEM, RPD, ADM, Public Works, DPH	STRATEGY SUMMARY: 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.	
COST: Medium: \$500K to \$5M	SF GOVERNMENT ACTIVITY: Public Assets Owner	STATUS: Sustaining
            		

C-5.02 Develop a Homelessness Disaster Response Plan		
KEY PLANNING ISSUES: N/A	VULNERABILITY ADDRESSED: Unhoused populations are among the most vulnerable San Franciscans. Without stable shelter options, this population is often more exposed to hazard events.	
LEAD: HSH PARTNERS: DPH, DEM, ORCP	STRATEGY SUMMARY: In the event of a disaster, homeless people are among the most vulnerable populations to experience impacts. To address this, HSH is working with consultants from the Technical Assistance Collaborative (TAC) to develop a Homelessness Disaster Response Plan. The plan will identify key recommendations and next steps for HSH and partners to plan for, mitigate, and respond to the unique needs of this population during a large-scale disaster.	
COST: TBD	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: New
            		

DOMAIN: RESILIENT COMMUNITIES (C)














Primary Hazard Group: All Hazards














C-5.03 Support volunteer emergency preparedness, response, and recovery programs including the Neighborhood Emergency Response Team (NERT) and Auxiliary Law Enforcement Response Team (ALERT).		
KEY PLANNING ISSUES: N/A	VULNERABILITY ADDRESSED: In the event of a major disaster, emergency response personnel might have limited capacity to respond to all needs of the community due to multiple competing demands and/or damage to emergency response facilities.	
LEAD: SFFD/SFPD PARTNERS: DEM, (VOAD), MYR, ORCP private funders	STRATEGY SUMMARY: SFFD routinely conducts Neighborhood Emergency Response Team (NERT) training. This training educates people about disaster preparedness for hazards that might impact their area and trains them in basic disaster response skills, such as fire safety, light search and rescue, team organization, and disaster medical operations. This strategy supports the NERT program, its growth in participation and retention. This will include increasing funding and staffing to a level commensurate with the work of daily operations as well as community engagement and training. The overall aim of the effort will increase the overall program from less than 1 percent of residents trained within 3 years to 5 percent of residents.	
COST: Medium: \$500K to \$5M	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: Sustaining
            		

C-5.04 Create a program to coordinate existing City programs providing in-home and resident-facing services related to hazard and climate resilience		
KEY PLANNING ISSUES: Housing, Existing Buildings	VULNERABILITY ADDRESSED: This strategy seeks to improve the City's capacity and streamline its efforts to improve the resiliency of San Francisco homes and residents, especially vulnerable populations, to many of the hazards included in this plan.	
LEAD: DEM, DPH PARTNERS: HSA, ORCP, MOHCD, SFE, DBI	STRATEGY SUMMARY: This strategy creates an interdepartmental effort coordinating existing City programs providing in-home and resident-facing services. Opportunities in City services would be identified for existing programs, including climate resilience and emergency preparedness opportunities. This strategy will include a training program to engage multi-unit landlords, particularly those serving vulnerable populations. By working with existing programs, age-related emergency preparedness education can be included for City staff on home assessments.	
COST: Low: \$0-500K	SF GOVERNMENT ACTIVITY: Research, Planning & Guidance	STATUS: New
            		

DOMAIN: RESILIENT COMMUNITIES (C)














Primary Hazard Group: All Hazards

C-5.05 Develop a Preparedness Equipment Purchase Program to direct and fund the purchase of climate preparedness equipment		
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: This strategy aims to build citywide resiliency by improving the City's ability to respond in emergency events.
LEAD: DEM, DPH PARTNERS: Public Works, ORCP, SFE, SFFD	STRATEGY SUMMARY: As climate change increases the prevalence and intensity of hazards such as extreme heat events and air quality events, a Preparedness Equipment Purchase Program would help fund the purchase of climate preparedness equipment to ensure City departments have equipment on-hand for deployment. This equipment can be used to augment and bolster the flexibility of the City's response to current and future extreme weather and hazard events.	
COST: Low: \$0–500K	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: New
            		

C-5.06 Expand the Neighborhood Empowerment Network (NEN) Empowered Communities Program (ECP) to additional neighborhoods		
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: Many communities lack the hyper-local connections between individuals and community organizations that is essential to safely navigate hazard events. Building this social connection is a viable means of increasing individual resiliency.
LEAD: NEN PARTNERS: ADM, DEM, NERT, CBO's, private businesses	STRATEGY SUMMARY: The Neighborhood Empowerment Network (NEN) Empowered Communities Program (ECP) provides neighborhoods with a comprehensive toolkit of programs, strategies, and resources that advance the overall resilience of their community at the individual, organizational, and community levels. Building on FEMA's Whole Community Approach, the lessons learned from Hurricane Katrina, and a growing body of academic research, the ECP fuses together modern community organizing techniques with classic emergency management goals. Expanding this effort would increase the capacity of neighborhood leaders to advance their community's resilience.	
COST: Low: \$0–500K	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: Scaling
            		

DOMAIN: RESILIENT COMMUNITIES (C)


Primary Hazard Group: All Hazards














C-5.07				Perform gap analysis of vulnerable populations (i.e., Access and Functional Needs) and available City services				
KEY PLANNING ISSUES:			VULNERABILITY ADDRESSED:					
N/A			Many buildings have significant maintenance needs, require adaptations for changing climates, and could need significant repairs following a					
LEAD:		STRATEGY SUMMARY:						
MOD		Conduct a study to better understand vulnerable populations (i.e. Access and Functional Needs) that are not connected to community partners, service providers and/or City social service agencies. The study might also include a potential assessment tool for identifying those people at most risk as well as recommendations for best practices reaching these populations.						
PARTNERS:								
DAAS, DPH, CON, DEM, Age & Disability Friendly								
COST:			SF GOVERNMENT ACTIVITY:			STATUS:		
Low: \$0–500K			Community Services Delivery			New		
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C-5.08				Develop a community-based capacity building Initiative				
KEY PLANNING ISSUES:			VULNERABILITY ADDRESSED:					
N/A			CBOs often lack the resources to preemptively invest in hazard mitigation and emergency preparedness without municipal assistance.					
LEAD:		STRATEGY SUMMARY:						
MOD		Building the capacity of community-based partners to develop their own emergency preparedness plans for the individuals, households, and/or neighborhoods that they serve, is an important means for the City to prepare its small business community to endure hazard events. This strategy is a key component of promoting neighborhood level resiliency.						
PARTNERS:								
DAAS, DPH, SFCARD, DEM, NEN, RTSF, H4H, Age & Disability Friendly								
COST:			SF GOVERNMENT ACTIVITY:			STATUS:		
Medium: \$500K to \$5M			Community Services Delivery			New		
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DOMAIN: RESILIENT COMMUNITIES (C)

Primary Hazard Group: All Hazards

C-5.09		Establish an evacuation strategy for people with Access and Functional Needs	
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: In the event of an evacuation, the length of time necessary to evacuate large volumes of people, coupled with the potentially short period of time available to safely evacuate, leads to populations with limited mobility or medical conditions being particularly at risk.	
LEAD: DAAS/MOD PARTNERS: Age and Disability Friendly SF, DEM, MOD, SFFD, DBI, DPH		STRATEGY SUMMARY: Vulnerable populations are acutely impacted by disasters and can often face unique challenges. By developing a coordinated evacuation strategy, with consideration for the needs of populations with access and functional needs, support for this population can be effectively communicated to the public in case evacuation procedures need to be pursued.	
COST: Medium: \$500K to \$5M		SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: New
            			

C-5.10		Continue Small Business Continuity of Operations (COOP) Assistance	
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: Small businesses may lack the resources to preemptively invest in hazard mitigation or lack the resources to whether long-term business disruption without municipal assistance.	
LEAD: OEWD PARTNERS: DEM, SBDC, GO-Biz, FEMA		STRATEGY SUMMARY: Vulnerable populations rely on specialized services and goods that may not be available elsewhere. Identifying these businesses and developing resources to support them in the development of a Continuity of Operations (COOP) plan will ensure that they are able to continue to provide these services in the aftermath of an emergency.	
COST: TBD		SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: Sustaining
            			

DOMAIN: RESILIENT COMMUNITIES (C)













Primary Hazard Group: All Hazards














C-5.11 Support the Small Business Development Center (SBDC)		
KEY PLANNING ISSUES: N/A	VULNERABILITY ADDRESSED: Small businesses may lack the resources to preemptively invest in hazard mitigation or lack the resources to weather long-term business disruption without municipal assistance.	
LEAD: OEWD PARTNERS: SBDC, USSBA, GO-Biz	STRATEGY SUMMARY: Small businesses face many particular challenges following a disaster event. This strategy will develop a plan to rapidly scale capacity of the Small Business Development Center (SBDC) to provide post-disaster support to small businesses following a significant event. Additionally, this strategy will intentionally include a focus on targeted networking opportunities to support childcare facilities to navigate permitting needs and challenges resulting from a disaster, as this market segment is	
COST: TBD	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: Sustaining
            		

C-5.12 Establish disaster relief funding and small business resilience fund		
KEY PLANNING ISSUES: Existing Buildings	VULNERABILITY ADDRESSED: Small businesses may lack the resources to preemptively invest in hazard mitigation or lack the resources to whether long-term business disruption without municipal assistance.	
LEAD: OEWD PARTNERS: MEDA, CON	STRATEGY SUMMARY: Explore the ability to offer grants, low-interest loans, and other technical assistance related to preventing closure of businesses impacted by natural disasters or fire. Grants could cover eligible, unmet rehabilitation repair, replacement, and mitigation needs or projects that will increase sales, increase foot traffic, and retain and create jobs.	
COST: TBD	SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: New
            		

DOMAIN: RESILIENT COMMUNITIES (C)














Primary Hazard Group: All Hazards














C-5.13		Expand layoff outplacement services	
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: Damage to downtown high-rise structures can lead to long-term disruption of whole neighborhoods. This could have impacts on housing, employment, and economic opportunity for thousands of residents.	
LEAD: OEWD PARTNERS: EDD, Chamber, GO-Biz, Bay Area Council, SVLG, SFMade, SBDC		STRATEGY SUMMARY: This strategy would aim to preemptively support those workers facing layoffs following a disaster event, in order to reduce the potential economic disruption that could ripple through communities following these events. A primary focus would be to enable affected workers to return to work as quickly as possible organize with partners to provide services to businesses and affected employees to ensure a transition that is as seamless as possible.	
COST: TBD		SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: Scaling
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C-5.14		Expand Women's Entrepreneurship Fund	
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: Small businesses may lack the resources to preemptively invest in hazard mitigation or lack the resources to whether long-term business disruption without municipal assistance.	
LEAD: OEWD PARTNERS:	STRATEGY SUMMARY: Significant literature exists detailing the role that women have in supporting our communities. By economically empowering woman, we are providing communities with more stability pre-disaster, so that disruptions will be reduced following a disaster. This strategy would provide micro-grants to women-owned small businesses operating in San Francisco for projects that will have a transformative impact on businesses' ability		
COST: TBD		SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: Scaling
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DOMAIN: RESILIENT COMMUNITIES (C)












Primary Hazard Group: All Hazards

C-5.15		Study the overlap between vulnerable populations and vulnerable buildings	
KEY PLANNING ISSUES: Housing, Existing Building		VULNERABILITY ADDRESSED: Private buildings (residential, commercial and industrial) are not designed to accommodate flooding, future heat impacts, poor air quality, and other natural and climate hazards. Vulnerable populations are disproportionately impacted by climate and other natural hazards and have fewer resources to make climate resilient home and business improvements.	
LEAD: Planning/ DPH/ORCP	STRATEGY SUMMARY: Study the overlap between vulnerable populations and vulnerable building types for natural and climate hazards. This will help identify property types and locations that may be particularly vulnerable (such as permanent affordable housing, SRO's, etc.) to hazards and may need public subsidy or technical support to equitably pursue resilience measures. Public engagement efforts to date have identified specific vulnerabilities to consider, from San Franciscans who rely on electricity for their medical needs, to inaccessible routes of emergency evacuation.		
PARTNERS: DBI, SFPUC, SFE, MOHCD,	COST: Low: \$0–500K	SF GOVERNMENT ACTIVITY: Research, Planning & Guidance	STATUS: New
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C-5.16				Develop and manage a system for hazard and climate resilience data			
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: Quickly accessing hazard and asset GIS data is a challenge for many departments. As assessments relating to hazards and climate change become more common, the need for data for analysis and mapping will increase.					
LEAD: ORCP/DT PARTNERS: DEM, Planning, DPH		STRATEGY SUMMARY: ORCP, Planning, and DEM have collected robust GIS data relating to hazards (seismic, SLR, etc.) and relevant assets. To benefit future projects and implementation of the HCR, a system needs to be established to organize, maintain, and make this data accessible to other departments. This benefits future projects involving neighborhood-level hazard or asset specific vulnerability assessments. Publishing non-sensitive data through a public data/mapping sharing platform will be pursued to improve accessibility for community-based organizations the general public. Analysis will also be produced at the neighborhood scale for dissemination.					
COST: Low: \$0-500K		SF GOVERNMENT ACTIVITY: Research, Planning & Guidance			STATUS: New		
            							

DOMAIN: RESILIENT COMMUNITIES (C)














Primary Hazard Group: All Hazards














C-5.17 Develop a communications strategy for citywide climate resilience efforts		
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: The City lacks clear messaging on how it is addressing hazards and climate change impacts citywide and how different efforts relate to each other. As a result, residents and other stakeholders may not understand if/how the City is working to increase resilience and how they can participate.
LEAD: ORCP PARTNERS: Planning, Port, SFE, DPH, SFPUC	STRATEGY SUMMARY: Department Public Information Officers will create coordinated messaging, content, and materials that communicate citywide climate resilience efforts. Materials may include FAQs, presentation slides, and handouts/pamphlets. These materials will augment communications for projects relevant to climate resilience so that it is clearer to the public how they relate to the citywide framework for action. Existing organizations, associations, and informal networks will assist in dissemination of information, reaching communities at the hyper-local level. Interfacing with the NEN Healthy Homes Program and specifically targeting vulnerable populations, such as SRO occupants, should also be components.	
COST: Low: \$0–500K	SF GOVERNMENT ACTIVITY: Research, Planning & Guidance	STATUS: New
            		

C-5.18 Improve San Francisco's climate health research capacity		
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: This strategy seeks to address all climate change-related hazards by understanding their impact on behavioral health and children/youth, while also better identifying and filling gaps in the City's emergency response Critical Partner's List.
LEAD: DPH PARTNERS: Varies	STRATEGY SUMMARY: Interventions to protect the public from the health impacts of climate change-related hazard events will be most successful if based on data-informed research and best practices. The SF Climate and Health Program has developed a range of resources. As the health impacts of climate change become more significant, it is important that San Francisco's climate health research capacity scales appropriately. As climate change advances, research is an essential pursuit to ensure that the City can be proactive in protecting residents from its impacts.	
COST: Low: \$0–500K	SF GOVERNMENT ACTIVITY: Research, Planning & Guidance	STATUS: Scaling
            		

DOMAIN: RESILIENT COMMUNITIES (C)















Primary Hazard Group: All Hazards














C-5.19 Develop and implement a Centralized Air Quality and Extreme Heat Preparedness campaign			
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: This strategy would improve overall outreach and education coordination in the City and with media and community group partners. This will improve the effectiveness of City messaging, reduce public confusion in emergencies and ignorance of hazards, and build capacity citywide for preparedness efforts.	
LEAD: DPH PARTNERS: DEM, ORCP, CBOs, SFE, Public Works, PIOs, Public Government Affairs Staff		STRATEGY SUMMARY: This strategy seeks to improve community engagement and education efforts. A centralized Air Quality and Extreme Heat Preparedness campaign, would partner with community-based, City, and regional partners to unify messaging around health impacts, vulnerable populations, preparedness best practices, and available emergency and information services.	
COST: Low: \$0–500K		SF GOVERNMENT ACTIVITY: Research, Planning & Guidance	STATUS: New
            			

C-5.20 Implement SFMTA's Traffic Signals Strategy			
KEY PLANNING ISSUES: Transportation		VULNERABILITY ADDRESSED: The roadway depends on electric power for lights and signals and for the overhead power lines of the electric trolley system.	
LEAD: SFMTA PARTNERS:		STRATEGY SUMMARY: The purpose of this strategy is to increase the resilience of the City's traffic network by upgrading traffic signals and signal infrastructure and by mitigating risks. Traffic signals are integral to the smooth functioning of the transportation system. By upgrading, renovating, and replacing traffic signals and signal infrastructure, this strategy will improve mobility, improve communication in an emergency event, and increase the safety of San Francisco roadways. Funding for this strategy is included in the FY2019–FY2023 Capital Improvement Program.	
COST: Medium: \$500K to \$5M		SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: Sustaining
            			

DOMAIN: RESILIENT COMMUNITIES (C)

Primary Hazard Group: All Hazards

C-5.21		Improve and prepare behavioral health services for hazard events	
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: Studies have shown that 25 to 50% of people exposed to natural hazard events are at an increased risk of experiencing anxiety, PTSD, and suicide. As climate change increases the frequency of hazard events, we must scale our behavioral health services to balance these increased demands with our current needs.	
LEAD: DPH PARTNERS: DEM, HSH NEN, MOD, CBOs, DAAS		STRATEGY SUMMARY: The objective of this strategy is to review current San Francisco Department of Public Health plans that support the demand for behavioral health services before, during, and after hazard events, and, as appropriate, identify additional activities to help ensure local behavioral health services are able to be scaled to meet this increased demand.	
COST: Low: \$0–500K		SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: Sustaining
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C-5.22		Continue to build trust between the Police Department and the communities they serve	
KEY PLANNING ISSUES: N/A		VULNERABILITY ADDRESSED: Strong relationships between the police and the community are critical to preparing and recovering from hazards. The Department of Justice (DOJ) identified the need to improve trust in the San Francisco Police Department (SFPD) through better community policing and engagement, enhanced accountability, reductions in biased policing, revised practices in the uses of force, and hiring and recruitment strategies reflective of San Francisco's diversity.	
LEAD: SFPD PARTNERS: CBOs	STRATEGY SUMMARY: As first responders, it is important that law enforcement officers develop strong relationships with communities before a disaster strikes. Implementing the recommendations made by the DOJ along with other efforts to build trust between the SFPD and all communities is vital to effective disaster mitigation, response, and recovery.		
COST: TBD		SF GOVERNMENT ACTIVITY: Community Services Delivery	STATUS: Sustaining
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7.5 Additional Strategies for Consideration

During the strategy development process, additional strategies were suggested that the City will continue to consider for implementation in subsequent Plan updates. These may be longer-term strategies or strategies that do not yet have a clear implementation path for the next five years.

Additional Strategies

Recommended Lead	Strategies for Consideration
SFMTA/CTA	Engage private transportation providers, such as transportation network companies (TNCs), micro-mobility companies, and shuttles regarding operations during a hazard event, especially to prioritize vulnerable people.
SFMTA/CTA	Improve transit affordability, especially during a hazard event, such as free public transit on Spare the Air Days.
SFCTA/Planning	Inventory multi-hazard vulnerability and risk assessments for regional transit systems serving San Francisco and co-create a regional hazard mitigation plan with relevant agencies.
MOD	Develop an inventory of accessible vehicles and a coordinated plan to share resources during a hazard event.
DT	Improve the technology and security of the Outdoor Public Warning System.
SFMTA	Continue to implement Vision Zero to improve the safety of city streets.
DBI/Planning	Streamline the permitting process for buildings to make resiliency-related improvements.
DPH/SFPUC	Better understand and mitigate the potential risks surrounding toxic waste and flooding and communicate that information to the public.
MOHCD/Rent Board	Develop strategies to address the vulnerability of renters to displacement following a major disaster.
Planning/SFE	Develop and apply an ecosystems services framework to climate adaptation plans and investments.
HSA/MOD/DPH	Coordinate with residential property managers that serve vulnerable populations to systematize how residents with access and functional needs are identified, how property managers use that information to conduct wellbeing checks, and how property managers communicate information to emergency responders.

Port	Understand the flooding risk of industrial facilities on the waterfront and develop resilience strategies, especially to prevent contamination.
DPH/Real Estate	Improve the resilience of the City's leased facilities to better serve the public during hazard events
Port/DBI/ORCP	Conduct groundwater data collection and modeling efforts to better understand the impacts of rising groundwater at the shoreline, including liquefaction risks.
RPD/SFPUC	Explore opportunities for stormwater catchment and non-potable reuse by considering the use of larger structures such as cisterns for lower-elevation areas within parks
Planning	Review and update the General Plan as needed to support climate resilience throughout the city.
Planning/SFE/SFPUC	Develop a Cool and Living Roof initiative for extreme heat.
SFMTA	Implement the Communications & IT Vision: Disaster Recovery/Continuity Plan.
SFMTA	Implement Security Vision: Market Street Natural Hazard Mitigation, Threat and Vulnerability Assessment Implementation, Subway Flooding Prevention, Preparedness, and Mitigation, and Incident Management Planning and Response.
SFMTA	Implement State of Good Repair & Asset Management Vision: Develop Phase II & III of the 10-Year Asset Management Strategy.
SFMTA	Implement parking facility structural and seismic upgrades.
SFMTA	Scale Building Progress Program: modernize municipal yards and facilities.