

Chapter 03

San Francisco Risk Landscape



This chapter sets the scene for the subsequent hazard analysis, risk assessment, and strategy sections by describing the demographics, geography, and economy of the City and County of San Francisco. It also includes an overview of the assets at risk.

3.1 Geography

Overview

The City and County of San Francisco includes a peninsula surrounded by the Pacific Ocean on the west and the San Francisco Bay on the east, as well as the Treasure, Yerba Buena, and Farallon Islands. San Francisco sits north of San Mateo County, and it is separated from Marin County to the north by Golden Gate strait and Alameda County to the east by the San Francisco Bay. Located about 30 miles off the Pacific coast of San Francisco, the rocky and uninhabited Farallon Islands are a National Wildlife Refuge, and were originally established as a refuge for native birds in 1909 by Theodore Roosevelt.¹ Treasure and Yerba Buena Islands are located in the San Francisco Bay. Yerba Buena is a natural rocky island connected to the artificial Treasure Island, which was constructed in 1936 and was subsequently used for military operations. Treasure Island was recently redeveloped for housing and commercial use. The City and County covers approximately 47 square miles of land and 185 square miles of water, and has nearly 30 miles of shoreline.²³

Natural Geography

San Francisco has a unique natural geography. Before the peninsula was developed, San Francisco featured numerous rocky hills cutting through miles of sand dunes to the north and west, and marshes and mudflats to the east along the Mission Creek and Islais Creek watersheds. San Francisco's sand dune ecosystem was the largest in the western hemisphere, stretching seven miles from Ocean Beach to the Financial District.⁴ Mission Creek and Islais Creek fed the two largest creek and marsh watershed systems. Today, these creeks are largely capped, with landfill developed over what was once large swaths of wetland at the mouth of both creeks.⁵ Despite the extensive infill and development of land and port area along the City's northern and eastern shorelines, there still exists important saltwater wetland habitat, including Heron's Head Park, Crissy Field, Yosemite Slough, and edges of the Mission Creek and Islais Creek channels,

¹ <https://www.gpo.gov/fdsys/pkg/FR-2005-05-31/pdf/05-10718.pdf>

² <https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk>

³ <https://www.sftravel.com/article/san-francisco-fact-sheet>

⁴ <https://sfenvironment.org/ecosystems/overview/ecosystems>

⁵ <http://explore.museumca.org/creeks/SFTopoCreeks.html>

which protect the coastline from severe weather, help to filter water pollutants, and provide habitat for hundreds of plant, bird, and fish species.⁶

Built Geography

San Francisco has been inhabited for more than 10,000 years, and was inhabited by the Ohlone people since about 740 AD. The Ohlone people in what is now San Francisco had dozens of village sites and practiced regular burning of the landscape to promote a plant and animal ecology that provided a regular food supply.⁷ More drastic changes in the built landscape began to occur in the late 1700s when the Spanish came to occupy the peninsula, and developed settlements, missions, and military outposts.

In 1848, San Francisco became a part of California, and through the late 1800s San Francisco grew into a major city, overlaying a grid system on the city's steep hills, and pushing development further westward toward the ocean. During this time that the waterfront was developed and the massive seawall was built, creating hundreds of acres of prime real estate on the northern and eastern shoreline.⁸ It was well into the middle of the 20th century that development of the Sunset District erased the last large swath of sand dunes in the west, and set the overall city building footprint we see today.⁹

Residential neighborhoods continue to dominate the western and southern districts, while the financial district and civic center in the northeastern quadrant form the economic engine of the city. The southeast quadrant contains the majority of the city's industrial use, including many city assets that support critical infrastructure operations, such as wastewater and mobility.

Future Development

Treasure Island, Mission Bay/SOMA, and Bayview Hunters Point have all seen and will continue to see tremendous growth and development over the next decades. These neighborhoods are all vulnerable shoreline communities located on landfill that could face serious challenges in the event of natural hazards, such as earthquakes and

⁶ <https://sfenvironment.org/ecosystems/overview/ecosystems>

⁷ <https://www.nps.gov/prsf/learn/historyculture/indigenous-period.htm>

⁸ <https://sfport.com/port-history>

⁹ http://www.foundsf.org/index.php?title=The_Sunset_District:_From_Dunes_to_Cityscape

flooding. In addition, the San Francisco seawall is undergoing initial planning for restoration, providing another opportunity for structural and environmental changes along the shoreline in the coming years. Where and how to develop affordable housing and middle-class jobs remains a pressing issue, and is likely to be the guiding force for development in the foreseeable future.

3.2 Demographics

Resident Population

San Francisco is the 2nd densest large city in the U.S. after New York City, with a population of more than 884,000 on less than 50 square miles of land. The city's population has seen a nearly 10% increase since 2010, and is projected to reach more than a million people by 2040.¹⁰

Non-Resident Population

In addition to residents, San Francisco hosts thousands of commuters and visitors each day. A 2010 American Community Survey report estimated a 21% population increase during the weekdays from commuting.¹¹ SF Travel also estimates an additional daily influx of 69,000 people who come to visit San Francisco for tourism or business travel, putting the City's daytime population at more than 1.1 million on average.¹²

Demographic and Socioeconomic Characteristics

Among all of San Francisco's residents, commuters, and visitors, certain populations are especially vulnerable in the event of a natural hazard. These include children and seniors, racial and ethnic minorities, people with pre-existing health conditions, and people with low income. More detailed descriptions of these groups and others can be found in the Vulnerable Populations section of the Vulnerability and Consequence Assessment in Chapter 05. The following provides broad descriptions of San Francisco residents' age, racial and ethnic composition, pre-existing health conditions, and income.

¹⁰ https://mtc.ca.gov/sites/default/files/2-The_Bay_Area_In_2040.pdf

¹¹ <https://www.census.gov/content/dam/Census/library/working-papers/2010/demo/top20-commuter-pop-change.pdf>

¹² <https://www.sftravel.com/article/san-francisco-fact-sheet>

Age: Compared to California and the U.S. overall, San Francisco has greater variance in population age, with the highest proportion of residents in their thirties and just 13% of the population under 18 (compared to 23% in California and the US). Less than 5% of the population is under 5 years of age, and 15% are 65 years and over.¹³ The very young and older adults are more vulnerable relative to the rest of the population due to their increased medical sensitivity, higher rates of dependency on others, and reduced levels of mobility. Over the next decades, the proportion of older adults in San Franciscans will increase substantially. By 2030, San Franciscans age 60 and over are projected to make up 27% of the population; by 2060, the percentage of San Francisco residents age 85 and over is projected to increase by about 400% since 2010.¹⁴

Racial and ethnic composition: The U.S. is projected to become majority people of color in the mid-2040s, a milestone passed in the Bay Area in the 2000s. In the region, Hispanic and Asian populations are steadily increasing, and white non-Hispanic and black population shares have been falling.¹⁵ In 2017, San Francisco's racial and ethnic composition was as follows: 4% two or more races, or a race not listed by the American Community Survey; 5% black; 15% Hispanic (of any race), 34% Asian; and 41% white (not Hispanic).¹⁶ White households represent 50% of total households in San Francisco.¹⁷ Black populations have declined very rapidly to less than half their proportion in 1990. Without action, black populations are projected to continue to decline, and San Francisco is the only county in the Bay Area where white populations are projected to increase in future decades.¹⁸

Pre-existing health conditions: The U.S. Census classifies disability by six types: hearing difficulty, vision difficulty, cognitive difficulty, ambulatory difficulty, self-care difficulty, and independent living difficulty. For non-institutionalized San Francisco

¹³ American Community Survey 2017 5-Year Estimates, Table DP05. <http://factfinder.census.gov> (2019)

¹⁴ State of California, Department of Finance, *P-2 County Population Projections by Age, 2010-2060*. Sacramento, California, May 2019.

¹⁵ https://nationalequityatlas.org/sites/default/files/Final_9_County_BayAreaProfile.pdf

¹⁶ American Community Survey 2017 5-Year Estimates, Table DP05. https://factfinder.census.gov/bkmk/table/1.0/en/ACS/17_5YR/DP05/0500000US06075 (Accessed 2019)

¹⁷ American Community Survey 2017 5-Year Estimates, Table S1903. https://factfinder.census.gov/bkmk/table/1.0/en/ACS/17_5YR/S1903/0500000US06075 (Accessed 2019)

¹⁸ <https://bayareaequityatlas.org/indicators/race-ethnicity>

residents, nearly 11% of the population has a disability in one or more of these categories.¹⁹ Black and American Indian populations experience disability rates higher than the citywide rate, the rate for black populations is greater than 20%.²⁰ Additionally, over one third of populations aged 65 and over experience disability. This age group has especially high rates of ambulatory difficulty (24%) and independent living difficulty (20%).²¹

Those living with chronic diseases are also at heightened vulnerability during a hazard event. In addition to being medically sensitive, these individuals may rely on access to pharmaceuticals and/or medical facilities. 6.6% of adults in San Francisco have diabetes, 5.3% have heart disease, and 15.2% have asthma.²² Black populations have much higher rates of these chronic diseases and have higher hospitalization rates. In 2014, black San Franciscans had 39.5 age-adjusted asthma hospitalizations per 10,000 residents, compared to 8.4 per 10,000 residents for Hispanic populations, which had the next highest hospitalization rate followed by Asian and white residents.²³

Income: In 2017, American Community Survey 1-year estimates for median income per household in San Francisco was \$110,816 (+/- 3,045),²⁴ with 5-year estimates at \$96,265 (+/- \$1349).²⁵ Median household income varies significantly by race and ethnicity. White non-Hispanic households have the highest median income of over \$120,000/year, and black households the lowest at around \$30,000/year.²⁶ Similar

¹⁹ American Community Survey 2017 5-Year Estimates, Table S1810.

https://factfinder.census.gov/bkmk/table/1.0/en/ACS/17_5YR/S1810/0500000US06075 (Accessed 2019)

²⁰ Ibid

²¹ Ibid

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<http://www.sfhip.org/?module=indicators&controller=index&action=indicatorsearch&doSearch=1&i=&l=275&primaryTopicOnly=&subgrouping=1&card=0&handpicked=0&resultsPerPage=150&showComparisons=1&showOnlySelectedComparisons=&showOnlySelectedComparisons=1&grouping=1&ordering=1&sortcomp=0&sortcompIncludeMissing=>

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<https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHIB/CPE/CDPH%20Document%20Library/County%20profiles/San%20Francisco%202016%20profile.pdf>

²⁴ American Community Survey 2017 1-Year Estimates, Table S1901.

https://factfinder.census.gov/bkmk/table/1.0/en/ACS/17_1YR/S1901/0500000US06075 (Accessed 2019)

²⁵ American Community Survey 2017 5-Year Estimates, Table S1903.

https://factfinder.census.gov/bkmk/table/1.0/en/ACS/17_5YR/S1903/0500000US06075 (Accessed 2019)

²⁶ Ibid

disparities persist when looking at poverty status and race and ethnicity. While less than 12% of all San Franciscans were under the poverty line, over 30% of black or African American populations and between 13-28% of Pacific Islander populations were below the poverty level.²⁷ The City has a high rate of inequality with a Gini coefficient of .519 (the closer to 1, the closer to perfect inequality). This rate has steadily increased over the past decade, and is higher than both California's and the US's coefficients of .488 and .48 respectively.²⁸ To put this in perspective, according to the CIA World Factbook's rankings, if San Francisco were a country it would rank as the 11th most unequal country in the world.²⁹

3.3 Economy

History

The California gold rush, the development of the transcontinental railroad, and a location on the Pacific Ocean helped San Francisco emerge as the economic engine of the west in the late 1800s. These factors facilitated opportunities for domestic and international trade, as well as migration, and many businesses that began in that time, such as Levi's, Ghirardelli's, and Wells Fargo, continue to be mainstays of the City's economy. The 1990s saw the beginning of the tech boom in the Bay Area, and this industry continues to fuel San Francisco's growth today.³⁰

Current and Projections

Today, San Francisco is a global economic force. San Francisco serves as the headquarters for 12 Fortune 1000 companies,³¹ and the City boasts the 2nd strongest economy in 2018, fueled by a booming tech industry that is buoyed by enormous venture capital investment.³² Biotech and life sciences industries in particular are

²⁷ American Community Survey 2017 5-Year Estimates, Table S1701.

https://factfinder.census.gov/bkmk/table/1.0/en/ACS/17_5YR/S1701/0500000US06075
(Accessed 2019)

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<http://www.sfhip.org/indicators/index/view?indicatorId=288&localeId=275&comparisonId=7227>

²⁹ <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2172rank.html>

³⁰ <http://sfced.org/why-san-francisco/a-brief-history/>

³¹ <https://littlesis.org/lists/38-fortune-1000-companies-in-san-francisco/members>

³² <https://www.businessinsider.com/san-francisco-area-best-us-economy-2018-4>

expanding quickly in SOMA and Mission Creek's development zones.³³ 70% of San Franciscan adults have training beyond high school, and almost 50% speak at least two languages, highlighting the diversity and skill of San Francisco's labor market.³⁴

San Francisco's major industries include technology, finance, and tourism. In the past decade, San Francisco regularly achieved the top spot in the nation as the fastest growing high-tech job market, and today the City is home to more than 300 IT firms that employ approximately 66,800 IT workers.³⁵³⁶ San Francisco is also the birthplace of the biotech industry and the location for nearly 300 biotech firms that benefit from relationships with programs at UC San Francisco, University of San Francisco, UC Berkeley, and Stanford. Venture capital for biotech in the Bay Area is second only to the software industry.³⁷

San Francisco is considered the financial capital of the west, with securities and investments making up a sizeable portion of the City's professional service economy.³⁸

In addition to the economic contributions of tech and finance, the tourism industry provides more than \$9 billion in visitor spending annually to San Francisco's economy, with more than 81,000 jobs supported by tourism in 2017.³⁹

Production, distribution, and repair (PDR) jobs are particularly important to provide employment to a broader swath of San Franciscans that are not in the professional and tech industries. PDR firms are often able to provide training on the job, as well as provide jobs that do not require advanced degrees. While the manufacturing sector in San Francisco has declined precipitously since the dot-com bust (65% reduction in employment from 1990-2015), the number of jobs has begun to stabilize and make small gains since 2010.⁴⁰ In particular, the food and beverage, apparel, and advanced manufacturing industries have made strides in growth and interest.⁴¹

³³ <http://sfced.org/why-san-francisco/a-brief-history/>

³⁴ <https://oewd.org/why-choose-sf>

³⁵ <http://sfced.org/san-francisco-named-number-1-high-tech-job-growth-market/>

³⁶ <http://sfced.org/why-san-francisco/sectors/information-technology/>

³⁷ <http://sfced.org/why-san-francisco/sectors/life-sciences-biotech/>

³⁸ <http://sfced.org/wp-content/uploads/2017/02/Financial-Professional-Services-Pitch-Sheet-2017.pdf>

³⁹ <https://www.sftravel.com/article/san-francisco-travel-reports-record-breaking-tourism-outcomes-2017-gives-projections-2018>

⁴⁰ <http://www.vitalsigns.mtc.ca.gov/jobs-industry>

⁴¹ http://oewd.org/sites/default/files/Documents/Make_to_Manufacture%20%282%29.pdf

Infrastructure Systems

Economic operations and growth depend on the many complex infrastructure systems that allow firms and consumers to maintain communications, transportation, energy, food, water, and sanitation. The following summarizes those systems that provide critical interconnections, namely transportation and communications. A more detailed explanation of city infrastructure is in Appendix A.

San Francisco is a part of a regional transportation system that depends on the coordination of several agencies to facilitate travel within a regional economy. In 2016, Bay Area residents boarded transit services (including rail, bus, and ferry) about 1.8 million times on a typical weekday.⁴² These many services, including Muni, BART, Gold Gate Ferry, AC Transit, Caltrain, and Amtrak among others, provide critical transportation to both commuters and visitors.

Trucking, maritime transport, and airlines are also critical to regional goods movement, providing materials through supply chains as well as delivering finished goods to stores and consumers. In 2014, goods movement dependent industries accounted for a little more than half of San Francisco Bay regional economic output, and nearly a third of regional employment.⁴³ San Francisco's Port is an important part of regional goods movement, importing and exporting nearly 1.4 million tons of cargo in 2017.⁴⁴ San Francisco's airport, SFO, is a critical asset, not only as a large international airport for passengers, but also as the primary international air cargo hub for the region.⁴⁵ All forms of transportation require fuel and energy sources, as well as physical infrastructure, to operate, which may be vulnerable during a natural hazard event.

Telecommunications are critical for normal economic, civic, and healthcare operations as well as emergency response. Residents, businesses, and government agencies rely more than ever on data networks and the City has invested in the construction of more than 240 miles of fiber optic to ensure connection to critical public safety services, and has extended WiFi connection to dozens of parks, libraries, SFO, public schools, public

⁴² <http://www.vitalsigns.mtc.ca.gov/transit-ridership>

⁴³ http://www.dot.ca.gov/hq/tpp/offices/ogm/regional_level/FR3_SFBAFMS_Final_Report.pdf

⁴⁴ <https://sfport.com/sites/default/files/Maritime/Docs/Tonnage%20Report.pdf>

⁴⁵ http://www.dot.ca.gov/hq/tpp/offices/ogm/regional_level/FR3_SFBAFMS_Final_Report.pdf

housing, and Market Street.⁴⁶ A plan is in place to expand the fiber optic network to all residents, with free access to those below the poverty line, beginning in 2020.⁴⁷

3.4 Assets

This section describes the asset sectors (key areas) and assets at risk that form the basis of the asset-based vulnerability assessment described in Chapter 05: Vulnerability and Consequences Assessment; i.e., those assets that are evaluated with full results and in-depth analysis presented in Appendix A. These assets span both public and private ownership but share an essential characteristic, they are essential to ensuring the delivery of vital services to the general public. These assets are segmented into different sectors for communication to relevant stakeholders (public stakeholders, City staff and decision makers, etc.).

People

Vulnerable Populations

Vulnerable populations refer to individuals within the city that are more susceptible to impacts from hazards because they have specific pre-existing conditions. Resilience in the face of hazards, particularly those influenced by climate change, are rooted in an interconnected set of conditions. Many of these are structurally determined, such as socioeconomic status, but others are particular to each individual, such as the prevalence of pre-existing health conditions. It's important to assess and understanding the ways that hazards can impact different particular groups in order to create more nuanced programs and strategies that consider the unique needs of different populations within the city.

Emergency Response Facilities

Critical Response Facilities

Critical response facilities are facilities that provide direct life safety, property, and environmental protection services essential to communities during and after an emergency or disaster. These include direct service facilities such as the city's police

⁴⁶ <http://tech.sfgov.org/sites/default/files/Document/SFDT%20CONNECTIVITY%20PLAN.PDF>

⁴⁷ <http://tech.sfgov.org/fiber>

and fire department buildings as well as facilities responsible for strategic coordination, known as the Emergency Operations Center (EOC) and the Departmental Operations Centers (DOC).

Hospitals

Hospitals provide life-saving and life-sustaining services to protect the health and well-being of all San Francisco residents. These include a number of hospital facilities that operate across the city.

Other Emergency Sites

These assets are composed of the numerous public and private locations that are essential in supporting the cities communities during and after an incident. These include indoor/outdoor shelter sites for those displaced during events, the animal care and control facility that will be essential in managing the animal population of the city, as well as resource staging areas to potentially be used following a hazard event.

Public and Community Services

Municipal Buildings and Facilities

This asset class includes municipal offices, correctional facilities, and city-owned cultural centers, museums, and performance halls. These facilities serve the community in many different capacities and some have unique cultural and economic value while the services rendered out of these buildings and facilities cannot be easily replaced (in some instances).

Municipal Yards

Many departments in the City are responsible for providing numerous sustained services (such as public transit or access to parks). This necessitates unique maintenance and storage needs for vehicles and equipment which the City accommodates through the operation of specialized facilities. The San Francisco Public Works, San Francisco Municipal Transportation Agency, the Port of San Francisco, and the Recreation and Park Department all have yards that fall under this category of facility and are listed under this asset class.

Health Care Facilities

Formal hospitals are not the only facilities in San Francisco that provide life-saving and life sustaining services, rather there are a wide range of facilities that also provide similar or more specialized services that maintain the health and wellbeing of the city's residents. Primary care clinics, skilled-nursing facilities, pharmacies, and residential care facilities for the elderly all play a critical role in response to hazard events while also often acting as a point of service for some of the most vulnerable people in the city.

Food Distribution

Food distribution is composed of the numerous wholesale suppliers, grocery stores and charitable food distribution facilities that regulate the flow of food to communities throughout the city, provide food services for vulnerable populations, and ensure everyday access to this vital resource.

Education Institutions

Educational institutions include public and private K-12 schools, as well as public and private colleges and universities spread across the city. K-12 institutions are vital in that they provide education, nutrition, and basic health care to children and youth, including those who may be more vulnerable to climate impacts because of existing disparities. Higher education institutions provide career services, confer degrees, and foster research, in addition to providing nutrition, housing, and health services to many of their students. Education institutions are also major employers, especially large universities.

Community Centers

Community centers provide a location where community members can obtain resources and information, and participate in spiritual, educational, recreational, and/or political activity. These include libraries, recreation centers, senior centers, youth centers, neighborhood centers, and faith-based centers. Community centers are run by the City, NGOs and places of worship, and many are a part of organizational networks, such as the YMCA. Some are large facilities that contain fitness, open space, and kitchen amenities. Others operate in small to medium sized commercial properties or in traditional building types for places of worship. These facilities are essential to community cohesion and often offer vital services to the residents of San Francisco.

Housing

The housing stock of San Francisco ranges from simple older buildings built over a century and a half ago, to complex, modern high-rises. This variety in form supports the wide variety of people that rely on these buildings for their housing needs. Variety is also seen on the quality and affordability of this housing stock which has notable implications for the ability of this housing to withstand hazards.

Business and Industry

Commercial

Commercial buildings make up a significant portion of the city's economy and are notable in contributing the economic health and well-being of the city. These buildings consist of offices, retail spaces, hotels, and mixed-use properties. They can typically be found broadly across the entire city, however, they are densely concentrated in the Northeastern corner of the city.

Industrial

Industrial buildings are known as production, distribution, and repair building types. These buildings are often used for industrially intensive businesses, such as waste management or Port facilities. These businesses often support low-income workers and are geographically concentrated in the east and southeast neighborhoods of the city. The majority of these are privately owned.

Maritime

The maritime uses of the Port of San Francisco range significantly over the shoreline properties that it leases, manages, or directly operates for commercial and industrial activity. These consist of a series of shoreline piers on parcels along the eastern coast of the city. A variety of fishing, police, recreational, research, cruise shift terminal, cargo, and heavy industrial uses occupy these properties and, due to their proximity to the shoreline, they are particularly vulnerable to many hazards exacerbated by climate change. These assets also play an essential role in disaster response.

Contaminated Lands

Historical land use and development of the city, before the enforcement of modern environmental regulations, has left a legacy of contaminated lands in areas of the cities. Furthermore, these lands can often geographically coincide with vulnerable communities of color, due to patterns of environmental racism historically seen in this country. The City of San Francisco recognizes the need to vet, and ensure, that land slated for development has been adequately evaluate soil condition in advance of development. These lands are subject to a variety of local and federal programs based on previous ownership, contamination type, and remediation needs. Many of these areas can be found on land that was previously federally owned such as areas in Bayview Hunter's Point and Treasure Island.

Hazardous Materials Sites

Hazardous materials facilities are those that generate, store, transport, or treat any of the following kind of materials: radioactive, flammable, explosive, toxic, corrosive, or unsafe in other ways. These are often facilities such as gas stations, paint supply stores, manufacturing facilities, or other businesses that use these materials to provide a variety of goods and services. These facilities can be publicly or privately owned, and are strictly regulated through enforcement of state provisions by the San Francisco Department of Public Health Hazardous Materials and Waste Program.

Transportation

Roadways

Roadways facilitate residents, workers, and visitors traveling within and through San Francisco, which supports economic activity, goods movement, and quality of life. The roadway network links people with community facilities and services, jobs, family and friends, recreation, and other destinations within the city and throughout the Bay Area region. Roadways as an asset class includes traditional roads, bicycle and pedestrian infrastructure, on-street parking, and bridges (state and local). Roadways are integral to transportation, access, and connectivity throughout the city even though they are managed by a variety of local, state, and federal agencies.

Parking

Parking garages are multi-story concrete parking structures. Rather than being spread throughout the city, they are concentrated largely in the Northeastern part of the city. This asset refers to the public garages owned by the city but managed by a variety of different departments.

Transit Network

The transit network facilitates the movement of residents, workers, and visitors traveling within and through San Francisco, supporting economic activity and quality of life. This is essential to connecting San Francisco's residents with services, jobs, family, recreation opportunities, and other destinations locally and regionally. The transit network includes systems managed by a variety of public entities, these include: SFMTA's Muni system, BART, Caltrain commuter rail, AC Transit, Sam Trans, and Golden Gate Transit.

Water Transportation

Water transportation consists of ferries, water taxis, and facilities for the docking of private vessels and motorized/non-motorized boats. This asset also includes the Ferry terminals, gangways, and external services required for the effective operation of these facilities. Ferry services are provided by the Water Emergency Transportation Authority (WETA), Golden Gate Ferry, Blue and Gold, and many smaller operators and not only are these valuable for everyday operation.

Airport

The San Francisco Airport is the largest of three airports in the Bay Area and provides a significant amount of commercial air travel to the region. The airport is located 11 miles outside of the City and County of San Francisco to the south, in San Bruno. This facility covers a vast area, predominately composed as reclaimed land through the filling of the Bay, and has a number of sophisticated utility systems and a large number of buildings to facilitate its day to day operations. These include the airfields, air traffic tower, terminals, utilities, and supporting structures required to process the large volume of air travel handled by the airport on a daily bases.

Utilities and Infrastructure

Power

Access to electrical power is essential to the continued operation of the communities of San Francisco. Many of the other assets listed in this chapter are heavily dependent external services, such as power, for their continued operation and to provide the goods and services that the city relies on. To achieve this provision, a combination of generation sources, substations, transmission lines, transmission poles and distribution lines are networked across the city. While distribution lines span the whole city, a large amount of this infrastructure is concentrated along the eastern edge of the city.

Natural Gas

While the city is committed to moving towards the phase out of natural gas as an energy source, in recognition of its commitments to addressing the climate crisis, many communities rely on natural gas for commercial, industrial, and domestic uses. Natural gas use is facilitated by a network of infrastructure production (originating out of state), interstate transmission lines, intrastate transmission lines, distribution lines, and natural gas stations spread across the city but predominantly located in the Southeast. This infrastructure is managed by Pacific Gas & Electric (PG&E), which is regulated primarily by the California Public Utilities Commission (CPUC).

Potable Water

The potable water system delivers water from a sophisticated, regionally connected collection of resources in order to meet the needs of San Francisco residents and businesses. Distribution pipelines, storage reservoirs, and groundwater well sites are essential components of the system. Operation of the system involves the use of pumping stations, geographically spread across the city, moving water over a range of elevations to serve a wide range of users. San Francisco's Public Utilities Commission (SFPUC) Water Enterprise is responsible for managing the transmission, treatment, storage and distribution of potable water in the City and County of San Francisco.

Emergency Firefighting Water System

The Emergency Firefighting Water System is a high-pressure firefighting water system was created to safeguard lives and property in the case of future earthquakes. It spans

the breadth of the city, covering the east side extensively, with improvements to the Westside and Southern areas currently being identified for implementation. This system is essential to combatting large urban fires that may occur following a significant earthquake hazard event. The system is composed of reservoirs/tanks as the primary supply of water, however, it can also access water from the Bay as a secondary source through the use of pumping stations, manifolds, and drafting points. While the system is operated by the San Francisco Fire Department, it is managed by SFPUC.

Combined Sewer

San Francisco's combined sewer system treats combined wastewater from the stormwater runoff and sewage generated by the city in order to service the waste produced by the cities communities. Using gravity and an interconnected web of combined sewers, tunnels, and transport/storage boxes to intercept, store, and convey combined sewer flows throughout the City. Where gravity isn't sufficient to move this water around the system, or where weather conditions require the use of different facilities, force mains and pumping stations move wastewater to its eventual destination at one of three treatment facilities. Following treatment to nationally permitted standards, effluent is either discharged to the Pacific Ocean on the Western/Pacific shoreline or discharged to the Bay through outfalls located along the Bayshore. The system has a variety of components essential to its operation, ranging from sewer pipes and tunnels to the treatment plants that treat the water for discharge.

Shoreline Protection Infrastructure

Shoreline infrastructure provides a critical function to much of the city, including flood protection during storms and extreme tide events, habitat, recreation opportunities, and public access. It also supports key utility and transportation infrastructure, including BART, Muni, the Port maritime facilities and ferry transportation. During an emergency it supports emergency response and recovery operations. Shoreline protection around San Francisco is made up of a variety of shoreline types and conditions, including beaches and bluffs along the western and northern shoreline of San Francisco, which fronts the Pacific Ocean and structural protection in many forms along the eastern and southern shorelines of the city along the San Francisco Bay. The majority of San Francisco's shoreline protection infrastructure is owned by public agencies, including the Port of San Francisco and the Department of Parks and Recreation; and the National Park Service.

Communications

The City's communications asset class transmits voice, video and data communications by fiber infrastructure, cellular and radio communications, and inside wired infrastructure. San Francisco Department of Technology (SFDT) manages a wide array of communications systems including radio, TV, internet, City internal data network, public warning sirens, emergency call boxes, communication path for traffic signals and the Mayor's Emergency Telephone Systems (METS). In some instances, these communication channels leverage private communications operators' fiber networks and internet service. Key City owned systems include the municipal fiber optics network, data centers, and the 800Mhz radio system. Private communications systems are owned by a wide range of operators, including Verizon, AT&T, T-Mobile, also Comcast and these provide redundant access to the Internet for municipal services.

Open Space

Parks and Open Space

Equally as important as the buildings and infrastructure that make up our cities are the recreation and open space that stitches together our communities. These areas make significant contributions to the quality life of community residents and provide locations for recreation, activity, and peace and enjoyment from the sometimes over stimulating aspects of living in a thriving built environment. In addition, these spaces provide natural areas for native species to thrive, contribute to the environmental health of the city, and provide benefits to climate adaptation through the provision of ecosystem services. Scattered around the city, these areas are managed primarily by public agencies including federal, state, and local entities.