1.1.4 Values at Risk to Be Protected

Values at risk, broadly defined, are tangibles of significant importance or value to the community or jurisdiction potentially at risk of harm or damage from a hazard occurrence. Values at risk typically include people, critical facilities/infrastructure, buildings, and key economic, cultural, historic, or natural resources.

People

Residents, employees, visitors, and travelers in a community or jurisdiction are vulnerable to harm from a hazard occurrence. Particularly vulnerable are specific at-risk populations, including those unable to care for themselves or self-evacuate in the event of an emergency. At-risk populations typically include children less than 10 years of age, the elderly, people housed in institutional settings, households below the federal poverty level, and people living unsheltered. The following table summarizes key demographic data for Los Angeles.

Table 16—Key Demographic Data – Los Angeles

Demographic	2022
Population	**3,903,648**
Under 10 years	11.80%
10 – 14 years	5.90%
15 – 64 years	68.60%
65 – 74 years	7.90%
75 years and older	5.90%
Median age	35.8
Daytime population	3,948,032
Housing Units	**1,513,840**
Owner-Occupied	34.80%
Renter-Occupied	58.90%
Vacant	6.30%
Average Household Size	2.67
Median Home Value	$736,691
Ethnicity	
White Only	34.10%
Black/African American Only	8.50%
Asian Only	12.30%
Other/Two or More Races	45.10%
Hispanic/Latino Origin	47.00%
Diversity Index	87.7
Education (population over 24 yrs. of age)	**2,663,659**
High School Graduate	81.00%
Undergraduate Degree	39.20%
Graduate/Professional Degree	13.10%
Employment (population over 15 yrs. of age)	**2,072,308**
In Labor Force	92.90%
Unemployed	7.10%
Median Household Income	$75,564
Population Below Poverty Level	16.90%
Population without Health Insurance Coverage	12.10%

Source: Esri Community Analyst (2022) and U.S. Census Bureau

Of note from the previous table is the following:

- Nearly 26 percent of the population is under 10 years or over 65 years of age.
- The City's population is predominantly Other Ethnicity / Two or More Races (45 percent), followed by White Only (34 percent), Asian Only (12 percent), and Black

/ African American Only (9 percent). In addition, 47 percent of the population is Hispanic/Latino in origin.

- Of the population over 24 years of age, 81 percent has completed high school or equivalency.
- Of the population over 24 years of age, slightly more than 39 percent has an undergraduate, graduate, or professional degree.
- Of the population 15 years of age or older, nearly 93 percent is in the workforce; of those, 7 percent are unemployed.
- Median household income is slightly more than $75,500.
- The population below the federal poverty level is nearly 17 percent.
- Slightly more than 12 percent of the population does not have health insurance coverage.

Projected Growth

The Southern California Association of Governments (SCAG) projects the City's population will grow by 18 percent over the next 18 years to 2040.[2]

Buildings

The City has more than 1.1 million buildings[3] with an assessed valuation of more than $774 billion to protect, including more than 1.5 million residential housing units[4] and approximately 200,000 businesses.[5]

Building Occupancy Risk Categories

The CFAI identifies the following four risk categories that relate to building occupancy:

Low Risk – includes detached garages, storage sheds, outbuildings, and similar building occupancies that pose a relatively low risk of harm to humans or the community if damaged or destroyed by fire.

Moderate Risk – includes detached single-family or two-family dwellings; mobile homes; commercial and industrial buildings less than 10,000 square feet without a high hazard fire load;

[2] Source: College Station Project, Draft Environmental Impact Report, March 2018, Table 4.8-1.

[3] Source: Los Angeles Fire Department Planning Section.

[4] Source: Esri Community Analyst – Community Profile (2022).

[5] Source: Esri Community Analyst – Business Summary (2022).

aircraft; railroad facilities; and similar building occupancies where loss of life or property damage is limited to the single building.

High Risk – includes apartment/condominium buildings; commercial and industrial buildings more than 10,000 square feet without a high hazard fire load; low-occupant load buildings with high fuel loading or hazardous materials; and similar occupancies with potential for substantial loss of life or unusual property damage or financial impact.

Maximum Risk – includes buildings or facilities with unusually high risk requiring an Effective Response Force (ERF) involving a significant augmentation of resources and personnel and where a fire would pose the potential for a catastrophic event involving large loss of life, significant economic impact to the community, or both.

Critical Infrastructure / Key Resources

The U.S. Department of Homeland Security defines Critical Infrastructure / Key Resources as those physical assets essential to the public health and safety, economic vitality, and resilience of a community, such as lifeline utilities infrastructure, telecommunications infrastructure, essential government services facilities, public safety facilities, schools, hospitals, airports, etc. The City has identified 3,023 critical facilities and infrastructure in its 2018 Local Hazard Mitigation Plan as summarized in the following table. The Battalion Risk Profiles previously provided use different data and counting criteria provided by the Department than do the Local Hazard Mitigation Plan. A hazard occurrence with significant consequence severity affecting one or more of these facilities would likely adversely impact critical public or community services.

Table 17—Critical Facilities/Infrastructure

Critical Facility/Infrastructure Category	Count[1]
Critical Operating Facilities	20
Education	847
Evacuation Centers	9
Healthcare	47
Infrastructure – Transportation	1,306
Infrastructure – Utilities	664
Public Safety	130
Total	**3,023**

Source: City of Los Angeles 2018 Local Hazard Mitigation Plan, Table 4-5

Economic Resources

With the 16th largest economy worldwide and regarded as the entertainment capital of the world, the City of Los Angeles economy is led by the education/healthcare/social services industry (22

percent), followed by the professional/scientific/management/administrative industry (15 percent), arts/entertainment/recreation industry (13 percent), public administration (3 percent), and other industries (47 percent).[6] The City's Adopted Budget for Fiscal Year 2022/23 is $11.76 billion, with a total assessed valuation of $723.6 billion.[7]

Natural Resources

Some of the key natural resources within the City of Los Angeles include the following.

- Pacific Ocean/Los Angeles Harbor
- Los Angeles River
- Griffith Park
- Santa Monica Mountains National Recreation Area

Cultural/Historic Resources

As a vibrant multicultural city, Los Angeles boasts a tremendous inventory of cultural and historic resources, some of which include the following.

- Natural History Museum
- Walt Disney Concert Hall
- Los Angeles County Museum of Art
- The Underground Museum
- The Museum of Jurassic Technology
- Museum of Tolerance
- Getty Art Museum
- Discovery Cube
- The Banning Museum

Special/Unique Resources

The City contains many special or unique resources to be protected, some of which include the following.

- Los Angeles International Airport

[6] Source: City of Los Angeles 2018 Local Hazard Mitigation Plan, Figure 4-20.

[7] Source: County of Los Angeles Auditor-Controller's Office website

- Multiple internationally known universities, colleges, and their sports venues
- Occidental College
- Dodger Stadium
- Griffith Observatory
- Crypto.com Arena

1.1.5 Hazard Identification

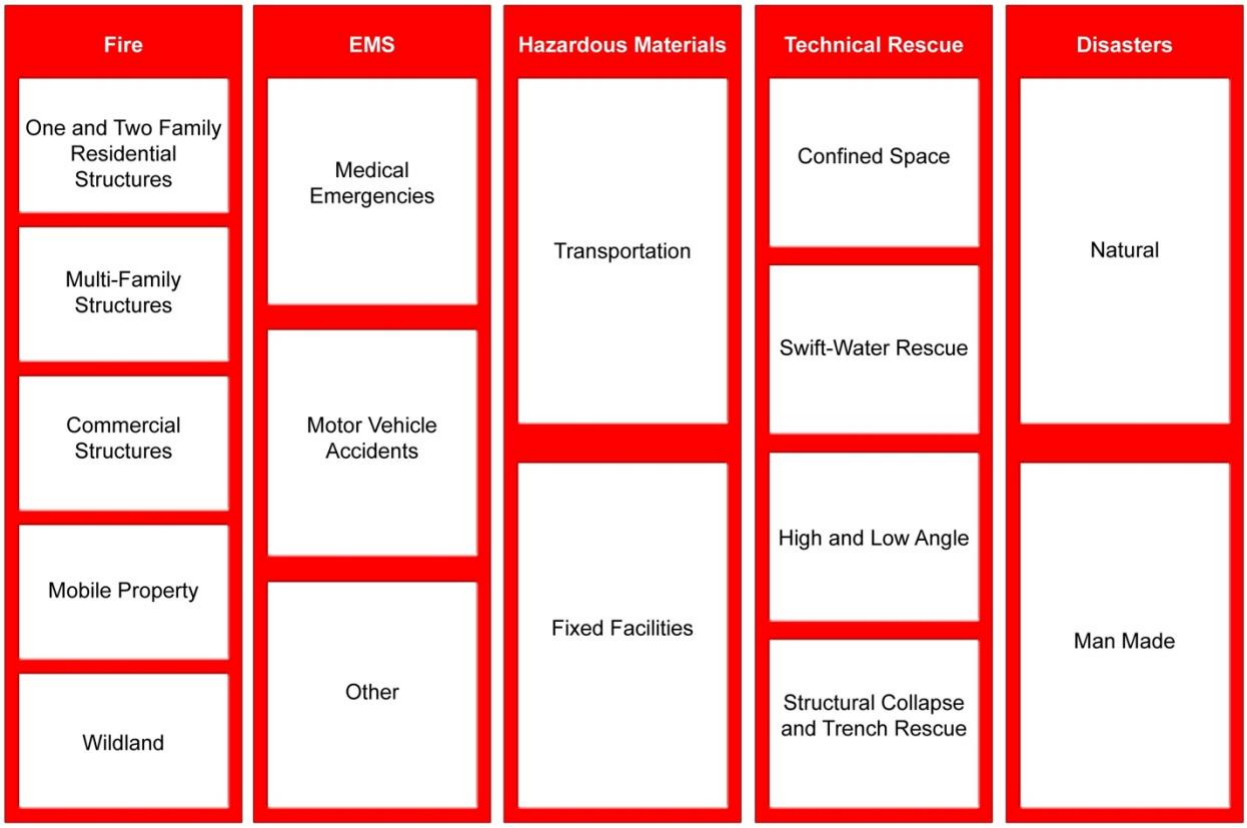
Citygate utilizes prior risk studies where available, fire and non-fire hazards as identified by the CFAI, and agency/jurisdiction-specific data and information to identify the hazards to be evaluated for this study. The 2018 City of Los Angeles Local Hazard Mitigation Plan identifies the following ten hazards of concern:

1. Adverse weather
2. Climate change / sea level rise
3. Dam failure
4. Drought
5. Earthquake
6. Flood
7. Landslide
8. Tsunami
9. Wildland/Urban Interface (WUI) fire
10. Human-caused hazards

LAFD provides some hazard mitigation services, such as fire prevention, code enforcement, and wildland fuel reduction programs. In addition, it must provide response services related to multiple hazards, including fire suppression, emergency medical services, technical rescue, and hazardous materials response.

The CFAI groups hazards into fire and non-fire categories, as shown in the following figure. Identification, qualification, and quantification of the various fire and non-fire hazards are important factors in evaluating how resources are or can be deployed to mitigate those risks.

Figure 16—Commission on Fire Accreditation International Hazard Categories



Source: CFAI *Standards of Cover* (Fifth Edition).

Subsequent to review and evaluation of the hazards identified in the City's 2018 Local Hazard Mitigation Plan, and the fire and non-fire hazards as identified by the CFAI as they relate to services provided by the Department, Citygate evaluated the following five hazards for this risk assessment[8]:

1. Building fire
2. Vegetation/wildland fire
3. Medical emergency
4. Hazardous material release/spill
5. Technical rescue

[8] Although the City of Los Angeles has aviation and marine risk exposure, these two hazards have been evaluated in other studies and were excluded from the scope of this assessment.

1.1.6 Service Capacity

Service capacity refers to an agency's available response force; the size, types, and condition of its response fleet and any specialized equipment; core and specialized performance capabilities and competencies; resource distribution and concentration; availability of automatic or mutual aid; and any other agency-specific factors influencing its ability to meet current and prospective future service demand and response performance relative to the risks to be protected.

The Department's service capacity for fire and non-fire risk consists of 1,023 response personnel on duty daily staffing 98 engines, 42 aerial ladder trucks (28 are staffed with at least one paramedic), 93 paramedic ambulances, 43 Basic Life Support (BLS) ambulances, 8 Aircraft Rescue Fire Fighting (ARFF) apparatus, 7 helicopters, 5 fireboats, 5 bulldozers/loaders, 1 heavy rescue, 1 hazardous materials company, 1 Urban Search and Rescue company plus 14 Battalion Chiefs and 2 platoon duty Assistant Chiefs for incident command, all operating from the Department's 106 fire stations. The Department also has 15 brush patrols, 3 hazardous materials companies, 5 Urban Search and Rescue (USAR) companies, and 4 firefighting foam tenders that can be cross-staffed with on-duty or call-back personnel as needed.

All response personnel are trained to either the Emergency Medical Technician (EMT) level, capable of providing Basic Life Support (BLS) pre-hospital emergency medical care, or EMT-Paramedic (Paramedic) level, capable of providing Advanced Life Support (ALS) pre-hospital emergency medical care. The Department also provides both ALS and BLS ground ambulance service.

Response personnel are also trained to the U.S. Department of Transportation Hazardous Material First Responder Operational (FRO) level to provide initial hazardous material incident assessment, hazard isolation, and support the Department's four hazardous material response teams from Stations 21 (fully-staffed), 48, 87, and 95 (cross-staffed).

All response personnel are further trained to the Confined Space Awareness and first responder operational level. The Department also deploys a heavy rescue at Station 3; six Urban Search and Rescue (USAR) companies at Stations 88 (fully-staffed), 3, 5, 27, 85, and 89 (cross-staffed); and cross-staffs four swift water rescue teams at Stations 5, 44, 86, and 88. Technical rescue personnel are trained to the trench rescue, low angle rope rescue, rescue systems 1, intermediate rope rescue, and confined space rescue level.

1.1.7 Probability of Occurrence

Probability of occurrence refers to the probability of a future hazard occurrence during a specific period. Because the CFAI agency accreditation process requires annual review of an agency's risk assessment and baseline performance measures, Citygate recommends using the 12 months following completion of an SOC study as an appropriate period for the probability of occurrence evaluation. The following table describes the five probability of occurrence categories and related general characteristics used for this analysis.

Table 18—Probability of Occurrence Categories

Category	General Characteristics	Anticipated Frequency of Occurrence
Rare	• Hazard ***may occur*** under exceptional circumstances.	25+ years
Unlikely	• Hazard ***could occur*** at some time. • No recorded or anecdotal evidence of occurrence. • Little opportunity, reason, or means for hazard to occur.	5–24 years
Possible	• Hazard ***should occur*** at some time. • Infrequent, random recorded or anecdotal evidence of occurrence. • Some opportunity, reason, or means for hazard to occur.	1–4 years
Probable	• Hazard will ***probably occur*** occasionally. • Regular recorded or strong anecdotal evidence of occurrence. • Considerable opportunity, reason, or means for hazard to occur.	1–12 months
Frequent	• Hazard is ***expected to occur*** regularly. • High level of recorded or anecdotal evidence of regular occurrence. • Strong opportunity, reason, or means for hazard to occur. • Frequent hazard recurrence.	1–4 weeks

Citygate's SOC assessments use recent multiple-year incident response data to determine the probability of hazard occurrence for the ensuing 12-month period.

1.1.8 Consequence Severity

Consequence severity refers to the magnitude or reasonably expected loss a hazard occurrence has on people, buildings, lifeline services, the environment, and the community as a whole. The following table describes the five consequence severity categories and general characteristics used for this analysis.

Table 19—Consequence Severity Categories

Category	General Characteristics
Insignificant	• No injuries or fatalities • None to few persons displaced for short duration • Little or no personal support required • None to inconsequential damage • None to minimal community disruption • No measurable environmental impacts • None to minimal financial loss • No wildland Fire Hazard Severity Zones
Minor	• Few injuries; no fatalities; minor medical treatment only • Some displacement of persons for less than 24 hours • Some personal support required • Some minor damage • Minor community disruption of short duration • Small environmental impacts with no lasting effects • Minor financial loss • No wildland Fire Hazard Severity Zones
Moderate	• Medical treatment required; some hospitalizations; few fatalities • Localized displaced of persons for less than 24 hours • Personal support satisfied with local resources • Localized damage • Normal community functioning with some inconvenience • No measurable environmental impacts with no long-term effects, or small impacts with long-term effect • Moderate financial loss • Less than 25% of area in *Moderate* or *High* wildland FHSZ
Major	• Extensive injuries; significant hospitalizations; many fatalities • Large number of persons displaced for more than 24 hours • External resources required for personal support • Significant damage • Significant community disruption; some services not available • Some impact to environment with long-term effects • Major financial loss with some financial assistance required • More than 25% of area in *Moderate* or *High* wildland FHSZ; less than 25% in *Very High* wildland FHSZ
Extreme	• Large number of severe injuries requiring hospitalization; significant fatalities • General displacement for extended duration • Extensive personal support required • Extensive damage • Community unable to function without significant external support • Significant impact to environment and/or permanent damage • Catastrophic financial loss; unable to function without significant support • More than 50% of area in *High* wildland FHSZ; more than 25% of area in *Very High* wildland FHSZ

1.1.9 Agency Impact Severity

Agency impact severity refers to the extent a hazard occurrence impacts the Department's ability to (1) provide an Effective Response Force (ERF) appropriate to prevent escalation of the

emergency incident and (2) to maintain sufficient response capacity throughout the City to control other concurrent incidents within desired response goals. The following table describes the five agency impact categories and related general characteristics used for this analysis.

Table 20—Agency Impact Severity Categories

Category	Typical Characteristics
Insignificant	• Hazard occurrence has ***none to minimal*** impact on the agency's ability to maintain full ERF response capacity *and* at least one minor concurrent incident response capacity within each battalion • Typically requires only a single unit response committed for less than 1 hour • Single concurrent incident rate less than 5% • None to insignificant EMS Emergency Department wait times
Minor	• Hazard occurrence has ***minor*** impact on the agency's ability to maintain full ERF response capacity *and* at least one minor concurrent incident response capacity within each battalion • Typically requires 1- or 2-unit response committed for less than 2 hours • Single concurrent incident rate less than 10% • Minimal EMS Emergency Department wait times (<15 minutes)
Moderate	• Hazard occurrence has a ***moderate*** impact on the agency's ability to maintain full ERF response capacity *and* at least one minor concurrent incident response capacity within each battalion • Typically requires 3- to 5-unit response and less than 20 personnel committed for up to 6 hours • Single concurrent incident rate less than 25% • EMS Emergency Department wait times frequently up to one hour
Major	• Hazard occurrence has a ***major*** impact on the agency's ability to maintain full ERF response capacity *and* at least one minor concurrent incident response capacity within each battalion • Typically requires 6- to 10-unit response and up to 40 personnel committed for up to 12 hours • Single concurrent incident rate less than 50% • EMS Emergency Department wait times frequently up to three hours
Extreme	• Hazard occurrence has an ***extreme*** impact on the agency's ability to maintain full ERF response capacity *and* at least one minor concurrent incident response capacity within each battalion • Typically requires more than a 10-unit response and more than 40 personnel committed for more than 12 hours • Single concurrent incident rate greater than 50% • EMS Emergency Department wait times frequently > three hours

1.1.10 Overall Risk

Overall risk was determined by considering the probability of occurrence, reasonably expected consequence severity, and agency impact according to the following tables.

Table 21—Overall Risk Categories – Insignificant Agency Impact

Probability of Occurrence	Consequence Severity				
	Insignificant	Minor	Moderate	Major	Catastrophic
Rare	*Low*	*Low*	*Low*	*Low*	*High*
Unlikely	*Low*	*Low*	*Low*	*Low*	*High*
Possible	*Low*	*Low*	*Low*	*Moderate*	*High*
Probable	*Low*	*Low*	*Low*	*Moderate*	*High*
Frequent	*Low*	*Low*	*Low*	*Moderate*	*Extreme*

Table 22—Overall Risk Categories – Minor Agency Impact

Probability of Occurrence	Consequence Severity				
	Insignificant	Minor	Moderate	Major	Catastrophic
Rare	*Low*	*Low*	*Low*	*Moderate*	*High*
Unlikely	*Low*	*Low*	*Low*	*Moderate*	*High*
Possible	*Low*	*Low*	*Moderate*	*High*	*High*
Probable	*Low*	*Low*	*Moderate*	*High*	*Extreme*
Frequent	*Low*	*Moderate*	*High*	*High*	*Extreme*

Table 23—Overall Risk Categories – Moderate Agency Impact

Probability of Occurrence	Consequence Severity				
	Insignificant	Minor	Moderate	Major	Catastrophic
Rare	*Low*	*Low*	*Low*	*Moderate*	*High*
Unlikely	*Low*	*Low*	*Moderate*	*High*	*High*
Possible	*Low*	*Low*	*Moderate*	*High*	*Extreme*
Probable	*Low*	*Moderate*	*Moderate*	*High*	*Extreme*
Frequent	*Low*	*Moderate*	*High*	*High*	*Extreme*

Table 24—Overall Risk Categories – Major Agency Impact

Probability of Occurrence	Impact Severity				
	Insignificant	Minor	Moderate	Major	Catastrophic
Rare	*Low*	*Low*	*Moderate*	*High*	*Extreme*
Unlikely	*Low*	*Low*	*Moderate*	*High*	*Extreme*
Possible	*Low*	*Moderate*	*High*	*High*	*Extreme*
Probable	*Low*	*Moderate*	*High*	*High*	*Extreme*
Frequent	*Moderate*	*Moderate*	*High*	*High*	*Extreme*

Table 25—Overall Risk Categories – Extreme Agency Impact

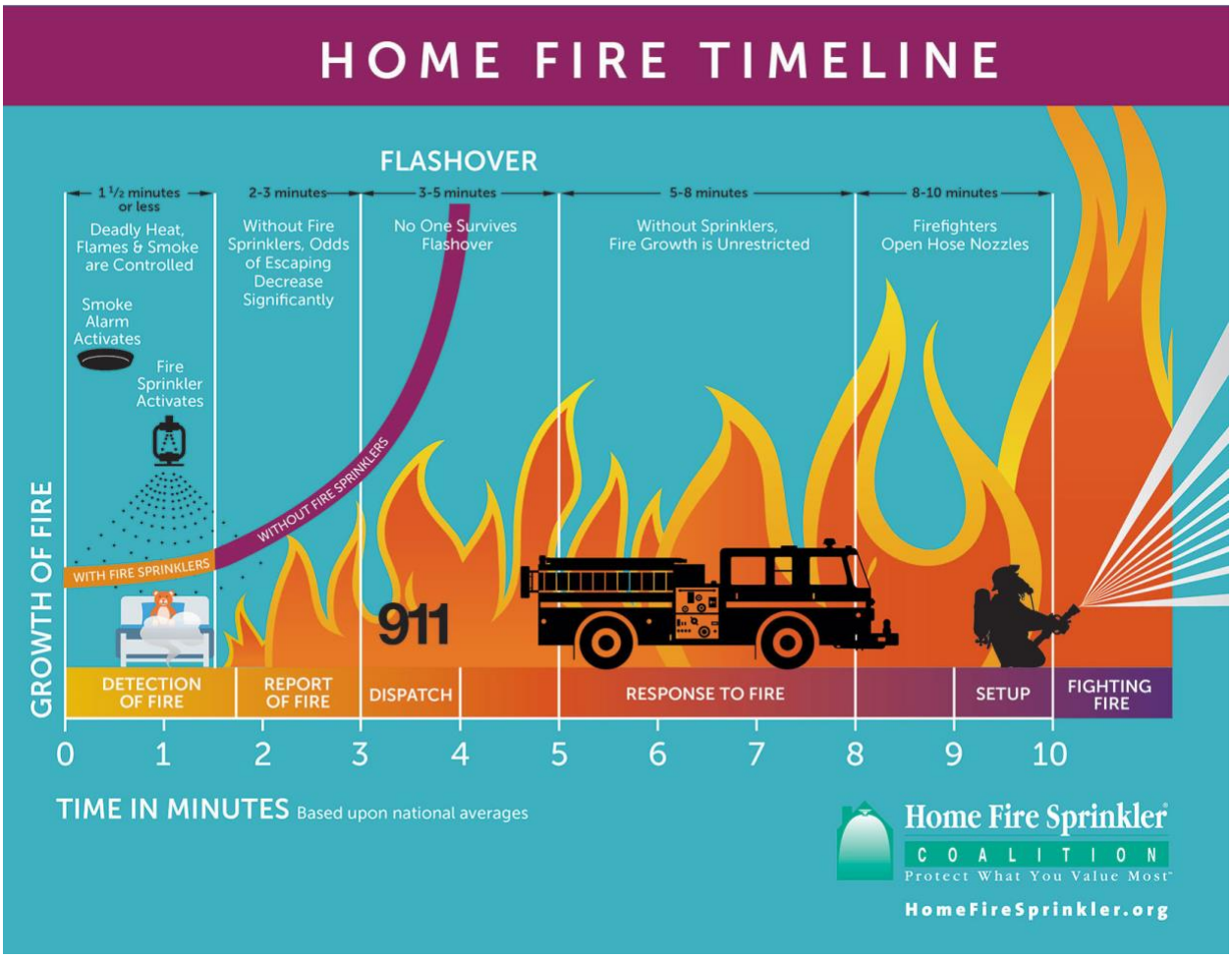
Probability of Occurrence	Impact Severity				
	Insignificant	Minor	Moderate	Major	Catastrophic
Rare	*Low*	*Moderate*	*High*	*High*	*Extreme*
Unlikely	*Low*	*Moderate*	*High*	*High*	*Extreme*
Possible	*Low*	*Moderate*	*High*	*Extreme*	*Extreme*
Probable	*Moderate*	*Moderate*	*High*	*Extreme*	*Extreme*
Frequent	*Moderate*	*Moderate*	*High*	*Extreme*	*Extreme*

1.1.11 Building Fire Risk

One of the primary hazards in any community is building fire. Building fire risk factors include building size, age, construction type, density, occupancy, and height above ground level; required fire flow; proximity to other buildings; built-in fire protection/alarm systems; available fire suppression water supply; building fire service capacity; and fire suppression resource deployment (distribution/concentration), staffing, and response time. Citygate used available data from LAFD and the 2018 Local Hazard Mitigation Plan in determining the City's building fire risk.

The following figure illustrates the building fire progression timeline and shows that flashover, which is the point at which the entire room erupts into fire after all the combustible objects in that room reach their ignition temperature, can occur as early as three to five minutes from the initial ignition. Human survival in a room after flashover is extremely improbable.

Figure 17—Building Fire Progression Timeline



Source: http://www.firesprinklerassoc.org.

Population Density

Population density within the City ranges from less than 5,000 to more than 40,000 people per square mile. Although risk analysis across a wide spectrum of other Citygate clients shows no direct correlation between population density and building fire *occurrence*, it is reasonable to conclude that building fire *risk* relative to potential impact on human life is greater as population density increases, particularly in areas with high density, multiple-story buildings.

Water Supply

A reliable public water system providing adequate volume, pressure, and flow duration in close proximity to all buildings is a critical factor in mitigating the potential consequence severity of a community's building fire risk. For Los Angeles, potable water is provided by the City and according to Department of Water and Power (LADWP) staff, available fire flow is adequate throughout the City, however some areas have low static pressure. The Fire Department is familiar

with these areas and has standard operating procedures (drafting from fire hydrant) to effectively mitigate this.

Building Fire Service Demand

For the three-year period from January 1, 2018, through December 31, 2020, the Department responded to nearly 16,000 building fire incidents comprising 1.08 percent of total service demand over the same period as summarized in the following table.

Table 26—Building Fire Service Demand

Hazard	Year	Risk Planning Zone (Battalion)							
		1	2	4	5	6	9	10	11
Building Fire	2018	812	280	164	327	210	167	350	470
	2019	854	309	166	404	262	131	344	501
	2020	939	337	191	475	249	151	359	596
	Total	**2,605**	**926**	**521**	**1,206**	**721**	**449**	**1,053**	**1,567**
Percent Total Battalion Demand		1.39%	1.63%	0.67%	1.21%	1.15%	0.80%	1.07%	1.25%

Hazard	Year	Risk Planning Zone (Battalion						Total	Percent Total Annual Demand
		12	13	14	15	17	18		
Building Fire	2018	376	847	243	123	222	394	**4,985**	1.01%
	2019	338	865	266	141	230	394	**5,205**	1.04%
	2020	334	960	376	104	240	356	**5,667**	1.18%
	Total	**1,048**	**2,672**	**885**	**368**	**692**	**1,144**	**15,857**	**1.08%**
Percent Total Battalion Demand		1.02%	1.11%	1.02%	0.62%	0.73%	0.94%		

As the previous table illustrates, building fire service demand varies significantly by battalion with Battalion 13 having the highest demand and Battalion 15 having the lowest. Overall, building fire service demand increased nearly 14 percent over the three-year period.

Building Fire Risk Assessment

The following table summarizes Citygate's assessment of building fire risk by incident sub-type.

Table 27—Building Fire Risk Assessment

Building Fire Risk	Incident Type				
	Outbuilding / ADU	Single-Family Dwelling	Apartment / Multi-Family Residence	Commercial	Heavy Commercial / Industrial
Probability of Occurrence	*Probable*	*Frequent*	*Frequent*	*Frequent*	*Frequent*
Consequence Severity	*Moderate*	*Moderate*	*Moderate*	*Moderate*	*Moderate*
Agency Impact Severity	*Minor*	*Moderate*	*Major*	*Major*	*Major*
Overall Risk	***Moderate***	***High***	***High***	***High***	***High***

1.1.12 Vegetation/Wildland Fire Risk[9]

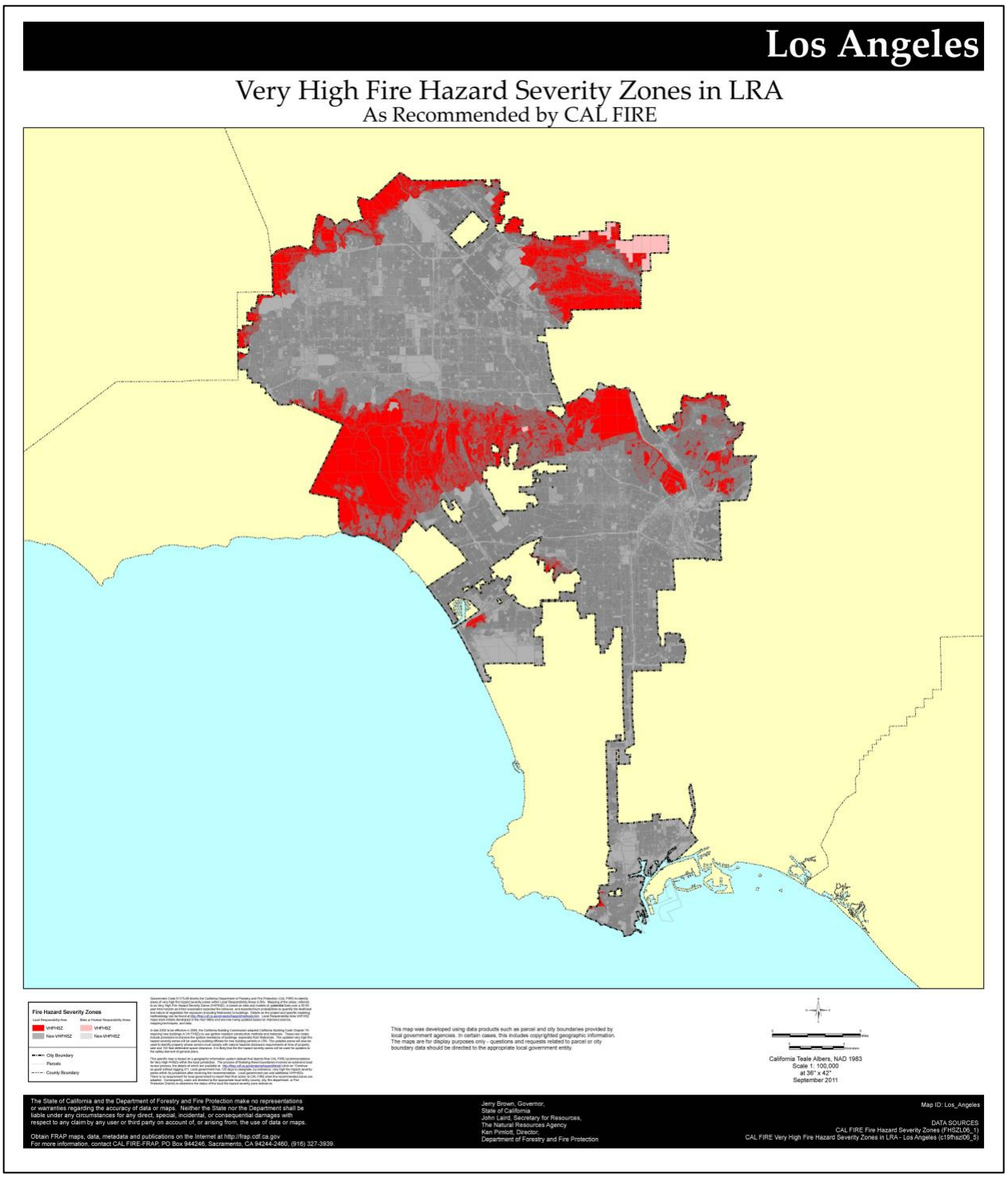
Many areas of the City are susceptible to a vegetation/wildland fire, particularly the northwestern to northeastern border areas, and west central to east central areas as highlighted in Figure 18 and Figure 19. Vegetation/wildland fire risk factors include vegetative fuel types and configuration, weather, topography, prior service demand, water supply, mitigation measures, and vegetation fire service capacity.

Wildland Fire Hazard Severity Zones

The California Department of Forestry and Fire Protection (CAL FIRE) designates wildland Fire Hazard Severity Zones (FHSZ) throughout the State based on analysis of multiple wildland fire hazard factors and modeling of potential wildland fire behavior. For State Responsibility Areas (SRAs) where CAL FIRE has fiscal responsibility for wildland fire protection, CAL FIRE designates ***Moderate***, ***High***, and ***Very High*** FHSZs by county. CAL FIRE also identifies recommended ***Very High*** FHSZs for Local Responsibility Areas (LRAs), where a local jurisdiction is responsible for wildland fire protection, including incorporated cities, as shown in red in the following map for Los Angeles City.

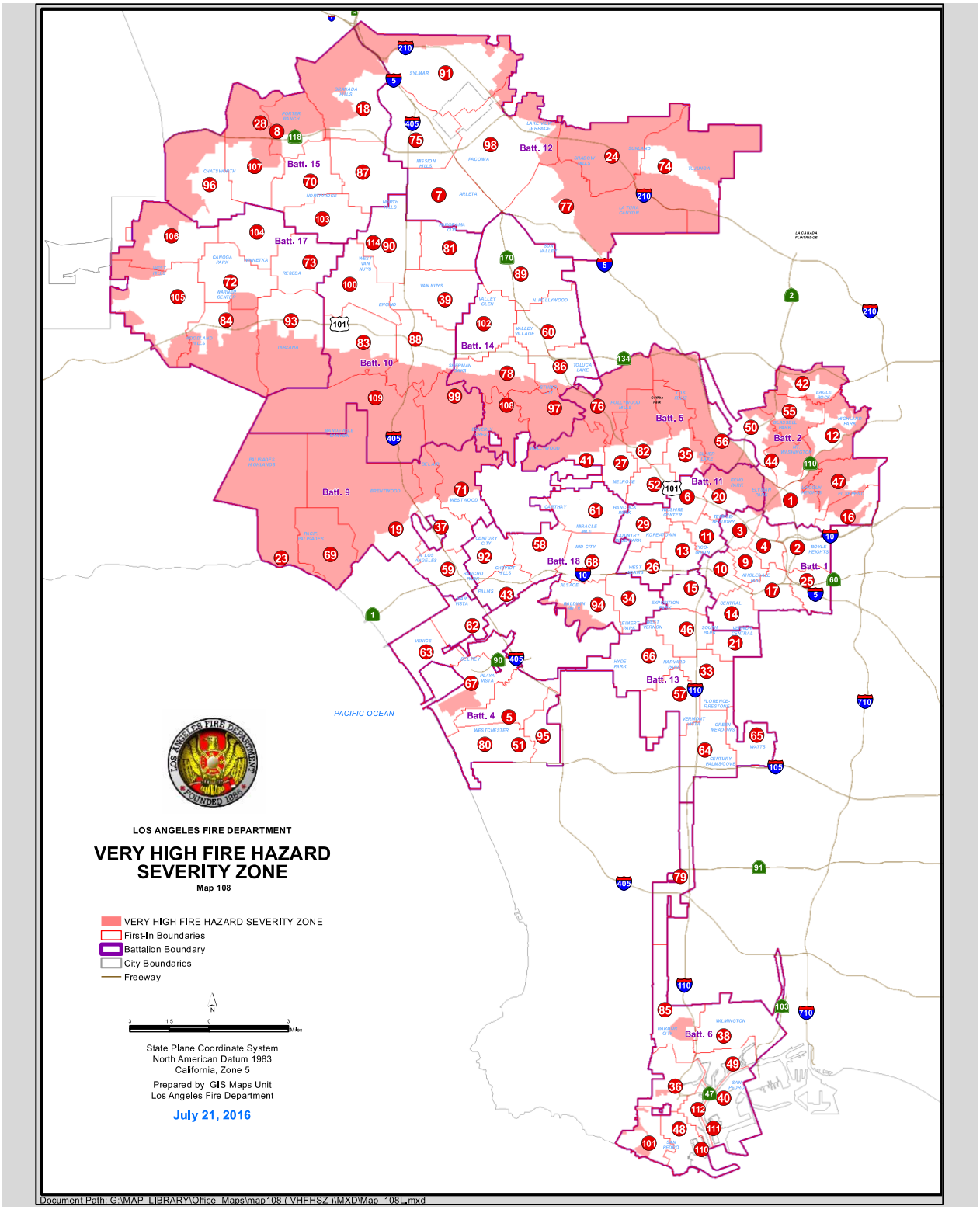
[9] Source: City of Los Angeles 2018 Local Hazard Mitigation Plan, Section 13

Figure 18—CAL FIRE Wildland Fire Hazard Severity Zones – Los Angeles City



The City also mapped the same ***Very High*** Wildfire Severity Zones as shown in the following figure.

Figure 19—Wildfire Severity Zones – City of Los Angeles



Vegetative/Wildland Fuels

Vegetative fuel factors influencing fire intensity and spread include fuel type (vegetation species), height, arrangement, density, and moisture. In addition to decorative landscape species, vegetative fuels within the City consist of a mix of annual grasses and weeds, brush, invasive species, and mixed deciduous, evergreen, conifer, and palm tree species. Once ignited, vegetation fires can burn intensely and contribute to rapid fire spread under the right fuel, weather, and topographic conditions.

Weather

Weather elements, including temperature, relative humidity, wind, and lightning, also affect vegetation/wildland fire potential and behavior. High temperatures and low relative humidity dry out vegetative fuels, creating a situation where fuels will more readily ignite and burn more intensely. Wind is the most significant weather factor influencing vegetation/wildland fire behavior, with higher wind speeds increasing fire spread and intensity.

Los Angeles has a two-season Mediterranean climate characterized by dry, warm summers and mild winters with an annual average of 14 inches of rainfall. Fuel and weather conditions most conducive to vegetation/wildland fires generally occur from about May through October; however, with global warming and climate change, vegetation fires can occur nearly year-round in Southern California.

Topography

Vegetation/wildland fires tend to burn more intensely and spread faster when burning uphill and up-canyon, except for a wind-driven downhill or down-canyon fire. The areas of the City with hilly terrain contribute more to vegetation/wildland fire behavior and spread.

Water Supply

Another significant vegetation fire consequence severity factor is water supply immediately available for fire suppression. As noted in the building fire risk section, all areas of the City have adequate available flow capacity and the Department has standard operating procedures in place to effectively mitigate areas with low static pressure.

Vegetation/Wildland Fire Service Demand

Over the three-year study period, the Department responded to 1,928 vegetation/wildland fires comprising 0.13 percent of total service demand over the same period, as summarized in the following tables.

Table 28—Vegetation/Wildland Fire Service Demand

Hazard	Year	Risk Planning Zone (Battalion)							
		1	2	4	5	6	9	10	11
Vegetation/Wildland Fire	2018	46	71	19	49	35	10	61	31
	2019	35	80	14	31	26	16	87	27
	2020	38	95	7	40	45	12	78	29
	Total	**119**	**246**	**40**	**120**	**106**	**38**	**226**	**87**
Percent Total Battalion Demand		0.06%	0.43%	0.05%	0.12%	0.17%	0.07%	0.23%	0.07%

Hazard	Year	Risk Planning Zone (Battalion						Total	Percent Total Annual Demand
		12	13	14	15	17	18		
Vegetation/Wildland Fire	2018	109	62	42	57	37	15	**644**	0.13%
	2019	109	69	27	40	28	19	**608**	0.12%
	2020	125	72	54	34	26	21	**676**	0.14%
	Total	**343**	**203**	**123**	**131**	**91**	**55**	**1,928**	**0.13%**
Percent Total Battalion Demand		0.33%	0.08%	0.14%	0.22%	0.10%	0.05%		

As the previous tables illustrate, annual vegetation/wildland fire service demand increased 5 percent over the three-year study period, with the highest demand in Battalion 12 and the lowest in Battalion 9.

Vegetation/Wildland Fire Risk Assessment

The following table summarizes Citygate's assessment of the City's vegetation/wildland fire risk by incident sub-type.

Table 29—Vegetation/Wildland Fire Risk Assessment

Vegetation/Wildland Fire Risk	Incident Type			
	Grass	Brush	Grass/Brush (High/Very High Hazard Areas)	WUI
Probability of Occurrence	*Probable*	*Probable*	*Probable*	*Possible*
Consequence Severity	*Minor*	*Moderate*	*Major*	*Major*
Agency Impact	*Minor*	*Moderate*	*Major*	*Extreme*
Overall Risk	***Low***	***Moderate***	***High***	***Extreme***

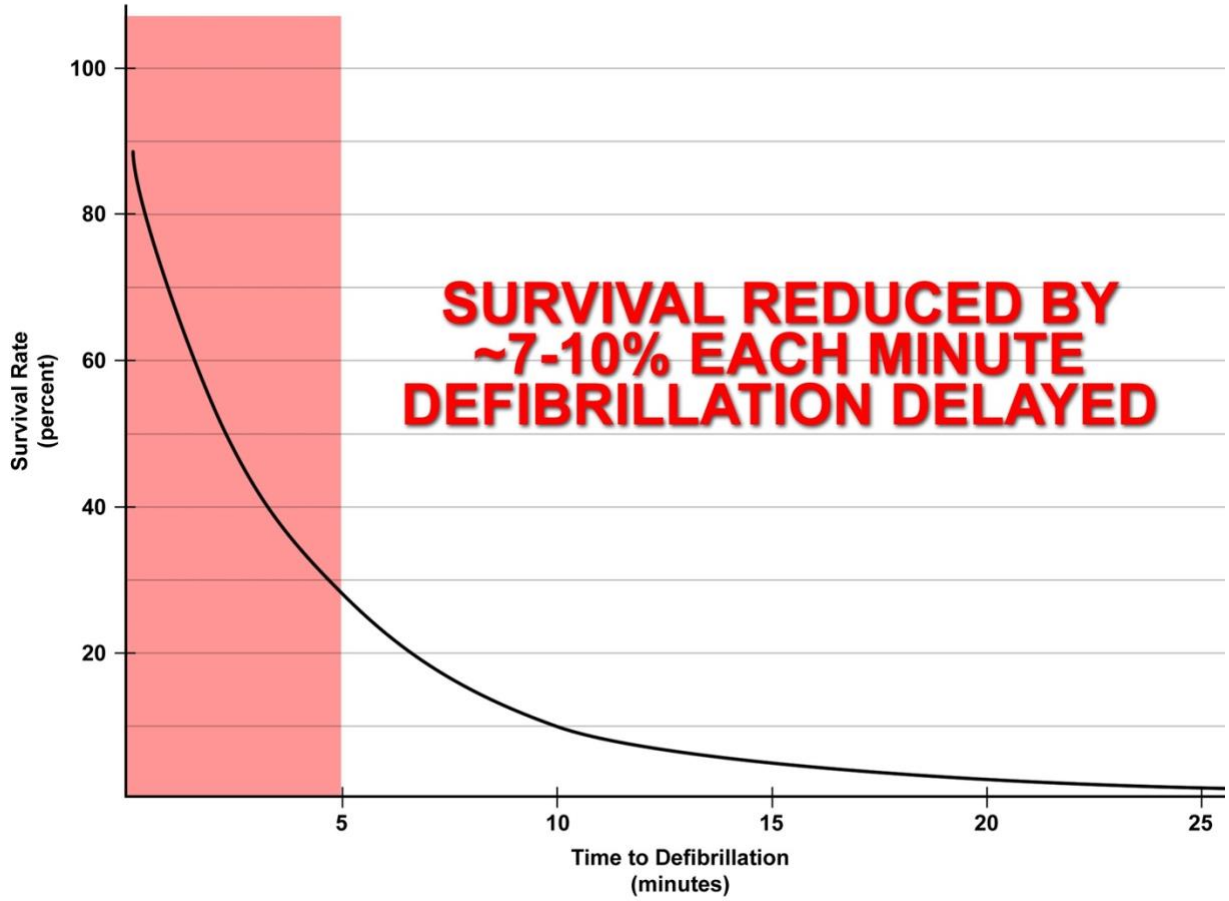
1.1.13 Medical Emergency Risk

Medical emergency risk in most communities is predominantly a function of population density, demographics, violence, health insurance coverage, and vehicle traffic.

Medical emergency risk can also be categorized as either a medical emergency resulting from a traumatic injury or a health-related condition or event. Cardiac arrest is one serious medical emergency among many where there is an interruption or blockage of oxygen to the brain.

The following figure illustrates the reduced survivability of a cardiac arrest victim as time to defibrillation increases. While early defibrillation is one factor in cardiac arrest survivability, other factors can influence survivability as well, such as early CPR and pre-hospital ALS interventions.

Figure 20—Survival Rate versus Time to Defibrillation



Source: www.suddencardiacarrest.org.

Population Density

Los Angeles' population density ranges from less than 5,000 to more than 40,000 per square mile as shown in Map #2 (**Volume 2—Map Atlas**). Risk analysis across a wide spectrum of other

Citygate clients shows a direct correlation between population density and the *occurrence* of medical emergencies, particularly in high urban population density zones.

Demographics

Medical emergency risk tends to be higher among older, poorer, less educated, and uninsured populations. As shown in Table 16, nearly 14 percent of the City's population is 65 and older; 19 percent of the population over 24 years of age has less than a high school education or equivalent; nearly 17 percent of the population is at or below poverty level; and slightly more than 12 percent of the population under age 65 does not have health insurance coverage.[10] In addition, the City has a large transient and homeless population.

Vehicle Traffic

Medical emergency risk tends to be higher in those areas of a community with high daily vehicle traffic volume, particularly those areas with high traffic volume traveling at high speeds. The City's transportation network includes Interstates 5; 10, 105, 110, 210, 405 and 710; US Routes 66 and 101 and State Highways 2, 27, 90, 134 and 170, carrying an aggregate annual average daily traffic volume of nearly 2.5 million vehicles, with a peak hour volume of more than 200,000 vehicles.[11]

Medical Emergency Service Demand

Medical emergency service demand over the three-year study period included more than 1.2 million calls for service comprising 83.14 percent of total service demand over the same period as summarized in the following table.

Table 30—Medical Emergency Service Demand

Hazard	Year	Risk Planning Zone (Battalion)							
		1	2	4	5	6	9	10	11
Medical Emergency	2018	50,142	15,460	22,736	27,145	17,033	14,949	27,652	33,770
	2019	52,197	15,000	23,552	27,488	17,098	15,001	27,678	33,994
	2020	46,854	15,258	17,329	24,568	17,106	13,039	26,256	34,799
	Total	**149,193**	**45,718**	**63,617**	**79,201**	**51,237**	**42,989**	**81,586**	**102,563**
Percent Total Battalion Demand		79.48%	80.65%	82.11%	79.35%	81.44%	76.64%	82.89%	82.08%

[10] Source: ESRI and U. S. Census Bureau (2022)

[11] Source: California Department of Transportation (2020)

Hazard	Year	Risk Planning Zone (Battalion						Total	Percent Total Annual Demand
		12	13	14	15	17	18		
Medical Emergency	2018	28,537	71,381	23,933	17,398	27,525	36,057	**413,718**	84.16%
	2019	28,467	70,912	24,302	17,071	27,568	34,538	**414,866**	83.02%
	2020	29,767	70,845	23,535	16,339	26,860	32,004	**394,559**	82.22%
	Total	**86,771**	**213,138**	**71,770**	**50,808**	**81,953**	**102,599**	**1,223,143**	**83.14%**
Percent Total Battalion Demand		84.59%	88.66%	82.50%	86.28%	85.94%	84.24%		

As the previous table show, medical emergency service demand varies significantly by battalion, and overall medical emergency service demand *decreased* nearly 5 percent over the three-year study most if not all of which was due to the COVID-19 pandemic.

Medical Emergency Risk Assessment

The following table summarizes Citygate's assessment of the City's medical emergency risk by incident sub-type.

Table 31—Medical Emergency Risk Assessment

Medical Emergency Risk	Incident Type				
	BLS Only	BLS/ALS	ALS	Active Shooter / Mass Casualty	WMD
Probability of Occurrence	*Frequent*	*Frequent*	*Frequent*	*Probable*	*Possible*
Consequence Severity	*Minor*	*Moderate*	*Moderate*	*Major*	*Catastrophic*
Agency Impact	*Major*	*Moderate*	*Moderate*	*Major*	*Extreme*
Overall Risk	***Moderate***	***High***	***High***	***High***	***Extreme***

1.1.14 Hazardous Material Risk

Hazardous material risk factors include fixed facilities that store, use, or produce hazardous chemicals or waste; underground pipelines conveying hazardous materials; aviation, railroad, maritime, and vehicle transportation of hazardous commodities into or through a jurisdiction; vulnerable populations; emergency evacuation planning and related training; and specialized hazardous material service capacity.

Fixed Hazardous Materials Sites

For this study, the Fire Departmenmt Planning Section identified 10,050 facilities within the city requiring a state or local hazardous material operating permit. The City also has large-diameter

pipelines transporting petroleum products, and high-pressure natural gas distribution pipelines are also located throughout the City.

Transportation-Related Hazardous Materials

The City also has transportation-related hazardous material risk from its aviation, harbor, road, and rail transportation system, with hazardous commodities transported into, from, and through the city via all four systems.

Population Density

Because hazardous material emergencies have the potential to adversely impact human health, it is logical that the higher the population density, the greater the potential population exposed to a hazardous material release or spill. As shown in Map #2 (**Volume 2 – Map Atlas**), the City's population density ranges from less than 5,000 to more than 40,000 people per square mile.

Vulnerable Populations

Persons vulnerable to a hazardous material release/spill include those individuals or groups unable to self-evacuate, generally including children under the age of 10, the elderly, and persons confined to an institution or other setting where they are unable to leave voluntarily. Emergency Evacuation Planning, Training, Implementation, and Effectiveness

Another significant hazardous material consequence severity factor is a jurisdiction's shelter-in-place / emergency evacuation planning and training. In the event of a hazardous material release or spill, time can be a critical factor in notifying potentially affected persons, particularly at-risk populations, to either shelter-in-place or evacuate to a safe location. Essential to this process is an effective emergency plan that incorporates one or more mass emergency notification capabilities, as well as pre-established evacuation procedures. It is also essential to conduct regular, periodic exercises involving these two emergency plan elements to evaluate readiness and to identify and remediate any planning or training gaps to ensure ongoing emergency incident readiness and effectiveness.

The City of Los Angeles has an Evacuation Plan Annex to its citywide Emergency Operations Plan that outlines operational concepts, responsibilities, and procedures for emergency evacuations. The City also has a free subscription and reverse 9-1-1-based mass emergency notification system (NotifyLA) that is used to provide emergency alerts, notifications, and other emergency information to email accounts, cell phones, smartphones, tablets, and landline telephones. The City also utilizes Federal Communications Commission (FCC) Wireless Emergency Alerts (WEA), the Emergency Alert System (EAS), Nixle, and social media (Facebook, Twitter) to provide emergency notifications and information to the public. The City also has a multi-year Emergency Management Training and Exercise Plan focused on maintaining core capabilities including operational coordination; situational assessment; public information and warning; mass care services; operational communications, logistics, and supply chain

management; critical transportation; and recovery for different hazard occurrences. The Emergency Management Department conducts training including focused exercises each quarter.

Hazardous Material Service Demand

The City experienced nearly 4,000 hazardous material incidents over the three-year study period, comprising 0.27 percent of total service demand over the same period, as summarized in the following tables.

Table 32—Hazardous Material Service Demand

Hazard	Year	Risk Planning Zone (Battalion)							
		1	2	4	5	6	9	10	11
Hazardous Material	2018	94	45	101	119	50	60	100	90
	2019	86	56	96	118	56	54	89	116
	2020	133	45	61	108	70	66	118	95
	Total	**313**	**146**	**258**	**345**	**176**	**180**	**307**	**301**
Percent Total Battalion Demand		0.17%	0.26%	0.33%	0.35%	0.28%	0.32%	0.31%	0.24%

Hazard	Year	Risk Planning Zone (Battalion						Total	Percent Total Annual Demand
		12	13	14	15	17	18		
Hazardous Material	2018	56	163	117	57	91	169	**1,312**	0.27%
	2019	69	180	110	64	91	160	**1,345**	0.27%
	2020	80	176	117	61	80	132	**1,342**	0.28%
	Total	**205**	**519**	**344**	**182**	**262**	**461**	**3,999**	**0.27%**
Percent Total Battalion Demand		0.20%	0.22%	0.40%	0.31%	0.27%	0.38%		

As the previous tables show, hazardous material service demand also varies significantly by battalion, however overall service demand was generally consistent over the three years, varying less than 3 percent.

Hazardous Materials Risk Assessment

The following table summarizes Citygate's assessment of the City's hazardous materials risk by incident sub-type.

Table 33—Hazardous Materials Risk Assessment

Hazardous Materials Risk	Incident Type				
	Alarm / Odor Investigation	Hazmat Level 1	Hazmat Level 2 / Biological or Chemical Threat / Natural Gas Leak	Hazmat Level 3 / Biological or Chemical Incident / Railroad Incident	Explosive Incident / WMD
Probability of Occurrence	*Frequent*	*Frequent*	*Frequent*	*Probable*	*Possible*
Consequence Severity	*Insignificant*	*Minor*	*Moderate*	*Moderate*	*Major*
Agency Impact	*Minor*	*Minor*	*Moderate*	*Major*	*Extreme*
Overall Risk	***Low***	***Moderate***	***High***	***High***	***Extreme***

1.1.15 Technical Rescue Risk

Technical rescue risk factors include active construction projects; structural collapse potential; confined spaces, such as tanks and underground vaults; bodies of water, including rivers and streams; industrial machinery use; transportation volume; and earthquake, flood, and landslide potential.

Construction Activity

There is ongoing residential, commercial, industrial, and infrastructure construction activity occurring within the City of Los Angeles.

Confined Spaces

There are numerous confined spaces within the City, including tanks, vaults, open trenches, etc.

Bodies of Water

In addition to some Pacific Ocean frontage and the Port of Los Angeles, Los Angeles has numerous open stream channels including the Los Angeles, Rio Hondo, San Gabriel, and Santa Ana rivers; Arroyo Seco, Pacoima, Tujunga, and Verdugo washes, and numerous smaller waterways and bodies of water.

Transportation Volume

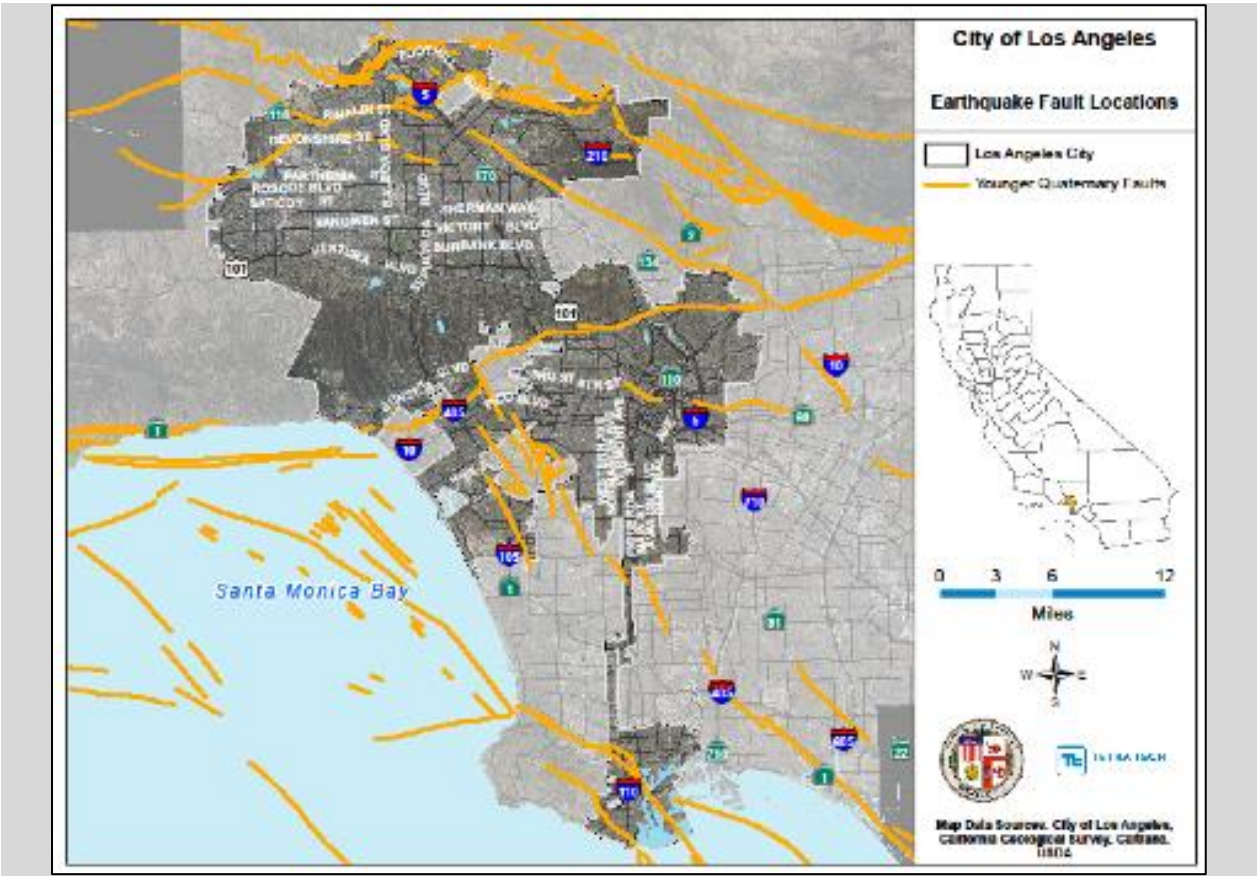
Another technical rescue risk factor is transportation-related incidents requiring technical rescue. This risk factor is primarily a function of vehicle, railway, maritime, and aviation traffic. Vehicle traffic volume is the greatest of these factors within the City with Interstates 5; 10, 105, 110, 210, 405 and 710; US Routes 66 and 101 and State Highways 2, 27, 90, 134 and 170 carrying an aggregate annual average daily traffic volume of nearly 2.5 million vehicles with a peak hour

volume of more than 200,000 vehicles. The City also has heavy aviation, railway, and maritime traffic contributing to its transportation-related rescue risk.

Earthquake Risk[12]

The City of Los Angeles is in a region of high seismic activity with numerous known faults, including the Newport-Inglewood, Palos Verde, Puente Hills, San Andreas, and Santa Monica faults as shown in the following figure.

Figure 21—Earthquake Fault Locations



The primary hazards are ground shaking and potential resultant liquefaction from shaking. Since 1970, there have been 14 earthquakes of Magnitude 5.0 or greater within a 100-mile radius of Los Angeles, including the Magnitude 6.7 Northridge event in 1994 that caused 57 fatalities and more than $1.6 Billion in property and infrastructure damage. The California Hazard Mitigation Plan projects a greater than 99 percent probability of a Magnitude 6.7 earthquake event over the next 26 years, and a 94 percent probability of a Magnitude 7.0 event.

[12] Source: 2018 City of Los Angeles Local Hazard Mitigation Plan, Section 9.

Flood Risk[13]

The Federal Emergency Management Agency (FEMA), through its National Flood Insurance Program (NFIP), has designated Special Flood Hazard Areas (SFHA) Areas of the City susceptible to:

- Shallow flooding
- Regulated floodway flooding
- Alluvial fan flooding
- Coastal flooding

There are also areas of the City outside of designated SHFAs that are susceptible to flooding, including some hillside, non-hillside, urban drainage, and coastal areas. The principal flooding source in Los Angeles is heavy precipitation over one or two days overwhelming the City's drainage systems.

The City has experienced 14 flooding events since 1969 that resulted in a federal disaster declaration. Large floods occur approximately every 5-6 years in the City.

Tsunami Risk[14]

Due to its location on the Pacific Coast, many low-lying coastal areas of the City are susceptible to a tsunami, particularly San Pedro, Los Angeles Harbor and Pacific Palisades. Since 1927, nine tsunami events have impacted Los Angeles County, including the March 2011 tsunami that originated in Japan and caused minor damage in Marina Del Rey.

Technical Rescue Service Demand

The Department responded to slightly more than 9,000 technical rescue incidents over the three-year study period, comprising 0.62 percent of total service demand for the same period as summarized in the following tables.

[13] Source: 2018 City of Los Angeles Hazard Mitigation Plan, Section 10.

[14] Source: 2018 City of Los Angeles Hazard Mitigation Plan, Section 12.

Table 34—Technical Rescue Service Demand

Hazard	Year	Risk Planning Zone (Battalion)							
		1	2	4	5	6	9	10	11
Technical Rescue	2018	614	52	152	376	82	257	223	488
	2019	619	83	173	367	96	248	204	461
	2020	509	49	139	292	67	212	151	356
	Total	**1,742**	**184**	**464**	**1,035**	**245**	**717**	**578**	**1,305**
Percent Total Battalion Demand		0.93%	0.32%	0.60%	1.04%	0.39%	1.28%	0.59%	1.04%

Hazard	Year	Risk Planning Zone (Battalion						Total	Percent Total Annual Demand
		12	13	14	15	17	18		
	2018	68	163	169	54	154	361	**3,213**	0.65%
	2019	67	150	196	59	213	374	**3,310**	0.66%
	2020	59	106	164	32	130	295	**2,561**	0.53%
	Total	**194**	**419**	**529**	**145**	**497**	**1,030**	**9,084**	**0.62%**
Percent Total Battalion Demand		0.19%	0.17%	0.61%	0.25%	0.52%	0.85%		

As the previous tables show, technical rescue service demand also varies widely by battalion, with Battalion 1 having the highest demand and Battalion 15 the lowest. Overall, technical rescue service demand fluctuated 20 percent over the three-year study period, with a 23 percent decrease in demand in 2020 from the previous year.

Technical Rescue Risk Assessment

The following table summarizes Citygate's assessment of the City's technical rescue risk by incident sub-type.

Table 35—Technical Rescue Risk Assessment

Technical Rescue Risk	Incident Type			
	Elevator Rescue	Trauma / Pin-In / Potential Jumper / Rope Rescue	Confined Space / Trench Rescue	Building Collapse / Natural Disaster
Probability of Occurrence	*Probable*	*Frequent*	*Possible*	*Unlikely*
Consequence Severity	*Insignificant*	*Moderate*	*Moderate*	*Catastrophic*
Agency Impact	*Insignificant*	*Minor*	*Moderate*	*Extreme*
Overall Risk	***Low***	***High***	***Moderate***	***Extreme***

1.1.16 Aviation Risk

While the City has aviation risk exposure, particularly from the Los Angeles International Airport, that risk has been evaluated in other study(s) and was excluded from the scope of this study.

1.1.17 Marine Risk

The City of Los Angeles also has marine risk exposure at the Port of Los Angeles and city beaches, however, that risk has been evaluated in other study(s) and was excluded from the scope of this study.