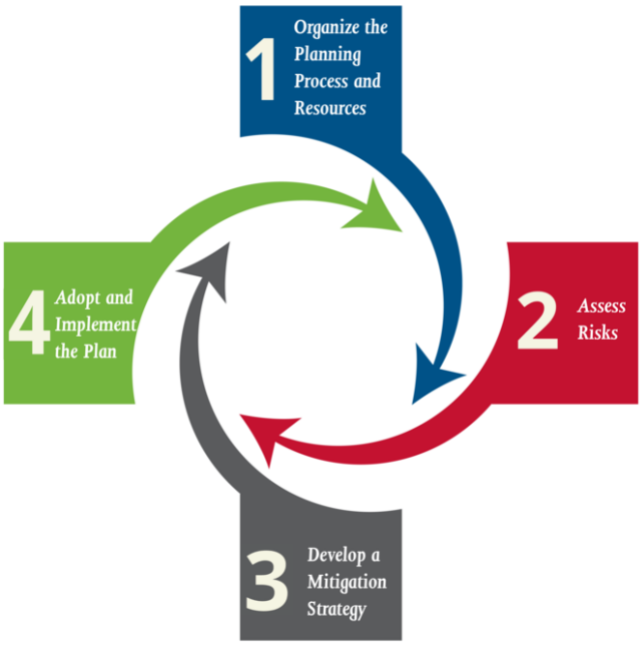
SECTION 4: RISK ASSESSMENT

The goal of mitigation is to reduce the future impacts of a hazard, including property damage, disruption to local and regional economies, and the amount of public and private funds spent for recovery. Mitigation decisions are based on risk assessments where the probability of an event is evaluated with respect to the anticipated damages caused by such an event.

The purpose of this section is to understand the hazards and their risks in the City's service area. There are generally four steps in this process: 1) hazard identification 2) vulnerability analysis 3) risk analysis and 4) vulnerability assessment, including an estimation of potential losses. Technically, these are four different items, but the terms are sometimes used interchangeably.



4.1 Hazard Identification

The Planning Team discussed potential hazards and evaluated their probability of occurrence. The following subsections describe this process and the results.

4.2 Hazard Screening Criteria

The intent of screening the hazards is to help prioritize which hazards create the greatest concern to the City. A list of the natural hazards to consider was obtained from Federal Emergency

Management Agency's State and Local Mitigation Planning How-to Guide: Understanding Your Risks (FEMA 386-1). The Planning Team used the Stafford Act, the California Emergency Service Act and STEPLEE to help rank each risk. The risks were ranked with from 1 – 4: with (1) being a "Highly Likely" event, (2) being "Likely" (3) being "Somewhat Likely" event, and (4) being "Least Likely" event. The Planning Team reviewed each hazard on the list using their experience and historical data pertaining to each hazard and developed the following ranked list.

Hazards:

Hazard	Risk Ranking (1-4)
Earthquake	2
Wildfire	1
Flooding	2
Climate Change	3
Drought	4
Dam Inundation	4

The following natural hazards were considered not to affect or be a risk to the City and were given a ranking of 4 or higher and are not considered applicable to the City for mitigation.

Volcanoes
Tsunami Liquidation
Landslides

Hazard Assessment Matrix
The City used a qualitative ranking system for the hazard screening process consisting of generating a high/medium/low style of rating for the probability and impact of each screened hazard.

For Probability, the ratings are: Highly Likely, Likely, or Somewhat Likely
For Impact, the ratings are: Catastrophic, Critical, or Limited

The screening assessment matrix was used for the City hazards. The hazards have been placed in the appropriate/corresponding box/cell of the corresponding "Screening Assessment Matrix" based on the Planning Team's collective experience as shown in Table 5 below. Prioritization of the hazards is discussed in the following section.

Screening Assessment Matrix
The screening assessment matrix is used for the District's hazards. The hazards have been placed in the appropriate/corresponding box/cell of the corresponding "Hazard Matrix" based on the Planning Team's collective experience. A subset of this group of hazards is used for the prioritization of the hazards in the following section.

Table 1: Screening Assessment Matrix

	Impact			
		Catastrophic	**Critical**	**Limited**
Probability	Highly Likely (1) (75 – 100%)	Earthquake Wildfires	Flooding	Windstorms
	Likely (2) (50-75%)			Drought Landslides
	Somewhat Likely (3) (50 – 75%)			Climate Change

4.3 Hazard Profiles

This section looks at all the hazards identified by the Planning Team. This section gives an overview of each hazard, the definition of each hazard, and a description of how each hazard is expected to affect the City service and/or service area using past examples and the hazards identified on the FEMA Website and the FEMA software program known as HAZUS, which contains models of natural disasters, and the effects the disasters can have on a region.

4.3.1 Earthquake

Probability: **Highly Likely**
Impact: **Catastrophic**

General Definition: An earthquake is a sudden, rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped the earth as plates that form the earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual, however increased movement occurs when the plates become locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free causing the ground to shake. Most earthquakes occur at the boundaries where the plates meet. However, some earthquakes occur in the middle of plates.

Ground shaking from earthquakes can collapse buildings and bridges; disrupt gas, electric, water utilities, and phone service; and trigger landslides, avalanches, fires, and destructive ocean waves, including tsunamis. Buildings with foundations resting on unconsolidated fill material and other unstable soil, as well as homes not tied to their foundations, are at risk because they can be shaken off their mountings even during a mild earthquake. When an earthquake occurs in a populated area, it may cause deaths, injuries, and/or extensive property damage.

Earthquakes strike suddenly and without warning. Earthquakes can occur at any time of the year and at any time of the day or night. On a yearly basis, 70 to 75 damaging earthquakes occur

throughout the world. Estimates of losses from a 7.8 magnitude earthquake in the southern section of the San Andreas Fault System, located in the regional area near Orange County could easily reach $200 billion.

There are 45 states and territories in the United States at moderate to very high risk from earthquakes, earthquakes are in every region of the country. California experiences the most frequent damaging earthquakes in the United States; however, Alaska experiences the greatest number of large earthquakes, most located in uninhabited areas. The nearby southern section of the San Andreas Fault is ranked in the top five (5) most likely faults to cause major damage in the United States by United States Geological Survey (USGS).

The source for the earthquake profile is a report that describes a new earthquake rupture forecast for California developed by the 2007 Working Group on California Earthquake Probabilities (WGCEP 2007). The Earthquake Working Group was organized in September 2005 by the USGS, the California Geological Survey (CGS), and the Southern California Earthquake Center (SCEC) to better understand the locations of faults in California. The group produced a revised, time-independent forecast for California for the National Seismic Hazard Map. The last two earthquakes that damaged infrastructure of Villa Park was the 2019 La Habra Earthquake and the 1994 Northridge Earthquake. Both earthquakes resulted in only minor damage. The Northridge and Corona earthquakes were felt in the service boundaries, but did no damage to the infrastructure

Description: There are several earthquake faults located in or near the City of Villa Park's boundaries. The El Modano Fault runs though the city on an east-west trajectory. The Peralta Hills Fault runs along the northern City's boundaries and the Elsinore Fault is approximately 20 miles north of the City. While there have been many earthquakes in and around Villa Park, there has not been a major earthquake in many years.

Mitigation: Projects to help mitigate damage from earthquakes include; a seismic retrofit of the City Hall and City Offices (as these buildings are un-reinforced concrete block), install flex couplings on wastewater pipelines in the City (so they move with ground movement from earthquakes), contract the Fire and Police Departments to develop an Emergency Operations Plan, and to create an Evacuation and Shelter Plan in the event of an earthquake.

Figure 1: Villa Park Fault Map

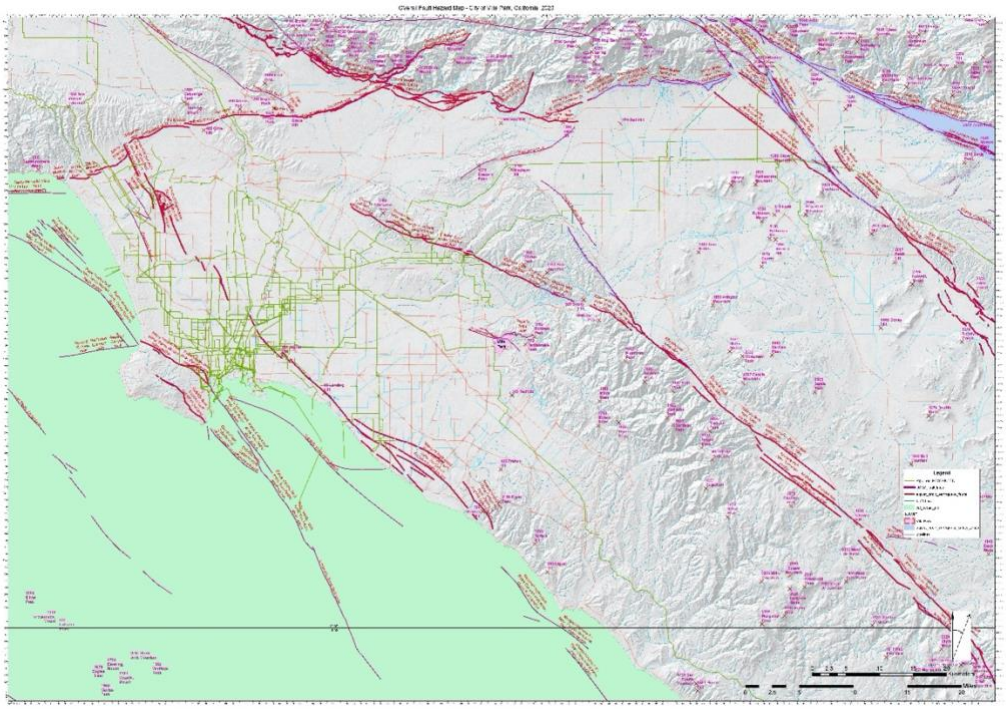


Figure 2. San Andreas Fault, USGS ShakeOut Map

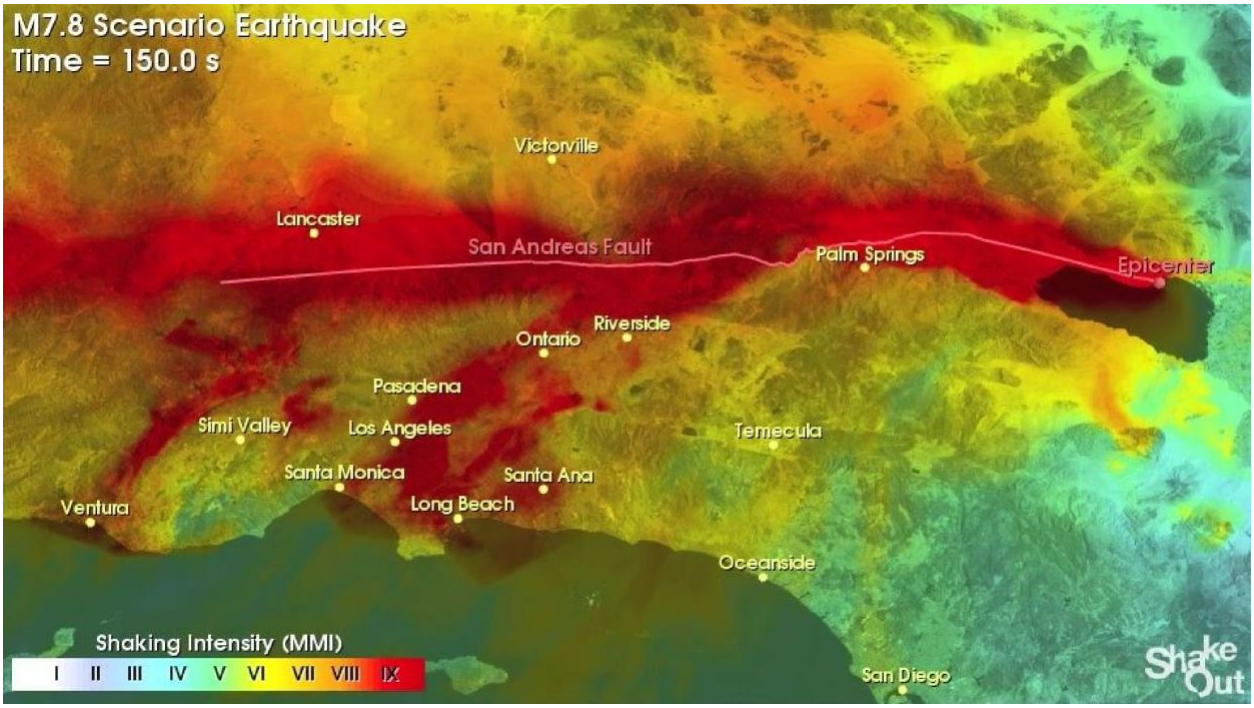


Table 2: Historic Southern California Earthquakes

Date	Area	Location	Mag	MI	Total damage / notes
4/5/2019	Kern/SB	Ridgecrest/Trona	7.1 M_w	VI	Unknown
7/4/2019	Kern/SB	Ridgecrest	6.72M_w	VIII	Limited
7/29/2008	Los Angeles Area	Chino Hills Earthquake	5.5 M_w	VI	Limited
10/16/1999	Eastern	Hector Mine Earthquake	7.1 M_w	VII	Limited
1/17/1994	Los Angeles Area	Northridge Earthquake	6.7 M_w	IX	$13–$40 billion
6/28/1992	Inland Empire	Big Bear Earthquake	6.5 M_w	VIII	Moderate/Triggered
6/28/1992	Inland Empire	Landers Earthquake	7.3 M_w	IX	$92 million
4/22/1992	Inland Empire	Corona	6.3 M_s	VII	Light–moderate
6/28/1991	Los Angeles Area	Sierra Madre Earthquake	5.6 M_w	VII	$33.5–40 million
2/28/1990	Los Angeles Area	Upland Earthquake	5.7 M_w	VII	$12.7 million
11/24/1987	Imperial Valley		6.5 M_w	VII	Triggered
11/23/1987	Imperial Valley		6.1 M_w	VI	$3 million
10/1/1987	Los Angeles Area	Whittier Narrows Earthquake	5.9 M_w	VIII	$213–358 million
7/21/1986	Eastern	Chalfant Valley Earthquake	6.2 M_w	VI	$2.7 million / sequence
7/13/1986	South Coast		5.8 M_w	VI	$700,000
7/8/1986	Inland Empire	North Palm Springs Earthquake	6.0 M_w	VII	$4.5–6 million
4/26/1981	Imperial Valley	Calexico	5.9 M_w	VII	$1–3 million
5/25/1980	Eastern	Salton Sea	6.2 M_w	VII	$1.5 million/Swarm
10/15/1979	Imperial Valley	Imperial Valley Earthquake	6.4 M_w	IX	$30 million
2/21/1973	South Coast	Point Mugu Earthquake	5.8 M_w	VII	$1 million
2/9/1971	Los Angeles Area	San Fernando Earthquake	6.5–6.7 M_w	XI	$505–553 million
4/8/1968	Imperial Valley		6.5 M_w	VII	Damage / rockslides
12/4/1948	Inland Empire	Desert Hot Springs Earthquake	6.4 M_w	VII	Minor
11/14/1941	Los Angeles Area		5.4 M_s	VIII	$1.1 million
6/30/1941	Central Coast		5.9 M_w	VIII	$100,000

5/18/1940	Imperial Valley	El Centro Earthquake	6.9 M_w	X	$6 million
3/10/1933	South Coast	Long Beach Earthquake	6.4 M_w	VIII	$40 million
6/21/1920	Los Angeles Area		4.9 M_L	VIII	More than $100,000
4/21/1918	Inland Empire	San Jacinto Earthquake	6.7 M_w	IX	$200,000
6/22/1915	Imperial Valley		5.5 M_w	VIII	Additional damage / doublet
6/22/1915	Imperial Valley		5.5 M_w	VIII	$900,000 / doublet
4/18/1906	Imperial Valley		6.3 M_w	VIII	Damage / triggered

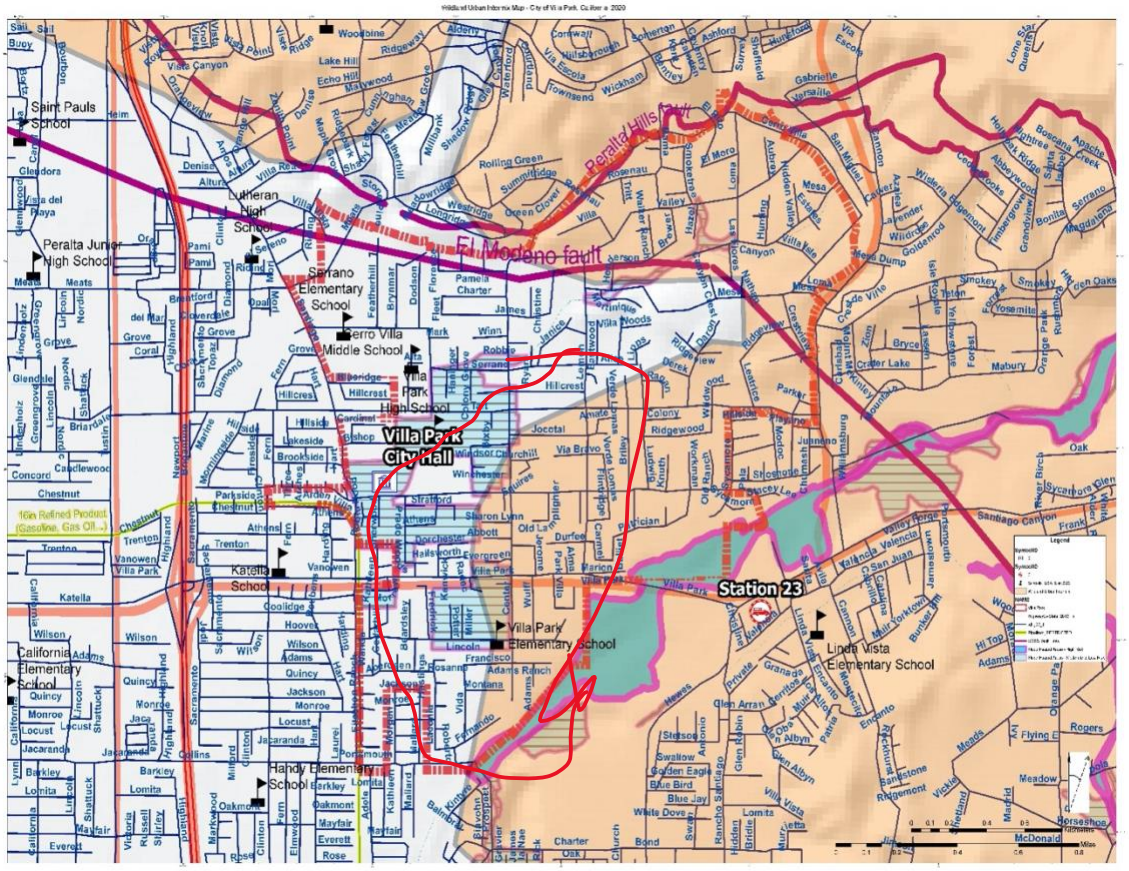
4.3.2 Wildfire

Probability: **Highly Likely**
Impact: **Catastrophic**

General Definition: California is very susceptible to wildfires, especially during the fall and summer months. Southern California experiences the Santa Ana winds that develop mostly in the late summer and fall. These winds are known for their high speeds and drying effect, which turn the natural grasses brown and dry. These winds are also capable of blowing down power lines that are known to start fires in the mountains and hills. The fires are driven by the high winds and the fires become large events that destroy large areas within cities and towns and cause loss of life and millions of dollars in property damage. The last major wildfires in the region surrounding Villa Park were the Sierra Fire in February 2006 and the Stagecoach Fire/Villa Park Fire in in October of 1993 which destroyed two homes and damaged 29 other in Anaheim Hills and Villa Park. The Gypsum Canyon Fire of October 1982 burned 17,000 acres and destroyed 14 homes in Villa Park, Orange, and Anaheim Hills.
Description: Local fires are a significant concern. The City Hall and offices are not in the FEMA fire zone, but there are many well established neighborhoods in the fire zone, which would be hard impacted by a large uncontrolled wind driven fire in the rolling hills neighboring the cities of Orange and Anaheim Hills. This type of fire would easily spread to the City of Villa Park when driven by a Santa Ana wind event. There is one elementary school in the high fire risk zone, which would limit the evacuation area to the one of the other Public Schools in the City.

Mitigation: Public information and education on fire safety, clearing brush and trees at least 25 feet from homes and businesses. The City needs public and school evacuation plans and Emergency Response Plans in place. The City needs to have mock exercises with Police, fire, and schools, both tabletop and functions exercise, so residents and the city staff better understand what to do in emergencies. Develop evacuation routes for neighborhoods in case of fires. Develop sound public notification system to evacuate for fire or flooding.

Figure 3: Fire Map



4.3.3 Windstorms

Probability: **Highly Likely**
Impact: **Critical**

General Definition: Santa Ana windstorms are common during the fall and winter months in Southern California. Winds are caused by a low-pressure system over the southern coastline and a high pressure over the Great Basin in Nevada. When the high-pressure turns counterclockwise the warm, dry air is pulled to the low-pressure zone and out to the Pacific Ocean. The hot dry air must be funneled through the mountain passes and canyons out to the California deserts and mountains and canyons and out to the Pacific Ocean.

Description: Wind speeds can reach 100 mph during these events. A yearly event occurring during the fall and winter months drives the wildfires in California, causing electrical outages, downed power lines, fallen trees, fires, and risk to life and safety of the residents as well as catastrophic destruction to property as seen during the devastating fires in California in the last several years. The damages from high windstorms include loss of power, downed power lines, and roof damage on water storage structures, loss of life and the loss of homes and businesses.

Mitigation: Projects to help mitigate damage from windstorms include public education regarding trimming trees around power lines (Southern California Edison, will normally clear tall trees from powerlines for free) and develop a plan in conjunction with Southern California Edison to inform the residents. Develop plans with Southern California Edison and the water company on Public Safety Power Shut-off (PSPS) Programs and hold town hall meetings to inform the public, this program would also inform Edison on which homes must have power for emergency medical needs. Additionally, the City should develop a program to clear downed trees on roadways.

4.3.4 Flooding

Probability: **Highly Likely**
Impact: **Critical**

General Definition: An unusually heavy rain in a concentrated area, over a short or long period of time that collects on the ground in low areas of the land. Flooding occurs when there are large amounts of rainfall in areas where the water runs off to lower elevations.

Description: Typically, flooding happens in Villa Park when there are storms in the local area and the rainwater runs out of the rolling hills into the valley. Wildfires can exacerbate flooding conditions, when infiltration is affected, and limited vegetation is in place. Major wildfires are known to, contribute to major flooding, as the vegetation is burned away, allowing the rainwater to runoff of the hills onto the valleys below.

Mitigation: As the map below shows the Villa Park elementary school and the City Hall are is in the 100- and 500-year flood plans**.** Mitigation for flooding are to develop emergency response and evacuation planning. Increase the capacity of the existing flood control systems in the City to carry flood waters to the Orange County flood control system. Land in the City of Villa Park is completely developed, the issue must be mitigated by improving the existing structures and not building new structures.

Figure 4: Flooding Map (Blue Area)

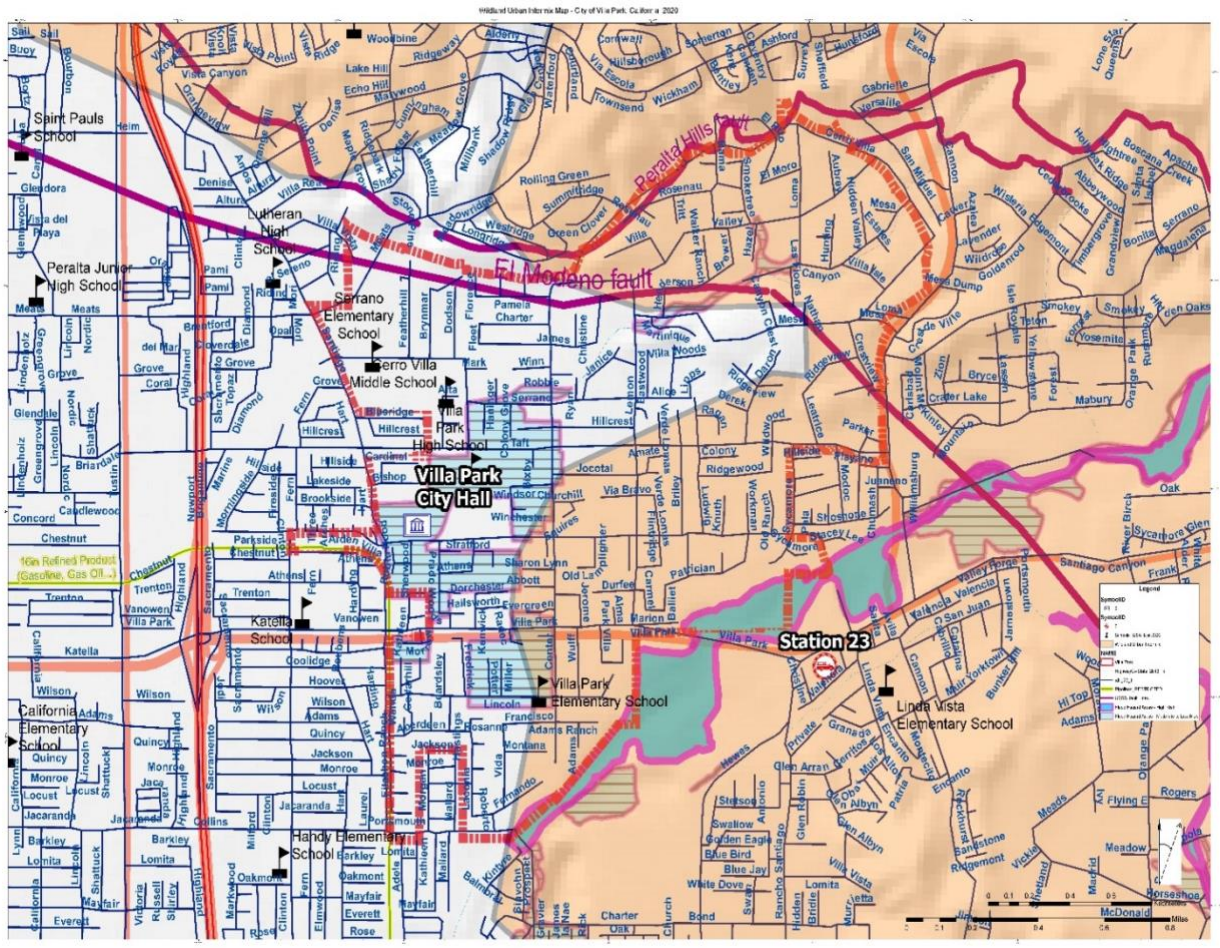


Table 3: USGS Flooding History

Date of event	Type of Damage	Amount of Damage	Statewide or Local
Dec-55	74 deaths	$200 M	Statewide
Apr-58	13 deaths, several injuries	$20 M, plus $4 M agricultural	Statewide
Fall 1965	Abnormally heavy and continuous rainfall.	Public- $5.8 M; private $16.0 M; Total $21.8 M	Riverside, San Bernardino, Ventura, San Diego Counties
Winter 1966	Abnormally heavy and continuous rainfall.	Public- $14.6 M; private $14 M; Total $28.7 M	Various
Winter 1969	Storms, flooding, 47 dead, 161 injured. An alluvial flood and debris flow on Deer Creek in San Bernardino County killed 11 people.	Public $185 M, Private - $115 M; Total $300 M	Various
Sep-1976	High winds, heavy rains, and flooding	Public$65.7 M; private- $54.3 M; Total $120 M	Imperial, Riverside, San Bernardino, San Diego Counties
Winter 1978	14 dead, at least 21 injured	Public $73 M; private-$44 M; Total $117 M; 2,538 homes destroyed	Various
Jul-1979	No Deaths	Public $3.0 M; private- $22.9 M; Total $25.9 M	Riverside
Feb-1980	Rain, wind, mud slides, and flooding	18M to 20M	Various
Winter 1982-1983	Heavy rains, high winds, flooding, levee breaks	Public $151 M; private $159 M; agricultural $214 M; Total $524 M	Various
Aug-1983	High winds, storms, and flooding; 3 deaths	Public $10 M, private $15 M, agricultural $10 M; TOTAL $35 M	Inyo, Riverside, San Bernardino Counties
Feb-1992	Flash Flooding, rainstorms, mud slides; 5 deaths	Public-$95 M; private- $18.5 M; business $8.5 M, agricultural $1.5 M; TOTAL $123 M	Los Angeles, Ventura, Kern, Orange, San Bernardino Counties
Dec-1992	Snow, rain, and high winds, 20 deaths, 10 injuries	Total - $600 M	Various
Jan-1995	11 deaths	Public $299.6 M; individual $128.4 M; businesses $58.4 M; highways $158 M; ag- $97 M; TOTAL $741.4 M; damage to homes: major- 1,883; minor 4, 179; destroyed-370.	Various

Date of event	Type of Damage	Amount of Damage	Statewide or Local
Feb-1995	17 deaths	Public property $190.6 M; individual $122.4 M; business $46.9 M; highways $79 M; ag $651.6 M; TOTAL approximately $1.1 billion; damage to homes: major-1,322; minor-2,299; destroyed 267	57 counties (all except Del Norte)
Feb-1998	17 deaths	$550 M	Various
Dec. - 2003	15 deaths	$30 M	San Bernardino, Waterman Canyon, Lytle Creek
Jan. 2004	None	$20,000 public property	San Bernardino County High Desert
October 2010	None	$2.5 M	Flash flooding San Bernardino County High Desert
Dec. 2010 Jan. 2011	None	$18 M San Bernardino/Highland, High Desert, San Bernardino Mountains, Forest Falls	Various location in San Bernardino County
May 2012 March 2014	None	$50,000	S.B. County High Desert Various

Fuel Pipeline: Another hazard identified in the map above is a high-pressure gas, diesel, and aviation fuel pipeline that runs on the western boundary of the City. The pipeline is owned by Kinder Morgan.
Mitigation: Develop an Emergency Response Plan and Evacuation Plan in conjunction with Kinder Morgan, the Contracted City Fire and Police Departments for utilization in the event of an explosion, rupture or fire involving this pipeline.

4.3.5 Climate Change/Drought

Probability: **Somewhat likely**
Impact: **Limited**

General Definition: Climate Change is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time (i.e., decades to millions of years). Climate change may refer to a change in average weather conditions, or in the time variation of weather around longer-term average conditions (i.e., more or fewer extreme weather events). Climate change is caused by factors such as biotic processes, variations in solar radiation received by the

earth, plate tectonics, and volcanic eruptions. Certain human activities have also been identified as significant causes of recent climate change, often referred to as global warming.

Description: Climate change could increase water demands while lowering the groundwater table. This will result in increased pumping costs and may require installing deeper water supply wells. Extreme weather events will increase runoff and flooding while reducing the groundwater recharge.

Mitigation: Homeowners will need to decrease lawn irrigation and landscaping, replace landscaping plants with drought tolerant plants. In general, reduce the household use of water. The City should communicate with the local water agency on how the City can support the water provider on climate change.

4.3.6 Drought

General Definition: A drought is a period of below-average precipitation in, a given region resulting in prolonged shortages in its water supply, surface water, or ground water. Droughts occur when there are long periods of inadequate rainfall. The cycle of droughts and wet periods are often part of El Nino and La Nina weather cycles. This is a growing concern in California, as the state has been in a drought for the last eight years. Northern California experienced some relief in the winter of 2016, although the El Nino effect that was expected to relieve the drought statewide did not materialize in Southern California. The lack of rain and most importantly the lack of snowfall in the Sierra Nevada mountain range severely impacted the residents of large parts of California.

Description: Orange County is one of the area's in California that is very dependent on imported water, from northern California, as this area does not have enough water to supply the large population. Metropolitan Water District of Southern California services most of the water providers with at least some water or at least as a back up to the ground water that is served in the area.

The National Integrated Drought Information System (NIDIS) is a tool that measures the drought-related risks in certain areas of the country. Figure 12 below shows that Orange County as with most of California is right on the line of another severe drought. and was moving to a severe drought until rains of 2020 provided relief.

Figure 5: Current Drought Conditions in San Bernardino as of May 2018

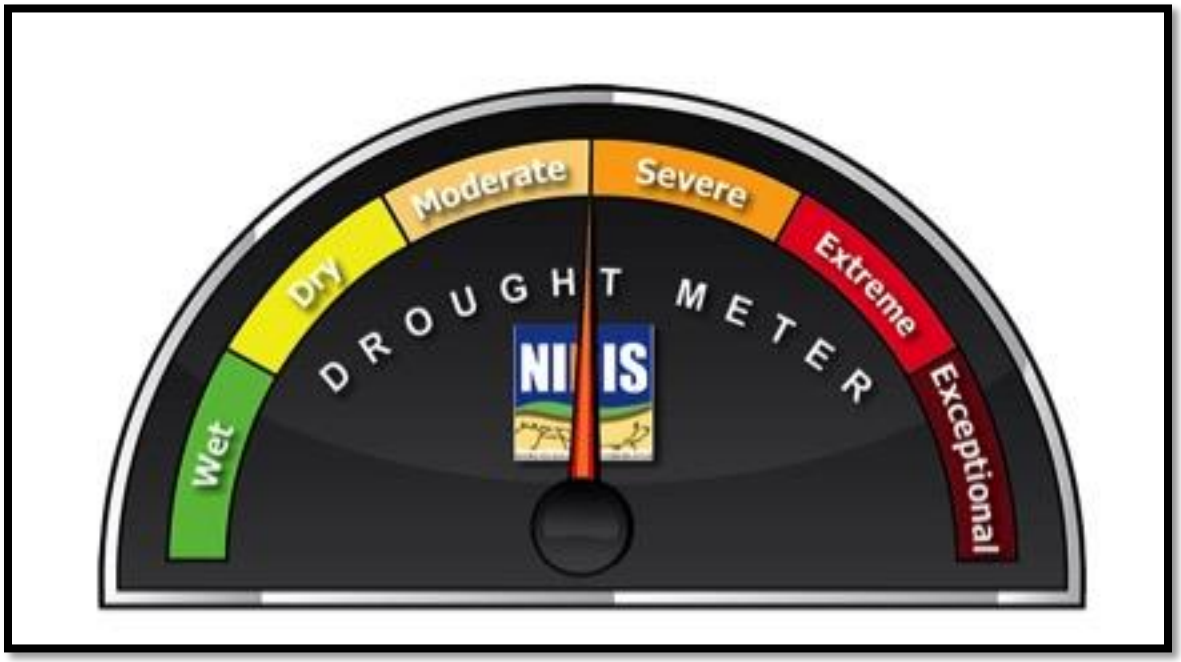


Table 4: California Drought History (extracted from USGS, California Drought History

1841	The drought was so bad that "a dry Sonoma was declared entirely unsuitable for agriculture"
1864	This drought was preceded by the torrential floods of 1861-1862, showing the fluctuation in climate back in the 1800s.
1924	This drought encouraged farmers to start using irrigation more regularly because of the fluctuation in California weather the need for consistent water availability was crucial for farmers.
1929–1934	This drought was during the infamous Dust Bowl period that ripped across the plains of the United States in the 1920s and 1930s. The Central Valley Project was started in the 1930s in response to drought.
1950s	The 1950s drought contributed to the creation of the State Water Project.
1976–1977	1977 had been the driest year in state history to date. According to the *Los Angeles Times*, "Drought in the 1970s spurred efforts at urban conservation and the state's Drought Emergency Water Bank came out of drought in the 1980s."
1986–1992	California endured one of its longest droughts ever observed from late 1986 through early 1992. Drought worsened in 1988 as much of the United States also suffered from severe drought. In California, the six-year drought ended in late 1992 as a significant El Niño event in the Pacific Ocean (and the eruption of Mount Pinatubo in June 1991) most likely caused unusual persistent heavy rains.
2007–2009	2007–2009 saw three years of drought conditions, the 12th worst drought period in the state's history, and the first drought for which a statewide proclamation of emergency was issued. The drought of 2007–2009 also saw greatly reduced water diversions from the State Water Project. The summer of 2007 saw some of the worst wildfires in Southern California history.
2011-2017	From December 2011 to March 2017, the state of California experienced one of the worst droughts to occur in the region on record. The period between late 2011 and 2014 was the driest in California history since record keeping began.

)

Progression of the drought from December 2013 to July 2014
(extracted from USGS, California Drought History)

The period between late 2011 and 2014 was the driest in California history since record keeping began. In May 2015, a state resident poll conducted by Field Poll found that two out of three respondents agreed that it should be mandated for water agencies to reduce water consumption by 25%.

The 2015 prediction of El Niño to bring rains to California raised hopes of ending the drought. In the spring of 2015, the National Oceanic and Atmospheric Administration (NOAA) named the probability of the presence of El Niño conditions until the end of 2015 at 80%. Historically, sixteen winters between 1951 and 2015 had created El Niño. Six of those had below-average rainfall, five had average rainfall, and five had above-average rainfall. However, as of May 2015, drought

conditions had worsened, and above average ocean temperatures had not resulted in large storms. The drought led to Governor Jerry Brown's instituting mandatory 25% water restrictions in June 2015.

Millions of California trees died from the drought - approximately 102 million, including 62 million in 2016 alone. By the end of 2016, 30% of California had emerged from the drought, mainly in the northern half of the state, while 40% of the state remained in the extreme or exceptional drought levels. Heavy rains in January 2017 were expected to have a significant benefit to the state's northern water reserves, despite widespread power outages and erosional damage in the wake of the deluge. Among the casualties of the rain was 1,000-year-old Pioneer Cabin Tree in Calaveras Big Trees State Park, which toppled on January 8, 2017.

The winter of 2016–17 turned out to be the wettest on record in Northern California, surpassing the previous record set in 1982–83. Floodwaters caused severe damage to Oroville Dam on the Feather River in early February, prompting the temporary evacuation of nearly 200,000 people north of Sacramento in response to the heavy precipitation, which flooded multiple rivers and filled most of the state's major reservoirs. Governor Brown declared an official end to the drought on April 7, 2017.

Mitigation: Develop ways to capture rainwater from the higher mountains during flash flooding events and divert those waters to the percolation ponds to recharge the underground aquifer.

4.3.7 Dam Inundation Zone

Probability: Somewhat likely
Impact: **Limited**

Definition: A failure of the Villa Park Dam, which is owned and operated by the Orange County Flood Control Agency, allows for a flood control for Villa Park, Orange, Tustin, and Santa Ana and spills from Irvine Lake.

Description: The Lake at Villa Park is normally empty. The Villa Park Dam was constructed in 1956 after the flood of 1936, as it took 20 year to obtain the needed funding. In 1969 the Villa Park Dam reached it limits and the Army Corps of Engineers built Padre Dam, and many years later 7-Oaks Dam in San Bernardino County to ensure the safety of Orange County residents.

Even, if Villa Park Lake was full and the dam failed, there is not enough water behind the dam to cause loss of life or major property damage to residents of Villa Park. The dam is in a canyon and homes are higher than the canyon walls. The failure would need to take place on four or five dams upstream to cause inundation in Villa Park. (Please see map above to see dam area to the east of the City.)

Mitigation: Orange County is currently removing some homes and enlarging the area were flooding may occur. There is no further mitigation known or needed at this time.

4.4 Inventory Assets Hazard Susceptibility

The following sections provide an overview of the assets of the City of Villa Park and the hazards to which these facilities are susceptible.

4.4.1 Facilities Overview

City Hall
Library Building
24.65 Miles of wastewater collection pipelines
36.13 Miles of City streets

4.4.2 Vulnerability Assessment

The team reviewed USGS, FEMA HAUS maps of each of the City's Hazards. The maps were presented with the infrastructure of the area to convey the locations within the city for each Hazard. The Planning Team has a long history in the area and knowledge of the potential disasters and emergencies that can occur in and around the community. The Planning Team has the knowledge to assess the system and give valuable input into the assessment and vulnerabilities to the City and the infrastructure.

4.4.3 Methodology

The Planning Team reviewed the City's infrastructure and applied their local and operational knowledge to evaluate how vulnerable each facility is to a potential hazard. The team ranked the facilities and infrastructure by their importance to the City and the residents. The team then used this ranking to develop an estimate of potential economic impacts that could be caused by the high priority hazards. A percentage based on ranking was applied to the City's projected 2020-2021 annual revenue to assess the annual economic impact for each City.

4.4.4 Earthquake Vulnerability Analysis

Population: Approximately 100% of City's population is vulnerable.

Critical Facilities: Approximately 100% of City's critical facilities are vulnerable.

All facilities are vulnerable in the event of a major earthquake within the Utility Department's service area boundaries. There are many nearby faults that could affect the Utility Department's facilities: Loma Linda, Middle Fork, Cleghorn, Arrowhead, Mill Creek, Grass Valley, Crafton Glen Helen, Big Bear, Southern San Andreas, and the San Jacinto. If any of these faults experience a rupture of 6.5 magnitude or more, it will have a negative effect on the City's facilities and pipelines.

Estimated Losses: The economic loss resulting from this hazard is approximately $5 billion. The loss from damage to structures and pipelines from this hazard is approximately $6.5 billion.

Losses are estimated assuming:

1. It is estimated 50% of the residents could have their home red tagged due to a 7.0 magnitude earthquake in Villa Park.
2. The City's wastewater collection system could suffer pipeline failure of 80% of the wastewater pipelines being ruptured.
3. City Hall houses the Police Department, which could suffer major damage in a 7.0 or higher magnitude earthquake.

4.4.5 Flooding Vulnerability Analysis

Population: Approximately 40% of the Villa Park population is vulnerable.

Critical Facilities: Approximately 100% of the City's critical facilities are vulnerable.

Flooding predominately happens when heavy and concentrated rains occur in the area and runoff is channeled down the hills into the low sections of the city.

Estimated Losses: The economic loss resulting from this hazard is approximately $80 million. The loss from damage to structures from this hazard is approximately $30 million, to homes, small businesses, and roadways.

4.4.6 Wildfire Vulnerability Analysis

Population: Approximately 75 % of Villa Park's population is vulnerable.

Critical Facilities: Approximately 5% of the City's critical facilities are vulnerable.

Wildfires are a major concern in California. However, most of the homes in Villa Park are in a high fire risk zone, which is a major concern to the city. The City Hall, Police Station and Library, which are City buildings are not in the high fire risk zone. Two of the schools are in the fire zone, but the schools are not owned by the City, however, evacuation of the schools, are a major concern to the City. The City does not own or operate the water system in the city. Fire does not harm the wastewater system, therefore is not a concern to the City.

Estimated Losses: The economic loss resulting from this hazard is approximately $100 Million. The loss from damage to structures from this hazard is approximately $80 million, to homes.

4.4.7 Climate Change/Drought Vulnerability Analysis

Population: 100% of Villa Park population is vulnerable to climate change.

Critical Facilities: None owned by the City

Climate change is an immediately sensitive issue in coastal communities, with increasing ocean waters, sea surges, tidal issues, and surging waves. Northern California and, in turn, the Central Valley are being affected by recent changes in weather patterns including seasonal snowpack and drought cycles. In the inland desert regions of California, climate change is a long-term concern. As the weather becomes hotter and dryer in a changing climate, water may need to be captured during the rainy periods to recharge the underground aquifers. Other water conservation measures will be needed in the long-term. However, the City does not own any potable water system, parks, or water recharge systems. The City is 15 miles inland, and 341 feet above sea level from the Pacific Ocean; therefore, sea level rise is not a concern to the City.

Estimated Losses: The economic loss resulting from this hazard is approximately Zero. The loss from damage to structures from this hazard is approximately Zero.

4.4.8 Long Term Drought Analysis

Population: Approximately 100% of Villa Park's population is vulnerable.

Critical Facilities: Approximately 100 % of Villa Park's wastewater critical facilities are vulnerable.

The are no critical facilities vulnerable in the Villa Park, as the City owns no parks or green spaces. However, the wastewater system could be vulnerable if there is not enough water being flushed into the system to keep the flow in the wastewater system moving, allowing gasses to build up in the pipelines and decaying the collection system or gasses to enter homes and business.

Estimated Losses: The economic loss resulting from this hazard is approximately $60,000 a month, due to loss of wastewater collection system failure.

4.4.9 Windstorm Vulnerability Analysis

Population: Approximately 75% of Villa Park's population is vulnerable.

Critical Facilities: Approximately 100% of the City's critical facilities are vulnerable.

City Hall/Police Station Library building could lose power, but there is backup generator to power the building and for back up communications. Most of the damage is to City streets and sidewalks from up rooted trees and downed trees that damage the streets and sidewalks.

Estimated Losses: The economic loss resulting from this hazard is approximately $1 million. The loss from damage to structures from this hazard is approximately $12 million