

A critique was conducted on the 2014 City and County of San Francisco Hazard Mitigation Plan regarding hazard types pertaining to weather and climate. The critique provides a brief summary about each hazard type as well as observations made by the authors.

Weather and Climate Hazard Mitigation Critique

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Introduction

The City and County of San Francisco published a hazard mitigation plan in the year 2014. The city distinguished all hazards the area is prone to experiencing as well as conducted a hazard profiling analysis to identify specific locations, intensity and frequency. “A natural hazard is a source of harm or difficulty created by a meteorological, environmental, or geological event. A human-caused hazard results from human activity and includes technological hazards and terrorism”. The following critique only address natural hazards caused by weather or climate events. This includes drought, flood, heat, non-earthquake landslides, wind, climate change induced hazards such as temperature rise, precipitation change, and sea level rise as well as pandemic, and wildfires.

Drought

The City and County of San Francisco Hazard Mitigation Plan addresses the effects of drought on the environment, economy and community. The drought plan begins with a detailed explanation of the definition of drought and the specific water source within San Francisco that is prone to drought. The hazard mitigation plan (HMP) then goes into brief detail of how drought is measured in terms of different commodities and social effects. The history of drought in the area is discussed and is said to be rare in the Northern California area. It is important that the mitigation plan incorporated dates of statewide drought because it gives an understanding of the vulnerability of the area.

Moving on, the HMP talks different models to measure drought and what is most commonly used for the area. It then goes on to say that state water officials have evaluated the area and concluded the area is prone to another year of drought even though, like previously discussed, it is rare for the area. One key element of the drought plan is that it clearly addresses change in climate. A change in climate is leading to a warmer plant and can lead to “reduced Sierra snowpack and earlier melting of the snowpack”. By addressing such changes, the city is preparing for a varied future and understands that an old plan created for past events will not suffice.

The drought plan shouldn't have discussed the impacts of drought in terms of a way to measure drought. It should have just simply listed the components effected by drought. By addressing these effected components as measurements, this confuses the reader on how to directly measure drought because this observation is based on opinion.

The drought plan does not show the specific area affected by drought as “all of San Francisco” is affected. The drought plan should have had a picture of the snowpack area affected by drought as well as the snowpack area at different levels of drought or at specific times in history. This is a visual aid for understanding the effects of drought because “all of San Francisco” is too vague of a statement.

The drought plan fails to mention how it has prepared or how it plans to mitigate the effects of drought. If it has addressed climate change, how does San Francisco plan to prepare for reduced snowpack if that is their major water source in the area. There should be a list of options such as purchasing water from nearby states or desalination projects.

Flood

The City and County of San Francisco Hazard Mitigation Plan addresses the effects of flooding in low lying areas. The flood plan provides a description of floodplain areas and the resulted physical damage. The areas damaged by flooding include building, roads, water infrastructure such as bridges, culverts, and dams, as well as erosion of stream banks and shorelines. This does cause a disruption to the economy through closure of businesses or effects on transportation.

The plan then goes into detail about the different types of flooding that can occur in San Francisco. Storm water ponding and Riverine flooding are addressed. Storm water ponding results when runoff rates are inadequate for the amount of precipitation and riverine flooding occurs when snowmelt or rainfall exceeds the carrying capacity of streams and rivers. Areas affected by flooding are clearly labeled using the Department of Public Works and is provided in the appendix. The flooding information provided further prepares the people of San Francisco and provides the city the resources to create a Flood Insurance Rate Map (FIRM) with the help of FEMA.

Unfortunately, the HMP failed to address if climate change will create any non-historical variability in flooding. The city has created a FIRM but it is not discussed if the plan will account for rising sea levels and or increase in precipitation intensity.

Heat

The City and County of San Francisco Hazard Mitigation Plan addresses the effects of excessive heat and its effects on the community. The plan first addresses the typical weather in San Francisco including historical data of severe fluctuations in weather. It then discusses the ways in which heat manifests itself including sweltering humidity and excessively dry conditions. Giving examples of such abrupt temperature changes due to these conditions provides an understanding about the variability and the dangerous aspects of heat.

Additionally, the local National Weather Service announcements are listed for certain excessive conditions. The San Francisco Department of Public Health developed a Heat Vulnerability Index to visually represent the most vulnerable neighborhoods at risk for excessive heat. This is important information to gain public awareness and to be able to provide assistance when excessive heat announcements are issued. Moving on, the California Climate Adaptation Strategy provided analysis that California is getting warmer therefore, “leading to increasing frequency, intensity, and duration of heat waves”. The HMP describes that during heat or extreme heat events the local weather service “may” issue messages regarding excessive conditions but this should be prioritized and not left up to a “maybe”.

Non-earthquake Landslide

The City and County of San Francisco Hazard Mitigation Plan addresses the effects of non-earthquake induced landslide. This is consequential to intense weather in the form of strong/prolonged precipitation. The hazard mitigation plan first describes the historic landslides in San Francisco and specifically, how the El Nino creates disruption to changes in precipitation. Even though a specific map for non-earthquake induced landslides is not provided, the CGS has prepared a visual representation of at risk areas for earthquake-induced landslides. This map is

sufficient because the same locations, including steep slopes on hills and cliffs, are prone to both types of landslides.

Additionally, the HMP, regarding non-earthquake induced landslides, discusses the possible locations vulnerable to such a weather induced event. On the other hand, the plan fails to discuss the possible measures taken if roads were blocked or if buildings were buried. It fails to address any safety measures or actions after a non-earthquake induced landslide occurs.

Wind

The City and County of San Francisco Hazard Mitigation Plan addresses wind and the time of year in which to expect high winds. Wind is defined as “horizontal flows of air that blow from areas of high pressure to areas of low pressure”. The National Weather Service provides information regarding the occurrence of Diablo winds (hot, dry offshore winds) and winter cold front winds.

We commend that the HMP addresses the Great Highway roadway closure that occurs at least once a year. Unfortunately, it does not talk about alternative routes available if this was to occur. Overall, the HMP fails to mention any way of mitigating harm to people or infrastructure such as cutting overhanging branches to avoid power outages.

Climate Change

The City and County of San Francisco Hazard Mitigation Plan addresses climate change as a risk to San Francisco City but the plan does not seem to have better preparedness for some major climate change risks. Extreme temperature, heavy downpours, sea level rise, reduced snow pack, spread of diseases, shortage in food and reduced power supply has been identified as potential climate change impacts for the CCSF Planning area from the past records, whereas the mitigation plan just discusses temperature rise, precipitation shifts and sea level rise as the major concerns, underweighting the impacts of several others.

The HMP talks about the areas being affected and their future projections but lacks a detailed quantitative and exposure analysis. Additionally, it does not give a detailed summary on effects of climate change. This would have been significantly important for the public in understanding and accepting the risk of climate change. A detailed summary on the effects of climate change could have been helpful in preparing society for the potential risks.

Temperature rise

There are sufficient statistics to prove extreme heat events as the number one cause of weather-related fatalities in the US. In addition, despite the threats of rising temperature from the climate projection and models, temperature rise is not considered as serious in the bay area due to its temperate climate. In addition, lack of physiologic and technologic adaptations has made San Francisco more vulnerable to rising temperature and an overall change in climate.

The San Francisco Department of Public Health had done an extensive study to identify local neighborhoods and population groups at greatest risk for heat waves and poor air quality in San

Francisco, which considers 20 different social, geographic, and environmental variables. The climate is expected to become considerably warmer during this century, and the mitigation plan has highlighted temperature rise as a potential threat but lack of preparedness was clearly observed when the highest risk of heat-related illness occurred in cooler regions in coastal counties, not in the Central Valley where the highest actual temperatures were experienced. In addition, heat events can create intensive demands on the electric transmission system, leading to power outages and their accompanying impacts on people. The plan address effects of temperature rise but unfortunately, the CCSF mitigation plan does not have sufficient awareness and preparedness for these potential issues.

Precipitation Change

Shift in precipitation patterns are expected in both California and the San Francisco Bay Area, but the nature and extent of precipitation are not very certain. The most frequent problems observed due to shifts in precipitation are the two extremes of water: too less or too much. Based on history, San Francisco ranges from very wet winters that greatly exceed its 100-year average of 21.14 inches of rain per year, to dry winters with nearly half the average annual rainfall. Reduced precipitation has led to reduction in overall water supply, and do pose a considerable risk for spread of diseases. On the contrary, heavy downpour could severely stress the city's combined sewer and storm water system.

Decreasing snowmelt and spring stream flows, coupled with increasing demand for water resulting from a growing population and from a hotter climate is likely to cause increasing water shortages. The plan talks about the potential risk but does not seem to have sufficient preparedness for the possible future risks. Also, the current models used to project precipitation impacts does not include future climate variability therefore, the preparedness entirely based on current model projections may not be effective.

Sea Level Rise

San Francisco is particularly vulnerable to rising sea levels because of its geological location. Flooding from sea level rise will likely damage buildings and roads in these areas. In addition, salt water intrusion could possibly damage underground infrastructure, such as pipes and foundations. Coastal flooding also presents a risk to major transportation infrastructure in the region. The California Climate Change Center estimated in 2009 that the number of San Franciscans at risk to a 100-year flood will increase from 190 to 3,800 individuals, assuming a 1.4 meter (55 inch) rise in sea level by 2100 using conservative modeling with emission scenarios that are less than current emission rates.

Despite several potential risks, the plan does not seem to be very effective in conveying the consequences of sea level rise. The plan does not have a summary of the impacts, neither the proper analysis on vulnerability and exposure. If the plan provided such information, it could have a strong influence on the public.

Pandemic

The City and County of San Francisco Hazard Mitigation Plan addresses the vulnerability to pandemic. The spread of infectious disease worldwide is referred to as pandemic. It does not seem to be directly affected by climate, but the change in climate and weather patterns can exacerbate the spread of infectious diseases. For example, a hotter climate may create an environment suitable for the flu to spread. The cumulative impacts of pandemics are likely to be overwhelming for both the health system and the community. During a moderate pandemic, San Francisco could see a sustained increase in intensive care unit admissions, in emergency department (ED) admissions, in patients needing to be placed in respiratory isolation, and in deaths. The capacity to provide medical care, including basic emergency medical system (EMS), hospital ED services, and isolation rooms, will be reduced. According to the mitigation plan, San Francisco is more vulnerable to pandemic due to increased number of travelers in and out of the Bay Area.

Despite the increasing vulnerability of pandemics and increasing climate risks, San Francisco does not have a specific plan or has shown preparation to reduce the effects of pandemics. Since migration is one of the major causes for spread of flu, the city could have some administered policies and regulations to monitor the health of people moving in and out. Additionally, spread of awareness and preventive measures against spread of flu would have been effective to reduce the flu virus and other pandemics.

Wildfire

The City and County of San Francisco Hazard Mitigation Plan addresses the effects of wildfires on the region. A wildfire is an unplanned, uncontrolled fire in an area of combustible vegetation or fuel, basically caused by human activities, such as arson or campfires, or by natural events such as lightning. Topography, type and condition of vegetation and weather are the significant factor affecting wildfire, of which weather is the most variable factor affecting the behavior of wildfires. Temperature, humidity, wind, and lightning can affect chances for ignition and spread of fire. Fire can risk life and property to a large scale if it is not controlled despite of its magnitude.

Based on the records of The California Department of Forestry and Fire Protection (CAL FIRE), there is no record of wildfires occurring within CCSF, and 2014 HMP does not address hazards for assets outside the planning area. However, there was declaration of local emergency during the development of this plan, due to the fire in a neighboring county: Tuolumne County, which threatened the Regional Water System for San Francisco. A Fire Hazard Severity Zone (FHSZ) maps was adopted by CALFIRE, in which San Francisco has no Very High Fire Hazard Severity Zones. Considering this point, there are no significant risks of fire in San Francisco, but to have safety plans and preparedness is always a wise option. It must be noted that a change in weather and vegetation type may lead to fire at any place at any time.

Conclusion

The Hazard Mitigation Plan 2014 for the City and County of San Francisco includes a diverse set of plans including reports on previous actions' status and other mitigation action for short-term and long-term. This plan covers a wide range of hazards from man -made to natural, including terrorism and cyberattacks, and climate change. The 2014 mitigation plan was the result of thorough review of old plan with updates on existing and identification of new and updated potential mitigation actions. The plan has been mostly successful in covering most of the hazards into its mitigation plan despite a few weakness and limitations.

The Hazard Mitigation Plan of San Francisco does not define the audience clearly. The report would have been much better if it was more organized avoiding the redundancies and talking to the point if it was meant for the authorities and policy makers. And, it should have a well- written report in a descriptive manner for public awareness purposes.

The plan lacks adequate information and data. It lacks the vulnerability and exposure analysis for a number of hazards with no any standard methodology for a quantitative exposure analysis. The limitations in data and information, and exposure analysis has limited the vulnerability results for several hazards such as: drought, heat, wind, climate change, pandemic. In addition, even for those with detailed analysis, it only reports the losses in terms of human and property damage and ignores several other impacts such as mental pressure and stress among the people due to the hazard event. In addition, there are several limitations in the mitigation strategy and financial aspects. The plan was developed with limited GIS capabilities and technology as like it does not address Repetitive Loss (RL) properties, which are properties that have experienced more than one flood insurance claim under the National Flood Insurance Program (NFIP).

The HMP could have been more effective with simple improvements discussed above. Overall, the plan does address the key elements of each hazard type related to climate and weather events. By addressing climate variability, the city and county of San Francisco is able to prepare for future events.