21. HAZARD RANKING

To assist the City with allocation of efforts and resources, the hazards of concern were ranked based on the risk they pose to the community. The risk ranking enables the community to identify hazards that present the highest levels of risk and necessitate prioritized intervention. By ranking hazards, the City can formulate specialized strategies to address the most critical risks, thereby enhancing overall resilience and preparedness.

21.1 HAZARD RANKING METHODOLOGY

The hazards of concern were ranked using methodologies promoted by FEMA's hazard mitigation planning guidance and input from the Core Planning Team and HMWG. The HMWG met on August 23, 2024, to discuss the best approach for ranking risk. The HMWG initially confirmed the following formula:

Risk Ranking Score Equation

Ranking Score= [(Consequence on Population x 3) + (Consequence on Property x 2) + (Consequence on Economy x 1) x 0.3] + [Adaptive Capacity x 0.3] + [Climate Change x 0.1] + [Probability of Occurrence x 0.3]

Utilizing this formula for all hazards of concern, a preliminary risk ranking was performed and presented to the HMWG on January 22, 2025. Subsequently, the Core Planning Team convened multiple times to reassess the risk and identify additional information and data sources to inform the risk ranking. The risk ranking scores were informed by data generated by FEMA's Hazus tool, results from a geospatial exposure assessment, completed local studies, and subject matter expertise. Changes to the formula above included:

- Renaming "Consequence on Economy" to "Structure Loss" to better align with the criterion's focus on replacement cost value and to clarify that it does not encompass potential cascading effects on the broader economy, such as impacts on the tourism sector.
- Integrating wind and storm surge data to comprehensively represent the various characteristics of hurricanes.
- The economic impacts of the COVID-19 pandemic were analyzed to quantify the consequences associated with health risk hazards.
- To quantify the potential impacts of health risks, drought, and vog on socially vulnerable populations, an average was calculated across all identified categories of social vulnerability to assess the overall estimated consequences on the population.

The hazard ranking methodology for some hazards of concern is based on a scenario event that only impacts specific areas (such as a floodplain), while others are based on their potential risk to the City as a whole. In order to account for these differences, the quantitative hazard ranking methodology was adjusted using professional

judgement and subject-matter input. The limitations of this analysis are recognized given the scenarios do not have the same likelihood of occurrence; nonetheless, there is value in summarizing and comparing the hazards using a standardized approach to evaluate relative risk.

A qualitative assessment was performed for the following human-caused hazards based on subject matter expertise: deliberate hazards (mass violence or cyber attacks), hazardous materials, and invasive species.

21.1.1 CATEGORIES USED IN RANKING

Probability of Occurrence

The probability of occurrence of the hazard scenario evaluated was estimated by examining the historical record or calculating the likelihood of annual occurrence. When no scenario was assessed, an examination of the historical record and judgment was used to estimate the probability of occurrence of an event that will impact the City. Table 21-1 summarizes the considerations for probability of occurrence.

Table 21-1. Considerations for Probability of Occurrence

Level	Consideration
Low	A hazard event is not likely to occur or is unlikely to occur with greater than a 10 percent annual probability.
Medium	Between 10 and 100 percent annual probability of a hazard event occurring.
High	100 percent annual probability; a hazard event may occur multiple times per year.

Consequence

Consequence represents the expected vulnerability and impact associated with the hazard. This is rated for three subcategories: vulnerability of people, vulnerability of property, and structure loss/economy.

- Vulnerability of people is calculated based on the exposure of the total population or socially vulnerable population.
- Vulnerability of property is calculated based on the total number of structures that are exposed to the hazard.
- Structure loss is calculated based on the replacement cost value of structures that are exposed to the hazard; this value represents the estimated cost to rebuild or replace damaged property using comparable materials and construction methods, without accounting for depreciation (FEMA 2020). In certain cases, the replacement cost value may not provide an accurate representation of risk, necessitating the use of alternative data sources. For instance, since drought rarely causes structural damage, structural loss for drought is measured by considering the impacts on agricultural land instead.

Table 21-2 summarizes the considerations for consequence.

Table 21-2. Considerations for Consequence

Level	Considerations
Population	
Low	14 percent or less of population is exposed to a hazard with potential for measurable life-safety impact due to its extent and location.
Medium	15 to 29 percent of population is exposed to a hazard with potential for measurable life-safety impact due to its extent and location.
High	30 percent or more of population is exposed to a hazard with potential for measurable life-safety impact, due to its extent and location.
Property	
Low	Property vulnerability is 14 percent or less of the total number of structures for your community.
Medium	Property vulnerability is 15 to 29 percent of the total number of structures for the community.
High	Property vulnerability is 30 percent or more of the total number of structures for the community.
Structure Loss/Economy	
Low	Loss estimate is 9 percent or less of the total replacement cost for the community.
Medium	Loss estimate is 10 to 19 percent of the total replacement cost for the community.
High	Loss estimate is 20 percent or more of the total replacement cost for the community.

Adaptive Capacity

Adaptive capacity describes the City's administrative, technical, planning/regulatory and financial ability to provide protection from or withstand a hazard event. Mitigation measures that can increase a jurisdiction's capacity to withstand and rebound from events include codes or ordinances with higher standards to withstand hazards due to design or location; deployable resources; or plans and procedures for responding to an event.

Information gathered from the capabilities assessment, along with qualitative input from the Core Planning Team, was utilized to assess and categorize the City's adaptive capacity in relation to each hazard. A rating of "low" for adaptive capacity means the City does not have the capability to effectively respond, which increases vulnerability. A "high" adaptive capacity means the City does have the capability to effectively respond, which decreases vulnerability. These ratings were assigned using the results of the core capability assessment. Table 21-3 summarizes the considerations for adaptive capacity.

Table 21-3. Considerations for Adaptive Capacity

Level	Considerations
Low	Weak, outdated, or inconsistent plans, policies, codes, or ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery.
Medium	Plans, policies, codes/ordinances in place and meet minimum requirements; mitigation strategies identified but not implemented on a widespread scale; the City can recover but needs outside resources; moderate City capabilities.
High	Plans, policies, codes/ordinances in place and exceed minimum requirements; mitigation/protective measures in place; the City has ability to recover quickly because resources are readily available, and capabilities are high.

Climate Change

Current climate change projections were evaluated as part of the hazard ranking to account for potential increases in severity or frequency of the hazard. This is important because the hazard ranking helps guide and prioritize the mitigation strategy as a long-term future vision for mitigating the hazards of concern. The potential impacts that climate change may have on each hazard of concern are discussed in the risk assessment chapters for each hazard. Table 21-4 summarizes the considerations for climate change.

Table 21-4. Considerations for Climate Change

Level	Considerations
Low	No local data are available; modeling projects are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).
Medium	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (moderate evidence).
High	Studies and modeling projections indicate exacerbated conditions and increased future risk due to climate change; very high confidence level (strong evidence, well documented, and acceptable methods).

21.2 HAZARD RANKING RESULTS

The Citywide hazard ranking includes the entire planning area and may not reflect the highest risk for individual regions on Oʻahu. Table 21-5 shows the hazard ranking for each hazard of concern.

Table 21-5. Hazard Ranking for the Hazards of Concern for the City

Hazard Ranking	Hazard	Categories					
			Consequence				
		Probability	Population	Property	Structure Loss/ Economy	Adaptive Capacity	Climate Change
High	Climate Change & Sea Level Rise	High	High	Medium	High	Medium	High
Medium	Deliberate Hazards	Medium	Medium	Low	Medium	High	Low
Medium	Drought	Medium	Low	Low	Low	High	High
Low	Earthquake	Medium	Low	Low	Low	Medium	Low
High	Flood	High	High	Medium	Medium	Medium	High
Low	Hazardous Materials	High	Low	Low	Low	High	Medium
High	Health Risks	High	High	Low	High	Low	High
High	Hurricane	Low	High	Medium	High	Medium	High
Low	Infrastructure Failure	Low	Low	Low	Low	Medium	Medium
Medium	Invasive Species	High	Low	Low	High	Low	High
Low	Landslide	High	Medium	Low	Low	Medium	Low
High	Tsunami	Low	High	High	High	Medium	Medium
Low	Volcanic Gas	Low	Low	Low	Low	Medium	Low
High	Wildland Fire	High	High	High	High	Medium	High
Low	Windstorm	High	Low	Low	Low	Medium	Medium