CONTENTS

TABLES

SECTION 4. RISK ASSESSMENT

4.17 VULNERABILITY SUMMARY

2023 SHMP Update Changes

- The 2023 SHMP Update uses the same hazard ranking methodology as the 2018 plan, but the hazard categories are now aligned with the HI-EMA Hazards and Vulnerabilities Overview document.

Element S6 and 44 CFR §201.4(c)(2)(ii) and 201.4(c)(2)(iii): The risk assessment shall include an overview and analysis of jurisdictions' vulnerability to the identified hazards and the potential losses, including jurisdictions most threatened by the identified hazards and most vulnerable to damage and loss from hazard events with respect to populations, structures, infrastructure, and community lifelines. Additionally, potential losses to the identified vulnerable structures based on estimates in the local risk assessments as well as the state risk assessment should be included.

2023 Hazard Ranking

- The purpose is to summarize statewide vulnerability and guide the updated mitigation strategy.
- The hazard ranking is provisional. It may change with time as additional data and analyses become available, capabilities in the State change, and changes associated with climate change become realized and fully predictable.
- Overall, the 2023 hazard ranking represents a snapshot in time based upon best available data.

At the conclusion of the risk assessment update documented in Sections 4.2 through 4.16, the 15 hazards of concern were ranked to summarize statewide vulnerability. The results of the hazard ranking were presented at the Forum and public meetings held in March and April 2023 to collect feedback (refer to Section 2 – Planning Process and Appendix A – Planning Process Documentation). The results were carefully reviewed by HI-EMA and the Forum, and adjusted as needed and appropriate, to ensure the hazard ranking aligned with the perceived statewide hazard risk.

The following summarizes the methodology and results of the State of Hawai'i's hazard ranking. Refer to Appendix F (State Profile and Risk Assessment Supplement) for the hazard ranking results developed for each county using the same methodology.

It is important to emphasize that all hazards evaluated in the 2023 SHMP Update are considered hazards of concern. Medium- and low-ranked hazards are of concern to the State of Hawai'i, and potential future losses resulting from these hazard events should be mitigated. Mitigation strategies are included in Section 6 (Mitigation Strategy).

4.17.1 2018 STATE AND COUNTY HAZARD RANKING

The 2018 SHMP and the hazard ranking methodology utilized to rank the hazards of greatest concern to the state and each county was reviewed, and the same methodology was used for the 2023 SHMP Update. Refer to Table 4.17-1 below for the

2018 SHMP state and county hazard rankings. Kaua'i, Honolulu, and Maui counties had Wildfire as their highest-ranked hazard risk, while Hawai'i had Volcanic Hazards as the highest-ranked hazard risk.

Table 4.17-1. 2018 SHMP Update Hazard Ranking

State	County of Kaua'i	City and County of Honolulu	County of Maui	County of Hawai'i
Climate Change and Sea Level Rise	Wildfire	Wildfire	Wildfire	Volcanic Hazards
Hurricane	Climate Change and Sea Level Rise	Hurricane	Hurricane	Hurricane
Tsunami	Hurricane	Climate Change and Sea Level Rise	Chronic Coastal Flooding	Landslide and Rockfall
Earthquake	Tsunami	Tsunami	Tsunami	Wildfire
Volcanic Hazards	Earthquake	Earthquake	Earthquake	Tsunami

Source: State of Hawai'i HMP 2018

4.17.2 2023 SHMP UPDATE HAZARD RANKING

The 2023 SHMP Update utilizes the same hazard risk ranking methodology as the 2018 SHMP. Numerical values allow identified hazards to be ranked against one another; the higher the relative risk factor calculated, the greater the hazard risk.

METHODOLOGY

The hazard ranking methodology designed for the State of Hawai'i includes risk factor categories that align with FEMA's State Mitigation Planning Key Topic Bulletin on Risk Assessment and FEMA's Comprehensive Preparedness Guide (CPG 101) risk analysis process. In addition, the methodology integrates the Threat and Hazard Identification and Risk Assessment (THIRA), the Hazards and Vulnerabilities Overview, and State of Hawaii's capabilities into the evaluation.

It is recognized that certain hazards have undergone more detailed analyses than others based upon the available data and hazard modeling methodologies available and/or conducted over the course of the 2023 SHMP Update. Therefore, for some hazards, qualitative assessments, and professional judgment were used to assign the most appropriate numeric value for each category evaluated.

As described in Section 4.1 (Risk Assessment Overview) and summarized in Table 4.1-7, three different levels of analysis were used to estimate potential impacts: (1) historic loss/qualitative analysis, (2) exposure analysis, and (3) loss estimation. All three levels of analysis are suitable for planning purposes; however, with any risk analysis, there is underlying uncertainty resulting from assumptions used to describe and assess vulnerability and the methodologies available to model impacts. Impacts from any hazard event within the State will vary from the analysis presented here based on the factors described for each hazard of concern, namely location, extent, warning time, and mitigation measures in place at the time of an event. The hazard ranking methodology for some hazards of concern is based on a scenario event, while others are based on the potential vulnerability to the State as a whole. In order to account for these differences, the quantitative hazard ranking methodology was adjusted using professional judgment and subject matter expert input and assumptions are included, as appropriate, in the following sections. The limitations of this analysis are recognized given that all 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. The following categories were considered when evaluating the relative risk of the hazards of concern.

- **Probability of Occurrence**—The probability of occurrence of the scenario evaluated was estimated by examining the historic record and/or calculating the likelihood of annual occurrence. When no scenario was assessed, an examination of the historic record and judgment was used to estimate the probability of occurrence of an event that will impact the State.
- **Impact**—The following three hazard impact subcategories were considered: impact to people; impact to assets and the economy; and impact to environmental resources and cultural assets. The results of the 2023 SHMP Update risk assessment and/or professional judgment were used to assign the numeric values for these three impact subcategories. For the statewide ranking, the impact to state assets and the overall state economy and resilience were considered. For the county-specific ranking, the impact to the general building stock, community lifelines that affect state resilience, and county economy were considered. A factor was applied to each subcategory, giving impact on population the greatest weight.
    - Population (total and socially vulnerable)—Numeric value x 3
    - Assets/Economy—Numeric value x 2
    - Environment Resources/Cultural Assets—Numeric value x 1
- **Spatial Extent**—The area of impact was calculated in GIS for the hazards with a delineated spatial extent. For hazards that do not have a geographic extent, it was determined whether the hazard event would have local, regional, island-wide or statewide impacts. Refer to Section 4.1 (Overview), which describes the spatial data sets used.
- **Warning Time**—The lead time associated with the hazard event was researched, and the warning measures/systems in place to alert the State in advance of the event occurring were considered. Warning time is discussed in each hazard profile (refer to Sections 4.2 to 4.16).
- **Duration**—The duration was estimated by determining the approximate length a hazard event may last and time until full recovery. An examination of the historic record was used as a point of reference.
- **Adaptive Capacity**—Adaptive capacity describes the State's current ability to protect from or withstand a hazard event. The State develops an annual Stakeholder Preparedness Report (SPR) that rates core capabilities across five elements: planning, organization, equipment, training, and exercises. The three-step self-assessment of capability levels is based on capability targets in the THIRA. These ratings, conducted by the HI-EMA and supporting stakeholders, form the basis for the adaptive capacity assessment for each hazard of concern for the 2023 SHMP Update.

Adaptive Capacity Defined

Adaptive capacity describes the State's current ability to protect from or withstand a hazard event.

- **Changing Future Conditions**—Current climate change projections were considered as part of the hazard ranking to ensure the potential for an increase in severity/frequency of the hazard was factored into the hazard ranking. This was important to the HI-EMA to include because the hazard ranking helps guide and prioritize the mitigation strategy development, which should have a long-term future vision to mitigate the hazards of concern. The potential impacts climate change may have on each hazard of concern is discussed in Sections 4.2 through 4.16. The benchmark values in the methodology are similar to confidence levels outlined in the National Climate Assessment 2017.

Table 4.17-2 summarizes the categories, benchmark values, and weights used to calculate the risk factor for each hazard. The relative hazard risk score was calculated for each hazard using the following formula. Using the weighting applied, the highest possible risk factor value is 6.75. The higher the number, the greater the relative risk.

Table 4.17-2. Summary of Hazard Ranking Approach and Associated Criteria

Category		Level	Degree of Risk/Benchmark Value	Numeric Value	Weight
Probability of Occurrence		Unlikely	Hazard event is unlikely to occur with less than a 1% annual chance probability	0	25%
		Rare	Between 1 and 10% annual probability	1	
		Occasional	Between 10 and 100% annual probability	2	
		Frequent	100% annual probability; may occur multiple times per year	3	
Impact ***(Sum of all 3)***	**Population (Numeric value x3)**	None	No anticipated displacement or injuries; minimal disruption on quality of life.	0	25%
		Low	Potential for measurable life safety impacts (displacement, injuries, fatalities) is less than 10% of the total and socially vulnerable population	1	
		Medium	Potential for measurable life safety impacts (displacement, injuries, fatalities) is 10-25% or less of the total and socially vulnerable population	2	
		High	Potential for measurable life safety impacts (displacement, injuries, fatalities) is greater than 25% of the total and socially vulnerable population	3	
	Assets (including Community Lifelines)/Economy (Numeric value x2)	None	No impact to minimal anticipated potential loss to property/assets; no anticipated economic impacts (interruption of services, businesses, jobs).	0	
		Low	Potential loss to property/assets is more than 10% of the total of all assets; impacts are localized affecting only a relatively small or isolated area; no interruption of services or business continuity.	1	
		Medium	Potential loss to property/assets is more than 25% of the total of all assets; impacts are local and regional; temporary shutdown of critical facilities, businesses/delivery of services/jobs	2	
		High	Potential loss to property/assets is greater than 50% of the total of all assets; impacts are regional/multiple counties; shutdown of critical facilities; interruption of business continuity/delivery of services/jobs	3	
	Environment Resources/ Cultural Assets [a] **(Numeric value x1)**	None	No loss is estimated from the hazard	0	
		Low	Potential loss to environmental resources/cultural assets is less than 10% of total of all assets.	1	
		Medium	Potential loss to environmental resources/cultural assets is 10-20% of total of all assets.	2	
		High	Potential loss to environmental resources/cultural assets is greater than 20% of total of all assets.	3	
Spatial Extent		None	No spatially delineated hazard area	0	15%
		Small	A portion of one island	1	
		Medium	2 to 3 islands	2	
		Large	Entire State (all islands)	3	

Category	Level	Degree of Risk/Benchmark Value	Numeric Value	Weight
Warning Time	More than 24 hours	Warning time is more than 24 hours	0	5%
	12 to 24 hours	Warning time is 12 to 24 hours	1	
	6 to 12 hours	Warning time is 6 to 12 hours	2	
	less than 6 hours	Warning time is 0 to 6 hours	3	
Duration of Event	Minimal	Less than 6 hours	0	10%
	Low	Less than 24 hours	1	
	Medium	Less than 1 week	2	
	High	Greater than 1 week	3	
Adaptive Capacity	Complete	The State has mitigated all hazard risk through mitigation measures and in-house capabilities.	0	10%
	High	Plans, policies, codes/ordinances in place and exceed minimum requirements; mitigation/protective measures in place; State has ability to recover quickly because resources are readily available and capabilities are high	1	
	Medium	Plans, policies, codes/ordinances in place and meet minimum requirements; mitigation strategies identified but not implemented on a widespread scale; State can recover but needs outside resources; moderate State capabilities	2	
	Low	Weak/outdated/inconsistent plans, policies, codes/ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery	3	
Changing Future Conditions [b]	No Change	Studies and modeling projections indicate there is no evidence at this time to indicate conditions may change in the future	0	10%
	Uncertain	No local data is available; modeling projects are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence)	1	
	Likely	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive to moderate evidence)	2	
	Highly Likely	Studies and modeling projections indicate exacerbated conditions/increased future risk due to climate change; very high confidence level (strong evidence, well documented and acceptable methods)	3	

[a] *The potential loss to environmental resources (critical habitat, wetlands, parks and reserves, reefs) and cultural assets (Hawaiian Home Lands and Cultural Resources) could not be estimated or monetized; therefore, the exposure analysis results in Sections 4.2 through 4.16 support this evaluation. It is recognized additional environmental resources and cultural assets may be impacted that were not included as part of the risk assessment.*

[b] *Similar to confidence levels outlined in the National Climate Assessment 2017*

Relative Risk Schema

Relative Risk = [(**Probability** × 0.25) + (**Impact** × 0.25) + (**Spatial Extent** × 0.15) + (**Warning Time** × 0.05) + (**Duration** × 0.1) + (**Adaptive Capacity** × 0.1) + (**Changing Future Conditions** × 0.1)]

In an attempt to summarize the confidence level regarding the input utilized to populate the hazard ranking, a gradient of certainty was developed. A certainty factor of high, medium, or low was selected and assigned to each hazard to provide a level of transparency and increased understanding of the data utilized to support the resulting ranking. The following scale was used to assign a certainty factor to each hazard:

- High—Defined scenario/event to evaluate; probability calculated; evidenced-based/quantitative assessment to estimate potential impacts through hazard modeling.
- Moderate—Defined scenario/event or only a hazard area to evaluate; estimated probability; combination of quantitative (exposure analysis, no hazard modeling) and qualitative data to estimate potential impacts.
- Low—Scenario or hazard area is undefined; there is a degree of uncertainty regarding event probability; majority of potential impacts are qualitative.

Table 4.17-3 summarizes the hazard scenario or hazard area evaluated; highlights key impacts to population, state assets, and environmental resources/cultural assets; and lists the associated certainty factor assigned for each hazard to convey the level of confidence in the data used. This table is not intended to be a complete and comprehensive list of all hazard impacts determined in the risk assessment and considered for the hazard ranking exercise. Refer to Sections 4.2 to 4.16 for a complete summary of all estimated statewide impacts for each hazard.

Table 4.17-3. Overview of the Hazard Scenario and Associated Estimated Impacts Considered in the Hazard Ranking

Hazard	Category				Certainty Factor
	Hazard Scenario/ Area Evaluated	Estimated Statewide Impacts			
		Population [b]	State Assets	Environment Resources/ Cultural Assets	
Climate Change and Sea Level Rise	Sea Level Rise Exposure Area (SLR-XA) 3.2ft (future chronic coastal flooding) 1%-Annual-Chance Coastal Flood Zone (1%CFZ) + 3.2ft SLR (event-based coastal flooding plus SLR)	SLR-XA-3.2: 19,830 people displaced 1%CFZ-3.2: 138,448 people exposed, including 23,830 socially vulnerable people	SLR-XA-3.2: 54 State buildings ($57.5M), 38.8 miles of State roads and 33 community lifelines ($4.9B) lost 1%CFZ-3.2: 638 State buildings ($2.4B), 100.9 miles of State roads and 218 community lifelines exposed	SLR-XA-3.2: 32 sq.mi. of environmental resource areas, 14.1 sq. mi. of cultural resources and 1.2 sq.mi. of HHL lost; 1%CFZ-3.2: 1,148 sq.mi. of environmental resource areas, 155.4 sq. mi. of cultural resources and 3.98 sq.mi. HHL exposed	High
Cyber Threat	Statewide	Entire state population exposed; impacts to health and safety of individuals are estimated to be minimal	All state assets exposed	All environmental/cultural assets exposed	Moderate

Hazard		Category: Hazard Scenario/ Area Evaluated	Category: Estimated Statewide Impacts: Population [b]	Category: Estimated Statewide Impacts: State Assets	Category: Estimated Statewide Impacts: Environment Resources/ Cultural Assets	Certainty Factor
Drought		Drought event	Entire state population exposed; impacts to health and safety of individuals are estimated to be minimal	Community lifeline and critical facility functionality may be impacted (e.g., water source for fire services); overall impacts to structures are low	Environmental damages; increased wildfire risk; agricultural losses ($564M market value exposed)	High
Earthquake		100-year probabilistic earthquake event 4 USGS ShakeMap scenarios: • Kalapana 1975 M7.7 • Ka'ū M8.0 • Lāna'i M7.0 • NE Maui M7.0	Entire population exposed; 1,758 displaced households; 1,244 people need short-term sheltering	$358.8M State building damages; $529.5M community lifeline and critical facility damages	Impacts to environment from hazardous materials release; induced flooding/landslides; poor water quality	High
Flood	**Event-Based**	1% Annual Chance Flood	91,462 people exposed, including 15,800 socially vulnerable people	$87.9M State building damages; 85.5 miles of State roads exposed; $441M community lifeline and critical facility damages	147 sq.mi. environmental resource areas, 47.7 sq. mi. cultural resources and 4.3 sq.mi. HHL exposed	High
	Chronic Coastal	SLR-XA-1.1ft	4,160 people displaced	8 State buildings ($31.9M), 15 miles of State roads and 8 community lifelines ($2.9B) lost	22.3 sq.mi. of environmental resource areas, 9.4 sq. mi. of cultural resources and <1 sq.mi. of HHL exposed	High
Hazardous Materials [a]		Release at a National Priorities List site	Population impacted will depend on the type of material and scale of the incident. May include population within small radii of site	The degree of damages to state asset depends on the scale of the incident.	The degree of damages depends on the scale of the incident.	Low
Health Risks		Statewide	Entire state population exposed	Loss of state services; Potential temporary closure of ports of entry impacting import/export of goods and vital resources	Livestock and poultry may become infected; impacts to food supply and water supply	High
Hurricane		Wind (500-year event) *buildings only* Category 4 storm surge (SLOSH)	142,622 people exposed to storm surge (Category 4), including 30,320 socially people; all exposed to wind	654 State buildings ($3.2B); 77.7 miles of State roads; 207 community lifelines ($7.5) exposed	33 sq.mi. environmental resource areas, 21.8 cultural resources sq.mi. and 2.5 sq.mi. HHL exposed	High
Infrastructure Failure		Inundation area for all high hazard dams	34,324 people exposed, including 12,510 socially vulnerable people	197 State buildings ($1.2B), 25.6 miles of State roads and 84 community lifelines ($4.8B) exposed	9 sq.mi. of environmental resources areas, 3.2 sq.mi. cultural resources and 1.9 sq.mi. of HHL exposed	Moderate

Hazard	Category: Hazard Scenario/ Area Evaluated	Category: Estimated Statewide Impacts: Population [b]	Category: Estimated Statewide Impacts: State Assets	Category: Estimated Statewide Impacts: Environment Resources/ Cultural Assets	Certainty Factor
Landslide and Rockfall	High landslide susceptibility areas	65,049 people exposed, including 14,823 socially vulnerable people	357 State buildings ($2B); 150.6 miles of State roads; 95 community lifelines ($2.29B) exposed	642 sq.mi. environmental resource areas, 89 sq.mi. cultural resources and 119.4 sq.mi. HHL exposed	Moderate
Terrorism	Statewide	Entire state population exposed	All state assets exposed	All environmental/cultural assets exposed	Low
Tsunami	School of Ocean & Earth Science & Technology (SOEST) Historic (200-yr) Great Aleutian Tsunami (GAT) (1,500-yr) American Society of Civil Engineers (ASCE) Design Inundation Mapping (3,500-yr)	54,429 people exposed, including 13,442 socially vulnerable people	420 State buildings ($1.5B); 88.7 miles of State roads; 193 community lifelines ($10.2B) exposed	29 sq.mi. environmental resources areas; 10.8 sq.mi. cultural resources and 1 sq.mi. HHL exposed	High
Volcanic Hazards	Hawai'i County lava zones 1-4 Maui County lava zones 1-2	181,731 people exposed, including 36,475 socially vulnerable people	1,115 State buildings ($3.28B); 240.8 miles of State roads; 201 community lifelines exposed ($4.9B)	1,938 sq.mi. environmental resource areas, 404.4 sq.mi. cultural resources and 70.8 sq.mi. HHL exposed	High
Wildfire	Communities at Risk from Wildfire (CAR) high wildfire risk areas [c]	568,401 exposed, including 139,125 socially vulnerable people	2,895 State buildings($7.3B); 335.3 miles of State roads; 694 community lifelines and critical facilities ($36B) exposed	82 sq.mi. environmental resource areas, 18.2 sq.mi. of DOFAW-managed land; 46.9 sq.mi. watershed partnership area; 38.6 sq.mi. cultural resources and 51 sq.mi. HHL exposed	Moderate
Windstorm	100-Year wind event	Entire state population exposed	All State buildings, community lifelines and critical facilities exposed; utility outages may cause disruption in services	All environmental resources and HHL exposed; potential agricultural losses and debris	Low

Notes: State building values are based on structure replacement cost; for SLR-XA-1.1 and SLR-XA-3.2 losses do not include land value.
a. The impacts and vulnerability from a hazardous materials event are greatly dependent on the material and its physical and chemical properties, the quantity released, weather conditions, micro-meteorological effects of buildings and terrain, maintenance/mechanical failures, and distance and related response time for emergency response teams.
b. All population estimates do not include visitors.
c. Statewide exposure is examined; however, it is highly unlikely that a wildfire event would take place across all islands at the same time. Therefore, the input to the risk ranking was adjusted to reflect this.
Exposed = This refers to the number of assets located in the hazard area, all of which may not incur losses as a result of the event.

Table 4.17-4 summarizes the projected changes in hazard event occurrences in terms of location, extent or intensity, and frequency and/or duration. In addition, it lists the associated value assigned to each hazard in the risk factor calculation (i.e., confidence in changing future conditions). Refer to Sections 4.2 to 4.16 for a more detailed discussion of all factors of change discussed for each hazard of concern.

Table 4.17-4. Overview of Projected Future Changes for each Hazard of Concern

Hazard	Projected Change			Confidence in Changing Future Conditions [a]
	Location	Extent/ Intensity	Frequency/ Duration	
Climate Change and Sea Level Rise	↑	↑	↑	Highly Likely
Cyber Threat	—	—	—	No Change
Drought	↑	↑	↑	Highly Likely
Earthquake	—	—	—	Uncertain
Flood	↑	↑	↑	Highly Likely
Hazardous Materials	—	—	—	No Change
Health Risks	—	—	—	No Change
Hurricane	↑	↑	↑	Highly Likely
Infrastructure Failure	— [b]	— [b]	↑ [b]	Likely
Landslide and Rockfall	—	—	↑	Highly Likely
Terrorism	—	—	—	No Change
Tsunami	↑	↑	—	Highly Likely
Volcanic Hazards	— [d]	— [d]	— [d]	Uncertain
Wildfire	↑	↑	↑	Highly Likely
Windstorm	—	—	↓ [c]	Likely

Notes:
Arrow direction indicates a projected increase or decrease based on literature review as described in Sections 4.2 through 4.16
— Straight line indicates uncertain and/or no change known at this time.

a. Similar to confidence levels outlined in the National Climate Assessment 2017
b. Increased rainfall, flooding, and sediment runoff may lead to an increase risk of a dam failure as some dams may not be designed to withstand an increase in rain totals. However, the probable maximum flood used to design each dam may be able to accommodate changes in climate.
c. Historic records indicate a decrease in northeast trade winds
d. Vog dispersion may be altered based on changes in wind patterns

Highly Likely = Studies and modeling projections indicate exacerbated conditions/increased future risk due to climate change; very high confidence level (strong evidence, well documented and acceptable methods).
Likely = Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive to moderate evidence).
Uncertain = No local data is available; modeling projects are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).
No Change = Studies and modeling projections indicate there is no evidence at this time to indicate conditions may change in the future.

HAZARD RANKING RESULTS

State Hazard Ranking

Table 4.17-5 provides the statewide hazard ranking for the 2023 SHMP Update.

Table 4.17-5. 2023 SHMP Update Hazard Ranking Results

Hazard Rank	Hazard	Category									Relative Risk Factor
		Probability	Impact			Spatial Extent	Warning Time	Duration	Adaptive Capacity	Changing Future Conditions	
			Population	Assets/ Economy	Environmental Resources/ Cultural Assets						
High	Health Risks	3	3	3	0	3	3	3	2	0	5.6
High	Climate Change and Sea Level Rise	3	1	3	2	2	0	3	2	3	4.6
High	Hurricane	2	2	2	1	3	0	3	2	3	4.5
High	Tsunami	1	2	2	1	2	3	3	2	3	4.3
High	Earthquake	1	2	2	1	3	3	3	2	1	4.2
High	Volcanic Hazards	3	1	2	3	2	1	3	2	1	4.2
Medium	Flood	3	1	2	1	2	1	3	2	3	3.9
Medium	Wildfire	2	2	1	1	2	1	2	2	3	3.8
Medium	Landslide and Rockfall	2	1	1	3	2	3	3	2	3	3.8
Medium	Drought	3	1	1	1	3	0	3	2	3	3.5
Medium	Windstorm	2	1	1	1	3	0	3	2	2	3.2
Medium	Cyber Threat	2	1	1	1	3	3	1	3	0	3.0
Low	Infrastructure Failure	1	1	1	1	2	2	3	1	2	2.8
Low	Terrorism	1	1	1	1	3	3	1	2	0	2.7
Low	Hazardous Materials	2	1	1	1	1	3	1	2	0	2.6

Note: Relative Risk Factor Scores - High: > 4.0; Medium: 3.0 to 4.0; Low < 3.0

The highest-ranked hazards for the State of Hawai'i when examining statewide risk are:

- Health Risks
- Climate Change and Sea Level Rise
- Hurricane
- Tsunami
- Earthquake
- Volcanic Hazard

Overall, the State of Hawaii's vulnerability to the identified hazards of concern have not drastically changed since the 2018 SHMP. This makes sense to the HI-EMA and Forum because these statewide high-risk hazards require a long-term vision and mitigation strategy to reduce overall risk. Table 4.17-6 compares the 2018 top six highest-ranked hazards to the 2023 top six-scoring hazards using the total Risk Factors. Health Risks became a high-ranked hazard due to its increased probability.

Table 4.17-6. Comparison Between the 2018 and 2023 SHMP Update Statewide Hazard Rankings

Numeric Rank	2018 Hazard Rank Order	2023 Hazard Rank Order
1	Climate Change and Sea Level Rise	Climate Change and Sea Level Rise
2	Hurricane	Hurricane
3	Tsunami	Tsunami
4	Earthquake	Earthquake
5	Volcanic (Lava flow; vog)	Health Risks
6	Wildfire and Landslide/Rockfall [a]	Volcanic Hazards

Notes:

a. *The wildfire and landslide/rockfall hazards have the same calculated risk factor score and are therefore listed together for the sixth ranked hazard for the 2018 SHMP Update. For the 2023 update, wildfire and landslide and rockfall still have the same calculated risk factor but dropped to 7th in the hazard ranking order.*

Counties Most Threatened and Vulnerable to the Identified Hazards

An updated hazard ranking was also conducted for each county using the same ranking process as for the statewide ranking (relative risk schema). The ranking considers the location of potential hazard impacts and the intensity of each hazard. For example, the hurricane storm surge hazard is analyzed with four intensities (Categories 1-4 SLOSH inundation areas). Each hazard is also analyzed by each county's adaptive capacity and takes into consideration future hazard impacts based on changing climate. Both the total population and socially vulnerable populations are considered in the risk ranking. Community lifelines and additional critical facilities are included when analyzing assets and economic impacts. Refer to Appendix F (State Profile and Risk Assessment Supplement) for each county's results. Table 4.17-7 summarizes the counties at greatest risk to each hazard based on the potential impacts to population and the built environment presented in Sections 4.2 through 4.16.

It is important to note that there is a difference in thought process when evaluating statewide risk and risk for an individual county. Due to the State's geography, some hazards are contained by island; therefore, their statewide risk is lower compared to the risk presented to a specific county. For example, the hurricane hazard may be ranked high for all counties and the State because a hurricane event may impact all islands as a result of the same event, leading to a potential disaster declaration. In contrast, a wildfire event would be isolated to one island and not impact the State as a whole at the same time. Therefore, each county may have a high wildfire hazard ranking because impacts are measured relative to their individual county; whereas the statewide wildfire ranking is a medium because, except for windblown smoke, a wildfire event is not likely to impact multiple counties at the same time.

Table 4.17-7. Summary of Counties at Greatest Risk to the Hazards of Concern

County	Highest Threat Hazards	Total and Socially Vulnerable Population Potentially Impacted	Community Lifelines and Critical Facilities Potentially Impacted	Risk Factor	Hazard Risk
Kaua'i	Health Risks	The entire population, including 11,149 socially vulnerable people	127 community lifelines 11 additional critical facilities	5.6	High
	Wildfire [a]	27,604 people; 725 socially vulnerable people	94 community lifelines 8 additional critical facilities	5.6	High
	Climate Change and Sea Level Rise [b]	1,007 people; 189 socially vulnerable people	32 community lifelines 4 additional critical facilities	5.2	High
	Hurricane [d]	2,462 people; 126 socially vulnerable people	23 community lifelines 2 additional critical facilities	5.0	High
	Tsunami [e]	4,490 people; 532 socially vulnerable people	33 community lifelines 4 additional critical facilities	4.3	High
Honolulu	Wildfire [a]	427,293 people; 117,049 socially vulnerable people	323 community lifelines 12 additional critical facilities	5.7	High
	Health Risks	The entire population, including 224,567 socially vulnerable people	750 community lifelines 33 additional critical facilities	5.6	High
	Hurricane [d]	135,313 people; 29,010 socially vulnerable people	129 community lifelines 5 additional critical facilities	5.1	High
	Climate Change and Sea Level Rise [b]	26,681 people; 6,469 socially vulnerable people	115 community lifelines 4 additional critical facilities	5.0	High
	Flood [c]	73,711 people; 13,226 socially vulnerable people	65 community lifelines 3 additional critical facilities	4.7	High
	Tsunami [e]	126,570 people; 27,767 socially vulnerable people	185 community lifelines 9 additional critical facilities	4.6	High
	Earthquake [f]	N/A [g]	750 community lifelines 33 additional critical facilities	4.2	High
Maui	Wildfire [a]	81,424 people; 20,679 socially vulnerable people	172 community lifelines 20 additional critical facilities	5.8	High
	Health Risks	The entire population, including 35,284 socially vulnerable people	250 community lifelines 34 additional critical facilities	5.6	High
	Hurricane [d]	3,755 people; 812 socially vulnerable people	37 community lifelines 1 additional critical facility	5.1	High
	Flood [c]	9,206 people; 1,225 socially vulnerable people	40 community lifelines 2 additional critical facilities	4.7	High
	Tsunami [e]	21,784 people; 4,077 socially vulnerable people	89 community lifelines 9 additional critical facilities	4.4	High
	Earthquake [f]	80,507 people; 2,764 socially vulnerable people [g]	250 community lifelines 34 additional critical facilities	4.3	High
	Climate Change and Sea Level Rise [b]	2,930 people; 484 socially vulnerable people	43 community lifelines 0 additional critical facilities	4.2	High

County	Highest Threat Hazards	Total and Socially Vulnerable Population Potentially Impacted	Community Lifelines and Critical Facilities Potentially Impacted	Risk Factor	Hazard Risk
Hawai'i	Volcanic Hazards [h]	161,698 people; 36,475 socially vulnerable people	185 community lifelines 16 additional critical facilities	6.2	High
	Health Risks	The entire population, including 45,257 socially vulnerable people	242 community lifelines 28 additional critical facilities	5.6	High
	Hurricane [d]	1,092 people; 309 socially vulnerable people	18 community lifelines 2 additional critical facilities	5.0	High
	Landslide and Rockfall [i]	52,256 people; 12,031 socially vulnerable people	74 community lifelines 17 additional critical facilities	5.0	High
	Wildfire [a]	32,080 people; 672 socially vulnerable people	60 community lifelines 5 additional critical facilities	4.6	High
	Climate Change and Sea Level Rise [b]	308 people; 48 socially vulnerable people	28 community lifelines 2 additional critical facilities	4.5	High
	Tsunami [e]	9,098 people; 7,325 socially vulnerable people	53 community lifelines 4 additional critical facilities	4.3	High
	Earthquake [f]	6,681 people; 20,783 socially vulnerable people [g]	242 community lifelines 28 additional critical facilities	4.2	High

Note:
a. High wildfire risk hazard area
b. Sea Level Rise Exposure Area (SLR-XA) 3.2ft
c. 1% annual chance flood event
d. Category 4 SLOSH inundation areas
e. Great Aleutian Tsunami (GAT) inundation areas
f. 100-year probabilistic earthquake
g. Based on population located on the NEHRP Class D and E soils
h. Lava flow hazard areas
i. High landslide susceptibility areas