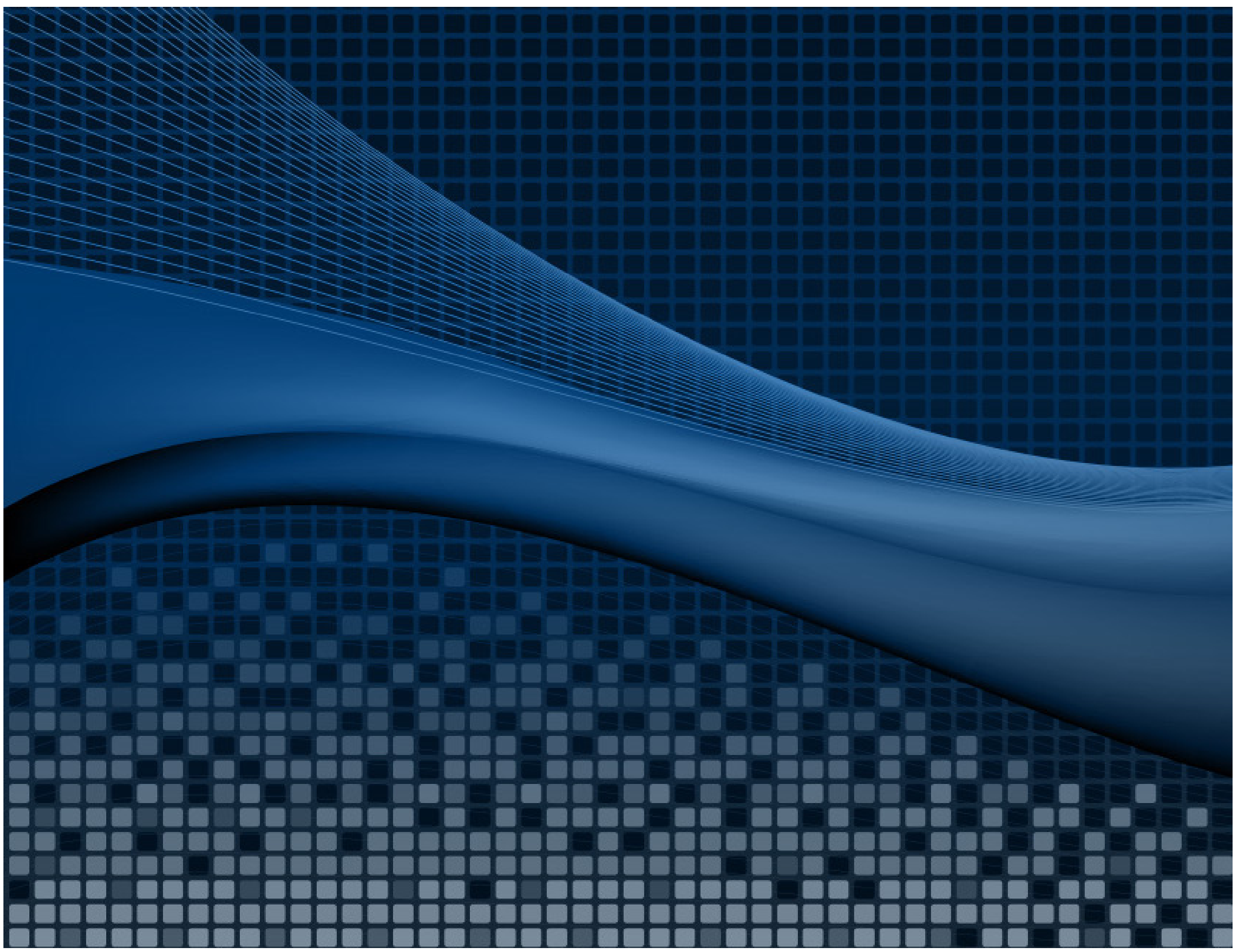
Multi-Hazard Mitigation and Resilience Plan

Volume 2 of 2



SWCA ENVIRONMENTAL CONSULTANTS

2026

County of Kaua‘i Multi-Hazard Mitigation and Resilience Plan

Appendix A. Abbreviations and References

A. ABBREVIATIONS

Abbreviation	Definition
°C	degrees Celsius
°F	degrees Fahrenheit
%g	Percent force of gravity (a measure of acceleration)
44 CFR	Code of Federal Regulations, Title 44
ACS	American Community Survey
ADA	Americans with Disabilities Act
ADC	Agribusiness Development Corporation
APA	American Planning Association
ASCE	American Society of Civil Engineers
ASYA	aquifer system areas
BARA	Best Available Refuge Area
BLM	Bureau of Land Management
CARW	Communities at Risk from Wildfires
CASPER	Community Assessment for Public Health Emergency Response
CCD	Census County Division
CDBG-DR	Community Development Block Grant Disaster Recovery
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
CFZ	Coastal Flood Zone
CIP	Capital Improvement Plan
CISA	U.S. Cybersecurity and Infrastructure Security Agency
CO_2	carbon dioxide
County	County of Kauaʻi
County General Plan	*Kauaʻi Kākou—Kauaʻi County General Plan*
CPC	Climate Prediction Center
CRS	Community Rating System
CSAV	Center for the Study of Active Volcanoes
CTA	Collaborative Technical Assistance
CWA	Clean Water Act
CWPP	Community Wildfire Protection Plan
CWRM	Commission on Water Resource Management
CZM	Coastal Zone Management
DART	Deep-Ocean Assessment and Reporting of Tsunamis
DBEDT	Hawaiʻi Department of Business, Economic Development &and Tourism
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Maps

Abbreviation	Definition
DHHL	Department of Hawaiian Home Lands
DHS	U.S. Department of Homeland Security
DLNR	State of Hawaiʻi Department of Land and Natural Resources
DMA	Disaster Mitigation Act of 2000
DOBOR	Division of Boating and Ocean Recreation
DOE	Department of Education (Energy??)
DOF	depending on funding
DOFAW	Division of Forestry and Wildlife
DOH	State of Hawaii Department of Health
DOPR	Department of Parks and Recreation
DOT	U.S. Department of Transportation
DOW	County of Kauaʻi Department of Water
DPR	County of Kauaʻi Department of Parks and Recreation
DPW	County of Kauaʻi Department of Public Works
DSCI	Drought Severity and Coverage Index
EAP	emergency action plan
EEO	Equal Employment Opportunity
EMPG	Emergency Management Performance Grant
ENSO	El Niño/Southern Oscillation
EOP	Emergency Operations Plan
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
EWP	Emergency Watershed Protection
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
FMAG	Fire Management Assistance Grant
FRS	Facility Registry Service
GIS	geographic information system
HAR	Hawaiʻi Administrative Rules
Hazmat	Hazardous materials
Hazus	Hazards U.S.
HDOT	State of Hawaiʻi Department of Transportation
HEC-RAS	Hydrologic Engineering Center's River Analysis System
HEER	Hazard Evaluation and Emergency Response
HETAC	Hawaii Earthquake &and Tsunami Advisory Committee
HGIA	Hawaiʻi Green Infrastructure Authority

Abbreviation	Definition
HHARP	Hawaiʻi Hazards Awareness and Resilience Program
HHPD	High Hazard Potential Dam
HHPD Grant Program	Rehabilitation of High Hazard Potential Dam Grant Program
HHS	Health and Human Services
HI C-PACER	Hawaiʻi Commercial Property Assessed Clean Energy and Resiliency
HI-EMA	State of Hawaiʻi Emergency Management Agency
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	hazard mitigation plan
HRS	Hawaiʻi Revised Statutes
HUD	U.S. Department of Housing and Urban Development
HVAC	heating, ventilation, and air conditioning
HWH	Hanalei Watershed Hui
HWMO	Hawaiʻi Wildfire Management Organization
IAL	Important Agricultural Lands
IBC	International Building Code
IPCC	Intergovernmental Panel on Climate Change
IRC	International Residential Code
IRT	Innovative Readiness Training
IT	information technology
KAA	Kekaha Agriculture Association
KC	Kauaʻi County (used as abbreviation in 2021 MHMRP mitigation actions only)
KCAAP	Kauaʻi's Climate Adaptation and Action Plan
KCC	Kauaʻi Community College
KDHO	Kauaʻi District Health Office
KEMA	Kauaʻi Emergency Management Agency
KFD	Kauaʻi Fire Department
KIUC	Kauaʻi Island Utility Cooperative
KPD	Kauaʻi Police Department
KWMCH	Kauaʻi War Memorial Conventional Hall
LCC	Lihue Civic Center
LiMWA	Limit of Moderate Wave Action
LOMR	Letter of Map Revision
MHMRP	Multi-Hazard Mitigation and Resilience Plan
mph	miles per hour
MRN	More Research Needed
MRP	Mean Return Period
NAISMA	North American Invasive Species Management Association
NASA	National Aeronautics and Space Administration

Abbreviation	Definition
NbS	nature-based solutions
NCEI	National Centers for Environmental Information
NDSP	National Dam Safety Program
NEHRP	National Earthquake Hazards Reduction Program
NFIP	National Flood Insurance Program
NIDIS	National Integrated Drought Information System
NIMS	National Incident Management System
NIST	National Institute of Standards and Technology
NLD	National Levee Database
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
OED	County of Kaua‘i Office of Economic Development
OPSD	State of Hawai‘i Office of Planning and Sustainable Development
PA	Public Assistance
Planning	County of Kaua‘i Planning Department
$PM_{2.5}$	Particulate matter 2.5 microns or less in diameter
ppm	parts per million
PDI	Palmer Drought Index
PDM	Pre-Disaster Mitigation
PDRF	Pre-Disaster Recovery Framework
PFIRM	Preliminary Flood Insurance Rate Map
PGA	Peak Ground Acceleration
PL	Public Law
SBCC	State Building Code Council
SDC	Seismic Design Category
SFHA	Special Flood Hazard Area
SGFCP	State General Flood Control Plan
SLOSH	Sea, Lake, and Overland Surges from Hurricanes
SLR	sea level rise
SLR-XA	sea level rise exposure
SME	subject matter expert
SPI	Standardized Precipitation Index
SQRA	Semiquantitative Risk Assessment
STAPLE+E	social, technical, administrative, political, legal, environmental, and economic
SVI	Social Vulnerability Index
SWCA	SWCA Environmental Consultants
THIRA	Threat and Hazard Identification and Risk Assessment
UBC	Uniform Building Code

Abbreviation	Definition
UH Sea Grant	University of Hawai‘i Sea Grant College Program
UHERO	University of Hawai‘i Economic Research Organization
UHI	urban heat island
USACE	U.S. Army Corps of Engineers
USAID	U.S. Agency for International Development
USDA	U.S. Department of Agriculture
USDM	U.S. Drought Monitor
US EIA	U.S. Energy Information Association
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WIOA	Workforce Innovation and Opportunity Act
WRCC	Western Regional Climate Center
WUDP	Water Use and Development Plan
WUI	wildland urban interface
WWF	wastewater facilities

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County of Kauaʻi Multi-Hazard Mitigation and Resilience Plan

Appendix B. Steering Committee Meeting Materials

B. Steering Committee Meeting Materials

This appendix includes supporting materials regarding the Core Team and Steering Committee. All Core Team members were part of the larger Steering Committee. It includes a timeline of milestones for both plan development teams and includes the teams' meeting minutes and associated meeting materials.

PLAN DEVELOPMENT CHRONOLOGY/MILESTONES

Table B-1 summarizes important milestones for plan development leadership teams.

Table B-1. Plan Development Milestones – Development Teams

Date	Event	Description	Attendance
2024			
2024	Initiate Consultant Procurement	Seek a planning expert to facilitate the process	Not applicable (N/A)
2024	Select SWCA to Facilitate Plan Development	Facilitation contractor secured	N/A
12/18	Kickoff Meeting with KEMA*	Introductions, deliverables, timeline, information sharing (i.e., SharePoint)	N/A
2025			
January	Core Planning Team Formed	Potential Core Team members contacted	N/A
1/14	Core Planning Team Meeting	Identification of potential Steering Committee members Confirm agenda for Steering Committee meeting Identify guidelines	11
January	Steering Committee Formed	Potential Steering Committee members contacted	N/A
2/26	Steering Committee Meeting #1 (In person)	Introduce potential Steering Committee members to planning process Discuss the role of the Steering Committee Review and discuss proposed guidelines for Steering Committee Review update process and schedule Introduce and discuss public involvement strategy	21
3/11	Core Planning Team Meeting	Steering Committee kickoff meeting review Vulnerability assessment process example	9
4/22	Steering Committee Meeting #2	Steering Committee, stakeholders, and SMEs Community engagement (website, survey, press release, public meeting planning) Hazard profiles Vulnerability assessment (critical facilities, loss estimates, social vulnerability)	22
5/6	Core Planning Team Meeting	Steering Committee meeting review Vulnerability assessment Risk rating approach Community engagement Risk assessment	10

Date	Event	Description	Attendance
6/19	Steering Committee Meeting #3	Overview of draft plan parts (Parts 1 and 2) Hazards of concern Risk ranking overview Mitigation strategy	22
6/25	Core Planning Team Meeting	Risk ranking scoring Capabilities charts and process Mitigation actions discussion	8
7/8	Core Planning Team Meeting	Progress on risk ranking, goals and objectives Action drafts and revisions Finalize action prioritization approach	10
9/10	Steering Committee Meeting #4	Outline and discussion of sections provided Risk ranking results and discussion Review of capability assessment, goals and objectives, actions Prioritization strategy exercise and discussion (e.g., wildfire, tsunami, etc.) Plan maintenance Project timeline review	20
10/15	Mayor's Office - Executive Briefing	KEMA overview of 2025 plan update Project timeline review Mayor's Office role in community engagement and plan approval process	4
2026			
	Plan Approval	Final draft plan submitted to the Hawaiʻi Emergency Management Agency and FEMA Region IX for review and approval on January 19, 2026.	N/A
	Adoption	Plan adopted by Kauaʻi County on May 1, 2026.	N/A
	Final Plan Approval	Final plan approved by FEMA on May 1, 2026.	N/A

Notes: Unless otherwise indicated, all meetings were held virtually.

*SWCA and the KEMA Team scheduled biweekly check-ins to ensure project progress.

Attachment B-1. Core Team Meeting Materials

Kauai County Multi Hazard Mitigation Plan Update
Core Planning Team Meeting held on: 1/14/2025

Attendees

- **County Representatives:** Alisha Summers, Ana Espanola, Christina Kaser, David Kennard, Elton Ushio, Niki Kunioka-Volz, Ruby Pap, Sarah Louxz, Sky Asio,
- **SWCA Representatives:** Lilly Stoilova, Wendy Blackwell

Meeting Highlights

- **Introductions:**
    - County staff and SWCA team introduced themselves and their roles.
- **Planning Process and Schedule:**
    - Reviewed organization of the plan table of content, tasks, schedule, and SWCA role.
    - Core Planning Team roster can now be accessed on SharePoint: KauaiCoHMP_CoreTeamRoster_01092025.xlsx
    - Estimated 10 meetings for the Core Planning Team throughout the 18 month planning process. Meeting dates will be based on the content being drafted and project milestones.
    - Updated project schedule can now be accessed on SharePoint. Core Planning Team meeting dates are estimated: Kauai HMP Schedule_Updated_01202025.pdf
    - 2021 HMP Core Planning Team information can be found at 2021 HMP page 1-4, Appendix C pages 1 and 2.
    - Steering Committee Role:
        - Steering Committee roster can now be accessed on SharePoint: KauaiCoHMP_SteeringCommitteeRoster_01202025.xlsx
        - First meeting will be in-person and the remaining three meetings will be virtual.
        - A discussion took place on changing date or venue for first Steering Committee meeting. February 26th is the preferred date (confirmed after the Core Planning team meeting).
    - Changes since 2021 HMP:
        - Updates on FEMA's guidance, tools, and handbook. These documents can be found on SharePoint, in the References folder: FEMA Guidance
        - The 2021 HMP and FEMA's Approval Plan review Tool can be found at 2021 Kaua'i HMP and Plan Review Tool
        - Notable changes and focus areas for HMP Update: climate change, socially vulnerable populations, High Hazard Potential Dam (HHPD) Program, wildfire
        - County requested for a brief description of the current insurance programs to be added into the HMP Update (Volume 1 Section 3.1 and Volume 2 Appendix J).
- **Reference Document Review:**
    - Introduced sections of the plan listing reference information (Appendix J).
    - As discussed, the Core Planning Team will review, answer the questions and update as homework the chart that lists the reference documents and SWCA's current understanding: HMP_Reference Questions for Core Team_01212025.docx

- We propose for this to be done within 2 weeks of this email, completed by 01/31/2025.

- **Logistics:**
  - Follow-up task list and key takeaways to be sent instead of formal notes for all Core Planning Team Meetings .
  - Lilly Stoilova is the primary SWCA Point of Contact (POC) for the Core Planning Team. Adam Radford is the SWCA POC for the Steering Committee.
  - All Core Planning Team documents will be transferred and accessed through SharePoint at External - Core Team

Action Items

- **SWCA:**
  - Update the project schedule to reflect correct meeting month.
  - Prepare and send Core Planning Team meeting follow-up notes.
  - Discuss public access to Steering Committee Meetings in the next bi-weekly KEMA meeting.
  - Provide access to SharePoint to all Core Team members.
  - Upload all reference documents to Core Team SharePoint page.
  - Upload to SharePoint the document "HMP_Reference Questions for Core Team_01212025.docx"
  - Add notes on insurance impacts to the Appendix and Mitigation Strategy sections.
  - Schedule the next Core Team meeting to take place after the Steering Committee meeting.
- **Core Planning Team Members:**
  - Review and edit the programs, plans, and regulations chart (HMP_Reference Questions for Core Team_01212025.docx) by 01/31/2025. Please do so in track changes, so that we can clearly see your revisions.
  - Follow up internally about changing the date or location of first Steering Committee meeting.
  - Contact Mary Alice to get more understanding on the Hawaii State Plan and how it may apply to the Kauai HMP (David)
  - Provide State Mitigation Administrative Plan (David)

Kauai County Multi Hazard Mitigation Plan Update
Core Planning Team Meeting held on: 3/11/2025

Attendees

- **County Representatives:** Alan Clinton, Ana Espanola, Christina Kaser, David Kennard, Niki Kunioka-Volz, Sarah Louxz
- **SWCA Representatives:** Adam Radford, Lilly Stoilova, Wendy Blackwell

Meeting Highlights

- **Steering Committee Meeting #1:**
    - General feedback is that the meeting went well and that there was better participation from a broader range of groups since the last Hazard Mitigation Plan (HMP) update.
    - The list of proposed suggestions for additional Steering Committee members (provided during the Steering Committee meeting and after the meeting) was reviewed.
        - Four representatives will be contacted to be invited to serve on the Steering Committee:
            - Daniel Hamada, Complex Area Superintendent for the Kauaʻi Department of Education
            - Adam Roversi, Kauaʻi County Homeless Support (Kauaʻi County Housing Agency)
            - Eric Fujikawa, Hawaiʻi Department of Transportation, Highways
            - TBD, Department of Water
        - Remaining contacts will be contacted for their interest to serve as Subject Matter Experts (SMEs).
        - The list of received contacts can be accessed at: Kauai County_HMP_Proposed_Additional_Contacts.docx. The Steering Committee and SME rosters will be finalized and provided prior to the next Steering Committee meeting.
    - As an action item for SWCA/KEMA, Native Hawaiian representatives from each district will be contacted for their interest to participate in the HMP as Steering Committee members or SME.
        - Proposed contact approach will be to send the Press Release and introductory email and then follow-up with a call as a personalized approach.
        - Intent is to vet outreach strategy and modify it to reach more of the native population, while staying in budget and on schedule.
    - Based on inclusion in the Hawaii County Hazard Mitigation Plan draft, it was suggested that food access, on-going failure of crop, and food distribution be considered as its own hazard.
        - Food access as it relates to natural hazard impacts to distribution sites and disruptions in the food supply will be considered to be incorporated in the HMP.
        - KEMA will further discuss this with Hawaii County and Megan Fox (Food Access Coordinator). She could be added to the SME list.
    - King tides will be included in the coastal flood section of the HMP. Data on king tides can be found in the sea level rise viewer.
    - For sea level rise, the more extreme scenario will be used for planning purposes.
- **Reference Chart Assignment:**

- SWCA will move forward with the assumption that yellow highlights in the spreadsheet without a response means there are no updates since the 2021 HMP.
- **Vulnerability Assessment Process Example:**
  - The vulnerability assessment process examines how each selected hazard is expected to impact critical infrastructure and the community,
    - Existing data on critical facilities (provided by the county) is overlaid with hazard exposure areas to determine which facilities will likely be impacted by a given hazard.
    - The main body of the HMP will include the results of the damage estimation modeling (Hazus), i.e. the number of each type of critical facility that may be impacted, building replacement costs, content costs, construction materials, and similar. The Appendix will include supplemental information such as the name of each facility.
  - Hazus provides tools we can use to analyze the tsunami, earthquake, dam failure, hurricane/high wind, inland flooding, and coastal flooding hazards.
  - For hazards where Hazus cannot be used, a similar methodology will be applied by overlaying the critical facilities and population data with hazard exposure areas to develop exposure/damage estimates.
  - In instances where GIS layers are not accessible (e.g., heat and drought), a qualitative analysis will be conducted of exposure and likely damages.
  - The Core Planning Team advised that census data is not granular enough to be used effectively for social vulnerability on Kauaʻi. The county typically only uses census data for federal grants
  - Typically, social vulnerability is calculated using census tract or block level data for the selected indicators. These findings are then used to develop a qualitative analysis of how each hazard is likely to impact social vulnerability within the county.
    - As suggested by the Core Planning Team, the Kauaʻi Climate Vulnerability and Equity Analysis provides more refined and relevant local social vulnerability data and is already divided into the 6 districts. SWCA will further review and discuss with KEMA on best approach.
- **Logistics:**
  - Core Meeting #3 will take place after Steering Committee Meeting #2. The group agreed to meet on May 6th, from 10:00am-11:00am.

<u>Action Items</u>

- **SWCA:**
  - In coordination with KEMA, contact potential new Steering Committee members and SMEs.
  - Finalize Steering Committee and SME rosters once all members have been contacted. Complete prior to next Steering Committee meeting.
  - SWCA/KEMA to discuss and finalize strategy for outreach to Hawaiian representatives on next client call.
  - SWCA/KEMA to discuss food access hazard on next client call.
  - SWCA to integrate king tide information from the sea level rise viewer.
- **Core Planning Team Members:**

- Complete hazard screening poll if you haven't already: Hazard Screening Tool. We will close the poll on March 21st.
- Provide feedback on changes to the vulnerability assessment process by March 21st.

Kauai County Multi Hazard Mitigation Plan Update
Core Planning Team Meeting held on: 5/6/2025

Attendees

- **County Representatives:** David Kennard, Alan Clinton, Ruby Pap, Ana Espanola, Niki Kunioka-Volz, Alisha Summers, Christina Kaser, Sarah Louxz, Elton Ushio
- **SWCA Representatives:** Wendy Blackwell, Lilly Stoilova, Adam Radford

<u>Meeting Highlights</u>

- **Steering Committee:**
  - Group agreed that having less information to present allowed for more interaction from the Steering Committee.
  - The next Steering Committee meeting will be structured this way as a result.
  - The next Steering Committee meeting will be on June 19th from 9-11.
- **Vulnerability Assessment:**
  - After some discussion Wendy will get back to the group on critical facility definition and categories (Vol 2 page 122 of the pdf).
  - Ruby noted that episodic beach erosion was also analyzed outside of Hazus during the last plan and should be considered.
  - One of the things that was brought up in the recovery planning process was hazard events brought on by invasive species. For example, Coconut Rhinoceros Beetle infestations impact agriculture and the economy. Can FEMA mitigation funding be used for that?
  - The KCAAP social vulnerability layer (https://kauaiadaptation.com/impacts/ was the "island wide hazards assets map" plus a social vulnerability map.
  - The KCAAP used a weighting index for social vulnerability.
  - Look at variables that were social, economic, physical support in a Natural Hazard event linked to climate disasters. In the weighting, they didn't include the hazard-specific impact in the analysis.
- **Risk Rating Approach:**
  - The Core Team agreed that SWCA will work with KEMA to create the Simplified Risk Ranking Calculator. The draft will be shared with the Core Team for comment.
  - The goal is finish the calculator by early June so at least one hazard ranking can be presented to the Steering Committee at the 3rd meeting.
- **Community Involvement:**
  - The website is transitioning to a newer version, which is causing delayed updates.
  - Native Hawaiian outreach: requested contact information so that key connections can be made.
- **Risk Assessment Integration:**
  - The 2021 MHMRP stated that the results of the risk assessment would be integrated into the "Public Safety & Hazards Resiliency" section of the General Plan? Is this statement still valid? There hasn't been an update since the last HMP. Alisha will follow-up.

<u>Action Item Deadlines</u>

- Sub-group to work on the Risk Rating Approach.

- Molly and Emmi to respond to Wendy's feedback and prep the 2 sections for client/Planning Team review by May 30th
- Lilly to do quick QAQC June 2nd and 3rd
- Lilly submits 2 section drafts to client June 4th
- Comments due back from client June 9th o Emmi and Molly update the profiles and vulnerability by June 10th
- Lilly to do quick QAQC June 11th
- Adam sends HMP Sections (1. hazard profiles and vulnerability assessments, 2. Planning Process and Community Profile), agenda and other homework reminders to Steering Committee June 11th

Kauai County Multi Hazard Mitigation Plan Update
Core Planning Team Meeting held on: 6/25/2025

Attendees

- **County Representatives:** David Kennard, Alan Clinton, Ruby Pap, Ana Espanola, Niki Kunioka-Volz, Alisha Summers, Christina Kaser, Sarah Louxz, Solomon Kanoho
- **SWCA Representatives:** Wendy Blackwell, Lilly Stoilova, Adam Radford

<u>Meeting Highlights</u>

- **Risk Ranking Scoring:**
    - SWCA reviewed the risk ranking scoring chart using the dam failure hazard as an example. 7 hazard drafts are completed and uploaded to Sharepoint and ready for review by the Core Team. Additional 3 hazards will be added by Monday, 6/30.
    - Make edits directly in the Excel spreadsheet and include your 'Name: comment'. This will allow others to see your suggestions and justification for making proposed changes.
    - Complete by July 7th. Send emails to David and Wendy with any questions.
    Relevant Documents:
    - Risk Ranking drafts for review: Risk Rankings for Core Planning Team 6-25-2025.
    - Risk Assessment document to be used as a resource when reviewing the risk ranking charts: Steering_Committee_2026_KauaiCountyHMP-Vol1-Pt2.docx
    - Volume 2, Appendix L with Detailed Hazard Profiles to be used as a resource when reviewing the risk ranking charts: Steering_Committee_2026_Update_KauaiCountyHMP-Vol.2-AppL_Detailed Hazard Profiles.docx
- **Capabilities:**
    - SWCA reviewed the capability charts with the Core Team discussing in detail the request for review and updates of the charts.
    - Make edits directly in the capability charts in tracked changes or with comment bubbles. This would allow us to follow up with you should there by any questions or need for additional discussion.
    - Complete by July 7th. Send emails to David and Wendy with any questions.
    Relevant Documents:
    - Appendix K: Capability for review: 2021-05-04_KauaiCountyHMP-Vol.2-App_K_Capability.docx
- **Mitigation Goals and Objectives:**
    - SWCA reviewed the mitigation goals and objectives from the 2021 HMP. SWCA will integrate the objectives from the Climate Action Plan document to consolidate the work on this task into one review.
    - Make edits and add comments in tracked changes on what is still relevant, what has been completed, and what new goals and objectives should be added.
    - Complete by July 7th. Send emails to David and Wendy with any questions.
    Relevant Documents:
    - Goals and Objectives for review: 2021-05-04_KauaiCountyHMP-Goals and Objectives Excerpt.docx

Upcoming topics of discussion for July 8th Core Team Meeting

- Action drafts and revisions
- Analyze the 2021 actions, determine what is still relevant and what new actions should be included
- Actions to be revised and ready for Steering Committee review by July 25th
- Finalize prioritization approach
- This decision will allow SWCA to prepare a prioritization exercise for Steering Committee Meting #4
- Determine voting approach for prioritization

Kauai County Multi Hazard Mitigation Plan Update
Core Planning Team Meeting held on: 7/8/2025

Attendees

- **County Representatives:** David Kennard, Alan Clinton, Ruby Pap, Ana Espanola, Alisha Summers, Christina Kaser, Sarah Louxz, Solomon Kanoho
- **SWCA Representatives:** Wendy Blackwell, Adam Radford

<u>Meeting Highlights</u>

- **Progress on Risk Ranking, Goals and Objectives:**
    - The Core Planning Team (CPT) aims to finalize Risk Rankings and Goals/Objectives by July 18th.
    - Ruby provided new feedback that may influence higher risk rankings; David will review and make final decisions, to be confirmed with SWCA.
    - Ruby recommended cross walking the MHMRP Goals and Objectives with another document for alignment. David will prepare and distribute this.
    - Alan emphasized that goals and objectives should primarily support KEMA, but also serve broader county needs like regulatory planning and grant applications.
    - David sees the MHMRP as a broad, flexible guide for the county.
- **Action Drafts and Revisions:**
    - The team is updating action drafts and formats, referencing the Master Action Plan Matrix (Volume 1), Action Status (Appendix A), and Action Plan Detail (Appendix O).
    - David and Ana agreed that the plan should enable opportunities rather than prescribe detailed actions—specifics should be left to the lead agency.
    - Ruby noted the county's improved mitigation capacity, reducing the need for detailed instructions.
    - Feedback on Action Charts:
    - Alisha suggested including project readiness in descriptions.
    - Wendy proposed adding funding readiness to STAPLEE+E descriptions.
    - Federal funding sources (HUD-CDBG-DR, USFS, NRCS, EPA, BLM) should be included in action narratives, with an emphasis on leveraging funding as it becomes available.
    - Revised actions must be ready for Steering Committee review by August 1st.
- **Finalize Action Prioritization Approach:**
    - The team will focus on implementation priority and cost-effectiveness in prioritization, rather than separate ratings.
    - SWCA will prepare a prioritization exercise for Steering Committee Meeting #4.
    - Options discussed: interactive voting during the meeting or survey-based voting afterward.
    - The final prioritization approach will be confirmed during the client call on July 9th.
- **Logistics:**
    - Core Team Meetings will take place as needed from now through plan completion.

<u>Action Item Deadlines</u>
July 18th

- Provide edits for Capability Assessment

- Recommend revisions for goals and objectives

By August 1st

- Revise action status from 2021 MHMRP and prepare actions for 2026 MHMRP

Attachment B-2. Steering Committee Meeting Materials

Kauaʻi County Multi-Hazard Mitigation and Resilience Plan Update
Steering Committee Meeting No. 1
10:30 a.m. to 1:30 p.m.—February 26, 2025
KEMA Emergency Operations Center, 3990 Kaʻana Street, Līhuʻe, Kauaʻi

The PowerPoint presentation used during this meeting can be accessed here:
Kauai County MHMP-Committee Mtg1 Presentation 02262025_For Notes [1]

I. Introductions

- The Kauaʻi Emergency Management Agency (KEMA) is the lead entity.
- SWCA Environmental Consultants (SWCA) is the consultant leading the planning effort.
- There were more than 20 participants in the meeting, with representation from KEMA, Kauaʻi Office of Economic Development and Planning Department, Kauaʻi Fire Department, Gay & Robinson, Hale Halawai, and more. See the Participants table at the end of this document for a list of attendees and affiliations.

II. Plan Update Process and Overview

- Successful natural hazard mitigation planning and implementation lessens the impact of natural disasters; therefore, it lessens emergency response time, speeds recovery, and creates better prepared and more resilient communities.
- Hazard mitigation planning also reduces the impacts of natural disasters by supporting protection and prevention activities.
- In Hawaiʻi, there is a 2023 State Hazard Mitigation Plan (HMP) and a variety of local plans (e.g., Kauaʻi Climate Adaption Plan).
  - The State of Hawaiʻi HMP was updated in August 2023 and is on a 5-year approval cycle.
- The proposed format of the Kauaʻi County Multi-Hazard Mitigation and Resilience Plan (MHMRP) includes sections on the planning process, hazard identification, risk assessment, mitigation strategy, and plan maintenance procedures.
  - Each of these sections is required to comply with the federal requirements outlined by the Federal Emergency Management Agency (FEMA).
- The planning process is expected to last through 2025; a full schedule is in the PowerPoint presentation (see URL below).
- Federal requirements for local HMPs are found in 44 Code of Federal Regulations 201.6; Kauaʻi County must meet each federal requirement.
- New FEMA guidance for local HMPs went into effect in April 2023 and requires information on potential climate change impacts for each hazard type and requires the planning process to engage socially vulnerable populations, analyze how hazards may impact socially vulnerable populations, and optionally include compliance with high hazard potential dams (HHPD) requirements.
  - Steering Committee members are not expected to read the guidance document, but it is important to understand that the MHMRP requirements come from the guidance document.
  - The State of Hawaiʻi has established an HHPD prioritization listing and is finalizing the State-level program. The Kaua'i MHMRP will provide a summary of the available data for compliance.

III. Roles and Responsibilities

- **Steering Committee members** are responsible for attending each of the four Steering Committee meetings and providing reference plans, studies, websites, etc. to be used in the MHMRP drafting process; providing

[1] https://swcacorp.sharepoint.com/:b:/r/sites/MyProjects92059-1630/Shared%20Documents/External%20-%20Kauai%20County%20Hazard%20Mitigation%20Plan/06.%20Steering%20Committee/Kauai%20County%20MHMP-Committee%20Mtg1%20Presentation%2002262025.pdf?csf=1&web=1&e=ehywXs

edits and feedback on the MHMRP draft, approach, and planning process; and integrating the MHMRP concepts into local plans and programs following MHMRP adoption.

- **Subject matter experts (SMEs)** will be identified by the Steering Committee to provide input and feedback on specific topics, provide additional plan references, and integrate MHMRP concepts into additional local plans and programs.
- **Stakeholders** will be identified to represent different perspectives throughout the community. This includes entities that are interested in the MHMRP but not directly involved in the MHMRP drafting process.
    - FEMA requires that the planning process include at least one stakeholder group from the following categories:
        - Neighboring communities
        - Local and regional agencies involved in hazard mitigation activities
        - Agencies that have the authority to regulate development
        - Businesses
        - Academia
        - Other private and nonprofit interests
        - Federal partners
- **Members of the public** will provide input based on local knowledge and community interests and respond to the draft MHMRP.

IV. Planning Process

- There will be four Steering Committee meetings that build off one another. Meeting Nos. 2 through 4 will be virtual only (not hybrid).
- Steering Committee members suggested considering the following contacts for involvement:
    - Daniel Hamada, Complex Area Superintendent for the Kauaʻi Department of Education
    - Flood mitigation project contacts
    - Hanalei Initiative
    - Hanalei Watershed Hui
    - Dr. Sarah Henly-Shepard
    - Hawaiʻi Community Foundation
    - Kauaʻi County Agency on Elderly Affairs
    - Kauaʻi County Homeless Support (Kauaʻi County Housing Agency)
    - Kauaʻi County Parks Department
    - Chris Shuler (Hydrologist, University of Hawaiʻi)
    - Pacific Missile Range Facility
    - Hawaiʻi Department of Transportation, Highways
    - Coordinator for Vulnerable Populations
    - Child and Family Service
    - Chan Zukerberg Kauaʻi Community Fund
    - Hawaiʻi Health Systems Corporation – Wilcox Medical Center
    - Department of Water
- The Steering Committee agreed that using the six districts to summarize social vulnerability and hazard data was the best approach. It was understood that some data may not be able to be broken out into districts.

Community Involvement Process

- Stakeholders may be helpful in assisting with community engagement efforts, including facilitating discussions with local community members, coordinating with existing events, and distributing a survey to inform the planning process.
- An initial press release will be published in mid-March to announce the planning process and work to be completed.
- As the planning process progresses, informational kiosks will be placed at community centers (or similar locations).
- Information will also be shared through the County mitigation webpage, which is the primary

notification and posting location throughout the HMP update process for community engagement.
    - An open house event is targeted for November 2025 to obtain community feedback on the draft MHMRP.
    - A second press release will be published to announce adoption of the MHMRP at local public meetings, which are planned to occur in spring 2026.

V. Reference Materials

- SWCA provided a list of example state, regional, and local reference materials for Steering Committee members to update. New or updated documents should be provided by the Steering Committee. The following are some of the suggestions and topics discussed during the meeting:
    - Local social vulnerability index in the climate adaptation plan
    - King tides will be included in the coastal flood section of the HMP
    - Decision will be made on what is the best number to use for sea level rise data
- Reference materials can be shared by uploading them to the SharePoint Site [2] or emailing them directly to SWCA (adam.radford@swca.com) or KEMA (dkennard@kauai.gov).

VI. Risk Assessment

- SWCA provided an overview of hazard profiles and the Hazard Screening Tool [3] to aid in identifying the 10 hazards the MHMP will profile.
    - Based on initial research and input from KEMA, the initial hazards that are being considered for inclusion in the MHMP are: tropical cyclones or other high winds; wildfire; inland flood; high surf, coastal flood, and erosion; tsunami; landslide; dam failure; earthquake; drought; and heat.
- SWCA explained that we are planning to include 10 hazards for the MHMRP. The following comments from the Steering Committee will be vetted through the Core Planning Team for direction and guidance.
    - One suggestion from the Steering Committee was to include a discussion of king tides.
    - One comment related to the criteria to be used for sea level rise.
- Two questions were posed to the Steering Committee, and will also be considered by the Core Planning Team:
    1. Should additional hazards be considered, and if so, where should they be ranked in order of priority?
    2. Should heat and drought be profiled together or separately?

  Steering Committee members were asked to use the online Hazard Screening Tool [3] to answer the questions above and rank the proposed hazards by March 12.
- SWCA will work with KEMA to synthesize the responses and inform the Steering Committee of the results.
- Hazard profiles and risk assessment will be the focus of the next Steering Committee meeting.
- SWCA will provide a draft of the hazard profiles section prior to the next meeting.
    - Hazard profiles include hazard type, location, magnitude/severity, previous occurrences, and probability.
    - SWCA is using the State HMP, National Weather Service databases, and other online data platforms to determine this information. However, Steering Committee members may have personal experiences and knowledge that can supplement national and state databases.

VII. Next Steps

- SWCA will send out a Doodle poll for scheduling Steering Committee Meeting No. 2 by February 27.
- Steering Committee members should respond to the poll by COB February 28. The meeting will be scheduled by March 12.
- SWCA will distribute the meeting notes and presentation to the Steering Committee members by March 5.
- SWCA will distribute draft hazard profiles to Steering Committee members for review prior to Steering

[2] https://swcacorp.sharepoint.com/:f:/r/sites/MyProjects92059-1630/Shared%20Documents/External%20-%20Steering%20Committee?csf=1&web=1&e=fO3cvK
[3] https://forms.office.com/r/vMP5yuKg7m

Committee Meeting No. 2.

- SWCA will distribute the updated Steering Committee, SME, and stakeholder contact lists prior to Steering Committee Meeting No. 2.
- Steering Committee Meeting No. 2 will be held online the week of April 21 or 28.
- Steering Committee member homework:
    - Submit reference materials by March 12.
    - Provide input on additional Steering Committee members, SMEs, and stakeholders by March 12.
    - Complete the Hazard Screening Tool [3] online form by March 12.
    - Review draft MHMRP sections prior to Steering Committee Meeting No. 2.

Participants:

Gina Belleau – DLNR
Kait Conant – Hale Halawai
Alan Clinton – Kauaʻi County Planning Department
Ana Espanola – Kauaʻi Office of Economic Development
Eli Jones – Kauaʻi District Health Office – Environmental Health
Jackie Kaina – Kauaʻi Economic Development Board
Solomon Kanoho – KEMA
Sue Kanoho – Hawaiʻi Visitors & Convention Bureau
Christina Kaser – Kauaʻi Office of Economic Development
David Kennard – KEMA
Niki Kunioka-Volz – Kauaʻi Office of Economic Development
Sarah Louxz – KEMA
Ryan Mills – Kauaʻi Fire Department
Mapuana O'sullivan – DLNR / Forestry & Wildlife
Ruby Pap – UH Sea Grant
James Robinson – Gay & Robinson
Scott Sato – Kauaʻi Island Utility Coop.
Alisha Summers – Kauaʻi County Planning Department
Elton Ushio – KEMA
Josh Uyehara – Kakaha Ag. Association
Byan Wienand – Kauaʻi Department of Public Works
Wendy Blackwell – SWCA
Lilly Stoilova – SWCA
Adam Radford – SWCA

Kauaʻi County Multi-Hazard Mitigation and Resilience Plan Update
Steering Committee Meeting #2
Virtual Teams Meeting

The PowerPoint presentation used during this meeting can be accessed here:
Kauai County MHMP-Committee Mtg2 Presentation 04-22-2025.pdf

I. Introductions

- There were more than 20 participants in the meeting, with representation from KEMA, Kauaʻi Office of Economic Development and Planning Department, Kauaʻi Fire Department, Gay & Robinson, Hale Halawai, and more. A full list of participants is on page 4 of these notes.
- There were no new participants in the meeting.

II. Planning Process Updates

- **Steering Committee, Stakeholders and Subject Matter Experts**
  - KEMA is the lead for the planning effort.
  - Core Team drives the planning process and is made up of County staff.
  - Steering Committee provides input and guidance.
    - Only one new member was added to the Steering Committee since the last meeting.
  - SWCA facilitates the planning effort.
  - Subject Matter Experts (SMEs) contribute specialized knowledge and feedback. They are individuals that provide topic-specific input.
    - Suggestions for outreach to specific individuals (e.g., Mehana Vaughan) for qualitative data collection were discussed.
    - There was an emphasis of incorporating local knowledge and experiences into the plan by the Steering Committee.
  - Stakeholders represent organizations or agencies and are categorized into six FEMA-required groups (slide 6).
  - Based on the current list of stakeholders, representatives from agencies that regulate development still need to be identified.
- **Community Engagement**:
  - A press release was issued on March 31st to announce the planning process.
  - A public survey was made available for feedback on the 2021 plan and current planning efforts. https://survey123.arcgis.com/share/1bcbb40ab4da4f2d9b6350f3097f1e9f
  - Updates to the KEMA website include information on the planning process and links to resources. https://www.kauai.gov/Government/Departments-Agencies/Emergency-Management-Agency/Multi-Hazard-Mitigation-and-Resilience-Plan

III. Hazard Profiles

- **Hazard Screening Results:**
  - There were 18 respondents that prioritized hazards based on overall importance in order to identify the hazards to be included in the HMP update.
    - Most respondents ranked tropical cyclone and other high winds as the hazard with highest importance.
    - Wildfire was identified by several respondents as the hazard with the highest importance.
    - Dam failure was ranked by one respondent as the hazard with the highest importance.
  - In addition to the three hazards listed above, the following will be included in the HMP:

inland flooding; high surf, coastal flood and erosion; tsunami; landslide; dam failure; earthquake; heat; and drought.
    - Additional hazards identified by the survey respondents (e.g., food security, pandemic, disease) will be incorporated into Appendix E as brief qualitative assessments. Structural failure and impact to ports will be included in the relevant hazard profile narrative or supporting appendices.
- **Hazard Profile Format:**
    - Each hazard profile includes past events, location, frequency, severity, warning time, and future conditions (e.g., climate change impacts).
    - Climate change impacts are integrated into each hazard for the HMP update rather than treated as a standalone hazard as was done in the 2021 HMP.
    - SMEs are being consulted to ensure accuracy and completeness of hazard data.
- **Providing Feedback:**
    - Steering Committee members should provide feedback (edits and comments) to the Hazard Profiles using the SharePoint link (2026KauaiCountyHMP-Vol1-Pt2_04162025.docx)
    - Notify SWCA of any issues accessing SharePoint.

IV. Vulnerability Assessment

- **Assessment Components:**
    - Critical facilities: County-identified essential services and infrastructure categorized by FEMA lifelines (safety/security, food/water/shelter, health/medical, energy, communications, transportation, hazardous materials).
        - Steering Committee to provide feedback and changes to the definition and descriptions.
    - Loss estimates: Dollar value losses calculated for mapped hazards.
    - Social vulnerability: Qualitative analysis based on census tract/block group data and overlaying hazard exposure areas.
- **Loss (Damage) assessment:**
    - FEMA's Hazus model is capable of running damage estimation for specific hazards like tropical cyclones and high winds; inland flooding; coastal flooding; tsunami; dan failure; and earthquake. Hazus will be used to estimate damages for these hazards.
    - For hazards like wildfire, landslide, heat, and drought, qualitative assessments will be conducted using building replacement values and exposure zones based on available data.
- **Social Vulnerability Analysis:**
    - Mirroring the Climate Action Plan's approach, social vulnerability indicators (e.g., household characteristics, socioeconomic status) will be overlaid with hazard maps.
    - Narrative descriptions will focus on high vulnerability areas and impacted populations.
- **Feedback from Steering Committee**
    - Include a description about the number of visitors every day (25,000 to 30,000). The HMP should take into account how mitigation activities and preparedness may differ for visitors.
    - The percentages of damage for the hazards without Hazus modeling, could be analyzed at different percents of damage. For wildfire and landslide, the 2021 HMP used 1%, 10%, 30% and 50% damaged. The Steering Committee may want to see different percentages used for the update.
    - A hazard could impact a dam without causing complete failure. How is this included in the damage estimation modeling for dam failure and the other hazards that may impact dams? SWCA will research this and respond to the Steering Committee with an answer.
    - The County Planning Department will provide the Extreme Tsunami data layer to use for damage estimation modeling.
- **Risk Ranking:**

  - Review of methodologies for calculating overall risk, including approaches from the 2021 HMP, the 2023 Hawaii HMP, and a simplified risk ranking model.
  - Feedback was solicited on preferred approach. The Steering Committee will provide additional feedback on which approach and modifications to use. Those interested in helping to refine the approach will also volunteer to assist with a sub-committee.
- **Document Structure/Formatting:**
  - Volume 1 of the mitigation plan will serve as a summary document, with detailed maps and data included in appendices.
  - Consistency in formatting, citations, and technical editing will be ensured in the final version.

V. Next Steps/Action Items

- **Follow-Up Actions:**
  - SWCA to send meeting follow-up with homework assignments by April 29th.
  - Steering Committee action items due May 6th:
    - complete the Doodle poll for the next meeting date
    - provide additional direction on the vulnerability approach (slides 19 to 31), critical facility definition and categories (slide 20), and risk rating approach (slides 32 to 34).
      - 2021 HMP Risk Rating Approach (pages 111 to 113 of the pdf at 2021-05-04_kauaicountyhmp-vol.2-app_final.pdf)
      - 2023 Hawaii HMP Risk Rating Approach (pages 540 to 543 of the pdf at 2023_Hawaii_SHMP_Final_Approved_Adopted_508Compliant-10.27.23.pdf)
      - Simplified Risk Ranking Approach: Priority Risk Index Template_04082025.xlsx
  - Steering Committee action items due by May 13th
    - provide feedback on hazard profiles
    - Provide input on Stakeholder and SME lists and the overall approach to inclusion of Stakeholders and SMEs. The contact lists are found at KauaiCoHMP_StakeholderRoster_04242025.pdf and KauaiCoHMP_SMERoster_04242025.pdf
  - Notify SWCA of any issues accessing SharePoint.
- **Upcoming SWCA Deliverables:**
  - The updated risk assessment (hazard profiles and vulnerability analysis), planning process, and county profile sections of the HMP to be distributed before the next meeting.

Participants:

Gina Belleau – DLNR
Alan Clinton – Kauaʻi County Planning Dept.
Kati Conant – Hale Halawi
Ana Espanola – Kauaʻi Office of Economic Development
Ellis Jones – Kauaʻi District Health Office
Jackie Kaina – Kauaʻi Economic Development Board
Solomon Kanoho – KEMA
Sue Kanoho – Hawaiʻi Visitors & Convention Bureau
Christina Kaser – Kauaʻi Office of Economic Development
Niki Kunioka-Volz – Kauaʻi Office of Economic Development
Sarah Louxz – KEMA
Roger Mills – Kauaʻi County Fire Dept.
Polly Phillips – Kauaʻi Mayorʻs Office
James Robinson – Gay & Robinson
Scott Sato – Kauaʻi Island Utility Coop.
Alisha Summers – Kauaʻi County Planning Dept.
Elton Ushio – KEMA
Josh Uyehara – Kekaha Ag. Assoc.
Bryan Wienand – Kauaʻi Dept. of Public Works

Wendy Blackwell – SWCA
Adam Radford – SWCA
Lilly Stoilova – SWCA

Kaua'i County Multi-Hazard Mitigation and Resilience Plan Update
Steering Committee Meeting #3
Virtual Teams Meeting

The PowerPoint presentation used during this meeting can be accessed here: Kauai County MHMP-Committee Mtg3 Presentation 06172025_Final.pdf

I. Introductions

- There were more than 20 participants in the meeting, with representation from KEMA, Kaua'i Office of Economic Development and Planning Department, Kaua'i Fire Department, Gay & Robinson, Hale Halawai, and more. A full list of participants is on page 4 of these notes.
- There were two new participants in the meeting: Koa Duncan (Assistant Housing Director with the Kaua'i County Housing Agency) and Marie Williams (Long Range Planning Division Manager with the County's Planning Department).

II. Overview of Drafts

- **General Considerations**
    - Volume 1 of the mitigation plan will serve as a summary document, with detailed maps and data included in the appendices (Part 2).
    - Consistency in formatting, citations, and technical editing will be addressed and incorporated in the pre-public release document version.
    - Consider other plans for inclusion in the MHMRP update, even as footnotes if they are not ready for inclusion in this iteration of the plan.
        - For example, Kaua'i Fire is working with FACETS to conduct a community risk assessment, community risk reduction, and standard of cover for Kaua'i County. The completion date is anticipated to be December of this year, after the MHMRP has been reviewed by the community. A short description including the status of the effort will be included in the 2026 MHMRP update with relevant information being integrated into the next update.
        - Kaua'i Fire is also in the process of the full 10-year Community Wildfire Protection Plan with HWMO. Similar to the above bullet, a short description including the status of the effort will be included in the 2026 HMP update with relevant information being integrated into the next update.
    - There was one general question regarding availability to access drafts and planning documents on the KEMA website, like the 2020 plan update: (https://www.arcgis.com/apps/MapSeries/index.html?appid=9283c6b4f9fe447689f707e42303ce4f). An updated webpage is being developed and will be available later in the summer.
    - KEMA expressed appreciation for the high participation and engagement.
    - KEMA reminded the Steering Committee that the plan is a "living document" and will evolve over time. "Please weigh in if something strikes you regardless of where we are in the update process!"
- **Part 1: Planning Process, County Profile, Regulations, and Programs**
    - Steering Committee members should provide feedback (edits and comments) using the SharePoint links.

- In each linked document, comments are highlighted by name or organization for easier navigation. There are also general comments to keep the Steering Committee up to date as we work through edits and updates.
- As edits or additions are suggested, the Steering Committee should:
  - provide feedback on any sections that may be too technical or confusing for the general reader; and
  - recommend specific Appendix sections (in Volume 2) that should be moved to the summary document (Volume 1) or if there are sections that would benefit from consolidation of the narrative.

- **Part 2: Risk Assessment**
  - Hazard Profiles and Vulnerability Assessment were discussed.
  - Feedback and discussion on conducting the Hazard Profiles and Vulnerability Assessment was encouraged.
  - Updates to the 2026 approach were discussed and approved so that KEMA and the Core Team can move forward with finalizing content for those sections. Examples include:
    - Vulnerability Assessment approach Critical Facilities approach
    - Social Vulnerability approach
    - Format for the vulnerability sections for each hazard

III. Risk Ranking

- The updated approach to risk ranking was introduced and discussed.
- Feedback and discussion on conducting the rankings were encouraged.
  - One suggestion on the risk ranking scores was to remove unnecessary decimal places (e.g., 0.1 vs. 0.10) to trim down the content.
  - The Steering Committee agreed that KEMA and the Core Planning Team would score each hazard for review prior to the next Steering Committee meeting.

IV. Mitigation Strategy

- **Capability Assessment Introduction**
  - Categories such as legal/regulatory, fiscal, technical, and outreach capacities were reviewed.
  - Adaptive capacity for climate change will be updated to align with the Climate Action Plan.
  - The Steering Committee agreed that KEMA and the Core Planning Team should update the capability charts for review prior to the next Steering Committee meeting.
- **Goals and Objectives from the 2021 MHMRP**
  - An overview of the 2021 HMP goals and objectives was provided.
  - Steering Committee members were encouraged to evaluate relevance and applicability of the goals and objectives from the previous plan and make suggestions for edits.
  - The Steering Committee agreed that the Core Planning Team and KEMA will revise and update the goals and objectives for review prior to the next Steering Committee meeting.
- **Overview of Action Status from 2021 MHMRP**
  - An overview of the 2021 HMP actions, descriptions, and prioritization process was provided.

- An overview of the requirements for action inclusion, recommended modifications to simplify the action descriptions, and considerations for the prioritization process were presented.
- The Steering Committee agreed that KEMA and the Core Planning Team would take the following steps review prior to the next Steering Committee meeting:
  - determine how to modify the approach for action descriptions;
  - update the status for all 2021 actions and determine which actions are still relevant for inclusion in the 2026 HMP;
  - prepare new actions from key reports like KCAAP, 2024 CWPP action updates, Capitol Improvement Project listing, and similar; and
  - review and revise the prioritization process.

Next Steps/Action Items

- Complete the Doodle poll for the next meeting date by June 30th.
- SWCA to send meeting follow-up with homework assignments by June 25th.
- Steering Committee review of Parts 1, 2, and Appendices (D, L, M) due July 9th:
  - The working draft of the Planning Process/Community Profile (Part 1) can be found here: Steering_Committee_2026_KauaiCountyHMP-Vol1-Pt1_Planning_Process.Comm.Profile.docx
  - Risk Assessment (Part 2) is located here: Steering_Committee_2026_KauaiCountyHMP-Vol1-Pt2.docx and Appendix D, L, M as follows:
    - Appendix D: Steering_Committee_2026_Update_KauaiCountyHMP-Vol.2-AppD_Risk Assessment Methodology.docx
    - Appendix L: Steering_Committee_2026_Update_KauaiCountyHMP-Vol.2-AppL_Detailed Hazard Profiles.docx
    - Appendix M: Steering_Committee_Update_KauaiCountyHMP-Vol.2-AppM_Detailed Risk Assessment Results.docx
- KEMA and Core Team to revise goals, objectives, and update capability assessment by July 18th. Revise action status from 2021 MHMRP and prepare actions for the 2026 MHMRP by August 1st.
- Notify SWCA (Adam Radford at adam.radford@swca.com) of any issues accessing SharePoint.
- Upcoming SWCA Deliverables:
  - Schedule August meeting.
  - Distribute revised versions of the Planning Process, County Profile, Risk Assessment, updated Mitigation Goals, Objectives & Actions before the next meeting.

Participants:

Gina Belleau – DLNR
Mason Chock – Kupu Aʻe Leadership Development
Kati Conant – Hale Halawi
Koa Duncan – Kauaʻi County Housing Agency
Ana Espanola – Kauaʻi Office of Economic Development
Padraic Gallagher – Kauaʻi Humane Society
Ellis Jones – Kauaʻi District Health Office
Jackie Kaina – Kauaʻi Economic Development Board
Solomon Kanoho – KEMA
Christina Kaser – Kauaʻi Office of Economic Development
David Kennard – KEMA
Niki Kunioka-Volz – Kauaʻi Office of Economic Development
Sarah Louxz – KEMA
Roger Mills – Kauaʻi County Fire Dept.
Polly Phillips – Kauaʻi Mayorʻs Office
James Robinson – Gay & Robinson
Scott Sato – Kauaʻi Island Utility Coop.
Elton Ushio – KEMA
Bryan Wienand – Kauaʻi Deptartment of Public Works
Marie Williams – County of Kauaʻi Planning Department
Wendy Blackwell – SWCA
Adam Radford – SWCA

Kauaʻi County Multi-Hazard Mitigation and Resilience Plan Update
Steering Committee Meeting #4
Virtual Teams Meeting

The PowerPoint presentation used during this meeting can be accessed here: Kauai County MHMP-Committee Mtg4 Presentation 09092025.pdf

I. Introductions

- There were more than 20 participants in the meeting, with representation from KEMA, Kauaʻi Office of Economic Development and Planning Department, Kauaʻi Island Utility Coop., Gay & Robinson, Kupu Aʻe Leadership Development, and more. A full list of participants is on page 4 of these notes.
- David Kennard welcomed attendees, noting the relief that the meeting was not in response to an active emergency. Adam Radford introduced the meeting as the final scheduled steering committee session, emphasizing ongoing opportunities for input during plan finalization.

II. Overview of Drafts

- **Outline of sections provided**
    - Participants were oriented to the draft documents sent out in advance of the meeting. These include the following:
        - Capability Assessment (2025 Update_KauaiCountyHMP-Vol.2-AppK_Detailed Capabilities Assessment.doc)
        - Goals and Objectives (2025_KauaiCountyHMP-Goals and Objectives Excerpt.docx)
        - Actions (Action Chart 090525.xlsx)
        - STAPLE+E definitions (Kauai STAPLE+E Definitions 090525.docx)
    - Also included was an excerpt of the methodology and results of the hazard risk ranking and the Appendices associated with Section 1 of the MHMRP (Kauaʻi County Profile and the Regulations and Programs), which are provided below:
        - Risk Ranking Excerpt (included in Section 2: Risk Assessment): Risk Ranking Excerpt.docx
        - Development Profile (Appendix G): 2025 Update_KauaiCountyHMP-Vol.2-AppG_Kauai County Development Profile.docx
        - Demographic Profile (Appendix H): 2025 Update_KauaiCountyHMP-Vol.2-AppH_Kauai County Demographic Profile.docx
        - Economic Profile (Appendix I): 2025 Update_KauaiCountyHMP-Vol.2-AppI_Kauai County Economic Profile.docx
        - Relevant Agencies, Policies, Programs, and Regulations (Appendix J): 2025 Update_KauaiCountyHMP-Vol.2-AppJ_Relevant Agencies, Policies, Programs, and Regulations.docx
- **Risk ranking results and discussion**
    - The risk ranking calculator and related results were reviewed. Results showed hazard priorities based on scoring by KEMA and the Core Team. Discussion about the scoring and reality of prioritization ensued. Some question as to whether dams and landslides should rank higher was raised. No changes to the scores were proposed, but the conversation highlighted that the scores help more from a document

organization standpoint and do not necessarily reflect the priorities of KEMA or other hazard managers, particularly as new information comes to light. Committee members were encouraged to provide feedback by September 24th if further analysis or modifications are desired.

- **Remaining questions and comments**
    - Appendix G, H, I, and J were highlighted for Steering Committee review, with a particular request to review the presentation of race and ethnicity in Appendix H (pages 2-5).

III. Mitigation Strategy

- **Review of Capability Assessment, Goals and Objectives, Actions**
    - Refined goals and objectives were reviewed with changes from the 2021 update highlighted. The new goals and objectives focus on reducing long-term vulnerability and promoting resilience. Unlike the 2021 plan, objectives will not be tied to every individual action but will be linked during grant applications or project planning.
- **Review of prioritization strategy**
    - An overview of the Action List and related workbook was provided.
    - The number of mitigation actions was consolidated, with some completed and new ones added, totaling around 40 when complete (there are 39 now).
    - Action descriptions include prioritization, hazards mitigated, lead and support agencies, timeline, funding sources and cost effectiveness.
- **Interactive prioritization exercise**
    - The Steering Committee used a Mentimeter Poll to review three actions (wildfire, structure / infrastructure, tsunami outreach) and determine which STAPLE+E concepts support it.
    - The intent of the exercise was to help Steering Committee members visualize how actions could be ranked (Low = 2 or 3 STAPLE+E characteristics are met / supported, Medium = 4-5, High = 6 or more).
    - The results were:

	Wildfire	Infrastructure	Tsunami
Social	7	5	10
Technical	3	9	6
Administrative	5	8	2
Political	4	10	7
Legal	2	5	2
Economic	8	9	7
Environmental	8	2	5

    - Committee members were asked to review action descriptions, including prioritization, and suggest any missing or incorrectly formulated items to KEMA by September 24th.

IV. Plan Maintenance Strategy Introduction

- **2021 approach and results**
    - Key considerations for keeping the plan current include:
        - Monitoring progress of action implementation
        - Evaluating the MHMRP for effectiveness
        - Updating the MHMRP by 2031
        - Continuing public participation
        - Incorporating into other planning mechanisms and programs

- Since 2021, 12 actions have been completed. The county achieved a Class 8 rating in the National Flood Insurance Program's Community Rating System. Ongoing actions continue with regular core team meetings and maintenance of mitigation plan resources.

- **Recommended changes**
  - A new element was proposed for 2026-2031 to simplify the maintenance requirement: a one-page survey for the Steering Committee and Core Team in the second year to provide feedback on the plan's effectiveness and action progress.
  - The results of this survey would be included in a summary chart or report to identify / track milestones and document improvements to effectiveness of the MHMRP.
  - A timeline for the 2016-2031 update included securing funding early in 2029 and continuing / encouraging public participation utilizing the MHMRP Story Map and announcements from the Mayor's Office.
- **Consensus on 2026 approach**
  - The Steering Committee agreed with the recommended approach to monitoring implementation, evaluating progress, updating regularly to prepare for the 2030-31 cycle, and continuing public participation. The Steering Committee also agreed that relevant portions of the MHMRP will be incorporated into other county plans and programs as appropriate, meeting the federal requirement.

V. Detailed Project Timeline Review

- **Milestones up through approval**
  - The following key dates were reviewed:
    - September 12: Follow-up email with meeting highlights and tasks
    - September 24: "Last" opportunity for detailed edits to KEMA
    - October 16: Final review of the plan email to Steering Committee
    - October 23: Comments due back from Steering Committee
    - October 30: Full pdf to decision makers
    - November 5: Comments due back and consolidated by KEMA
    - December 1: Public review period begins
    - December 9: Community open house
    - December 19: Deadline for community feedback
  - Other tentative dates were also reviewed with submittals anticipated to the State (Jan. 2026), FEMA (Feb. 2026), and FEMA approval (May 2026).
- **Community involvement and input**
  - The current KEMA landing page https://www.kauai.gov/Government/Departments-Agencies/Emergency-Management-Agency/Multi-Hazard-Mitigation-and-Resilience-Plan was discussed and its role pointing viewers to the new plan update StoryMap page (i.e., webpage).
  - The new webpage is up in its basic form (https://storymaps.arcgis.com/stories/41f9c2e49f254d05a15cf2b58998d1ce), but much like the 2021 update page, will include the following "tabs":
    - Welcome
    - Plan Update Process
    - Draft Plan Review (i.e., Public Comment Tab)
    - Hazards
    - Hazard Mapping Tool

- Hazard Exposure Data
- Shoreline Erosion

- Plans for an in-person open house event on December 9th include a presentation of the MHMRP and how to navigate it as well as kiosks staffed by SWCA, KEMA, and Steering Committee members to engage the public and collect feedback. Hard copy and online feedback surveys will be available with online feedback encouraged for documentation purposes.
- Informational kiosks will also be available during the public comment period at community center locations.
- KEMA will work with the Core Planning Team to consider techniques that may be effective to get community input on action prioritization.

- **Steering Committee and Core Team roles**
  - Members are encouraged to show support during the open house and public comment period, assist with outreach, and continue communication via email.

VI. Next Steps/Action Items

- See the Milestones through approval above.
- SWCA to send meeting follow-up with homework assignments by September 12th.
- Notify SWCA (Adam Radford at adam.radford@swca.com) of any issues accessing SharePoint.

Participants:

Gina Belleau – DLNR
Alan Clinton – Kaua‘i County Planning Department
Mason Chock – Kupu A‘e Leadership Development
Kati Conant – Hale Halawi
Koa Duncan – Kaua‘i County Housing Agency
Ana Espanola – Kaua‘i Office of Economic Development
Jackie Kaina – Kaua‘i Economic Development Board
Solomon Kanoho – KEMA
Sue Kanoho – Hawai‘i Visitors & Convention Bureau
Christina Kaser – Kaua‘i Office of Economic Development
David Kennard – KEMA
Niki Kunioka-Volz – Kaua‘i Office of Economic Development
Sarah Louxz – KEMA
Polly Phillips – Kaua‘i Mayor‘s Office
James Robinson – Gay & Robinson
Brad Rockwell – Kaua‘i Island Utility Coop.
Scott Sato – Kaua‘i Island Utility Coop.
Alisha Summers – Kaua‘i County Planning Department
Wendy Blackwell – SWCA
Adam Radford – SWCA

County of Kaua‘i Multi-Hazard Mitigation and Resilience Plan

Appendix C. Public Involvement

C. PUBLIC INVOLVEMENT

This appendix provides supporting materials for the public involvement process used to support development of the 2026 Multi-Hazard Mitigation and Resilience Plan (MHMRP) Update.

COMMUNITY INVOLVEMENT

The strategy described below involved initiating and maintaining a dialogue with the public and providing multiple opportunities during the planning process for interested people and organizations (i.e., stakeholders) to provide input, with an ancillary goal of developing local support for hazard mitigation. The public must have opportunities to comment on disaster mitigation plans during the drafting stages and prior to plan approval. The following describes how that requirement was met.

Media Outreach

Press Releases

Press releases were distributed over the course of the plan’s development as key milestones were achieved, including prior to the public “Open House” and plan adoption. The following are examples of press coverage:

- March 31, 2025, press release published on the Kaua‘i County website – *County to update to Multi-hazard Mitigation and Resilience Plan* (https://www.kauai.gov/County-Press-Releases/County-of-Kaua%E2%80%98i-to-update-Multi-hazard-Mitigation-and-Resilience-Plan) (Figure C-1) (County of Kaua‘i 2025a)

County to update Multi-hazard Mitigation and Resilience Plan

Published on March 31, 2025

LĪHU'E – The County of Kaua'i is updating its Multi-Hazard Mitigation and Resilience Plan.

During this process, County staff, along with community organizations and State colleagues, will review and update the plan elements, including the impacts of natural hazards affecting Kaua'i, the county's capability to mitigate those risks, and the strategy for reducing vulnerabilities and increasing resiliency to natural disasters.

Kaua‘i Emergency Management Agency

News Release

The Federal Emergency Management Agency (FEMA) requires local jurisdictions to review and update their plans at least every five years to remain eligible for a range of federal programs, including FEMA's Hazard Mitigation Grant Program and the Building Resilient Infrastructure and Communities grant program.

The planning process will include a community open house and a feedback survey anticipated for late summer with final plan approval anticipated for the spring of 2026.

The County will use the following website to provide updates throughout the planning process for the 2026 Multi-Hazard Mitigation and Resilience Plan Update. A copy of the 2021 Plan and additional information are currently available on this website: https://www.kauai.gov/Government/Departments-Agencies/Emergency-Management-Agency/Multi-Hazard-Mitigation-and-Resilience-Plan.

There is also a link to an input form to provide feedback on the current plan and submit general comments: https://survey123.arcgis.com/share/1bcbb40ab4da4f2d9b6350f3097f1e9f.

For more information, please contact David Kennard at the Kaua'i Emergency Management Agency office at dkennard@kauai.gov or by phone at 808-241-1800.

If you need an ASL Interpreter, materials in an alternate format, or other auxiliary aid support, or an interpreter for a language other than English, please contact KEMA at 808- 241-1800 or KEMA@kauai.gov as soon as possible. Requests made as early as possible will allow adequate time to fulfill your request. Upon request, this notice is available in alternate formats such as large print, Braille, or electronic copy.

Figure C-1. March 31, 2025, press release on Kaua‘i County website.

- November 12, 2025, press release published on the Kaua‘i County website (https://www.kauai.gov/County-Press-Releases/Public-invited-to-participate-in-the-2026-update-of-the-County-of-Kaua%E2%80%98i-multi-hazard-mitigation-and-resilience-plan) and distributed to media outlets (Figure C-2).

DEREK S.K. KAWAKAMI, MAYOR
REIKO MATSUYAMA, MANAGING DIRECTOR

News Release
For Immediate Release: November 12, 2025

COUNTY OF KAUAʻI
KAUAʻI EMERGENCY MANAGEMENT AGENCY
ELTON USHIO, ADMINISTRATOR
(808) 241-1800

Public invited to participate in the 2026 update of the County of Kauaʻi multi-hazard mitigation and resilience plan

The Kauaʻi Emergency Management Agency (KEMA) invites residents to take part in updating the County's Multi-Hazard Mitigation and Resilience Plan (MHMRP)—a key effort to strengthen community preparedness and reduce risks from natural disasters.

KEMA will host an in-person public meeting on Wednesday, Dec. 10, from 5 to 7 p.m. at the Planning Commission Conference Room (Moʻikeha Building, 4444 Rice Street, Suite 2A/2B, Līhuʻe).

During the meeting, attendees will learn about the planning process, review core components of the five-year plan update, and have the opportunity to ask questions and share feedback. Public input will help shape the 2026 version of the plan and guide future hazard mitigation and resilience priorities for the County.

Hazard mitigation refers to actions that reduce loss of life and property by lessening the impact of natural disasters, while resilience describes the capacity of individuals, communities, institutions, and systems to adapt and thrive amid challenges such as wildfires, severe storms, tsunamis, and landslides. The updated MHMRP will outline strategies to minimize risks, strengthen Kauaʻi's ability to withstand hazards, and build long-term community resilience.

Public participation and feedback are vital parts of the hazard mitigation and resilience planning process. KEMA encourages residents to complete the online survey, found on the KEMA-Multi-Hazard Mitigation and Resilience Plan, 2026 Update webpage, to share their experiences and ideas for improving the 2026-2030 MHMRP.

Please click on the link here: https://www.kauai.gov/Government/Departments-Agencies/Emergency-Management-Agency/Multi-Hazard-Mitigation-and-Resilience-Plan.

If you have any questions or if you require an auxiliary aid or service, an interpreter for non-English speakers, or another accommodation due to a disability, please contact David Kennard at 808-241-1800 or email dkennard@kauai.gov as soon as possible. Early requests are encouraged to ensure adequate time to meet your needs. Upon request, this notice is available in alternate formats, including large print, Braille, or electronic copy.

###

Figure C-2. County of Kauaʻi press release NR 11-12-25, for general distribution.

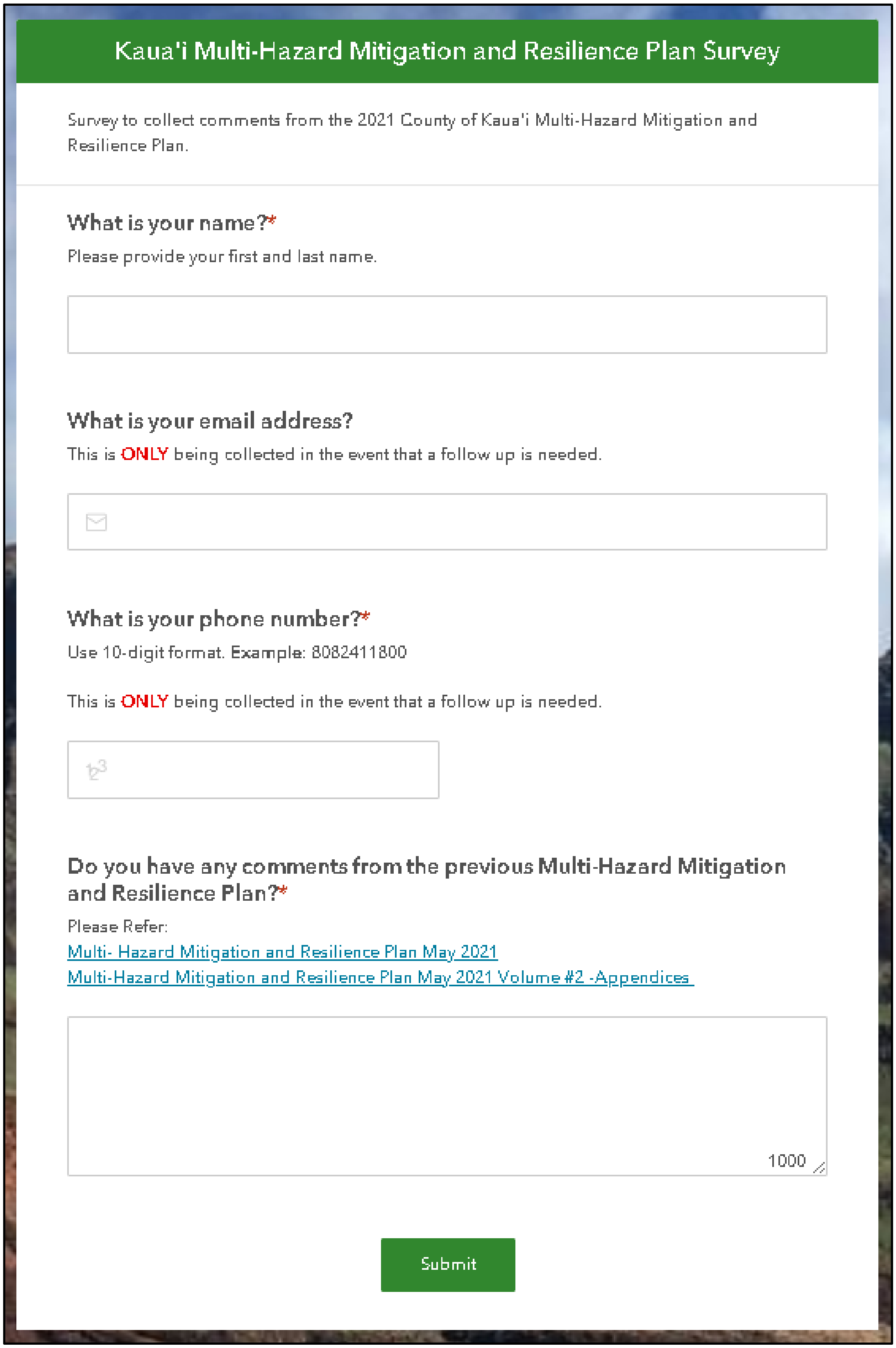
- Updates throughout the planning process were also picked up by local media outlets. Like this example from Hawaiʻi News Now, a leading statewide broadcaster: *Community input wanted to update Kauai disaster plan* (https://www.hawaiinewsnow.com/2025/06/17/community-input-wanted-update-kauai-disaster-plan/) (Brammer 2025).

Internet

Throughout the plan update process, the County maintained their hazard mitigation website (https://www.kauai.gov/Government/Departments-Agencies/Emergency-Management-Agency/Multi-

Hazard-Mitigation-and-Resilience-Plan) (Figure C-3) to include information about the update process and to provide an opportunity to comment on both the 2021 MHMRP Update and 2026 MHMRP Update (Figures C-4 and C-5) (County of Kaua‘i 2025l). The site was updated in September 2025 to point users to a new StoryMap and again in November to notify the public of the comment period, which ended on December 19, 2025 (County of Kaua‘i 2025l).

Figure C-3. Landing page from MHMRP website.



Kaua'i Multi-Hazard Mitigation and Resilience Plan Survey

Survey to collect comments from the 2021 County of Kaua'i Multi-Hazard Mitigation and Resilience Plan.

What is your name?*

Please provide your first and last name.

What is your email address?

This is ONLY being collected in the event that a follow up is needed.

What is your phone number?*

Use 10-digit format. Example: 8082411800

This is ONLY being collected in the event that a follow up is needed.

Do you have any comments from the previous Multi-Hazard Mitigation and Resilience Plan?*

Please Refer:

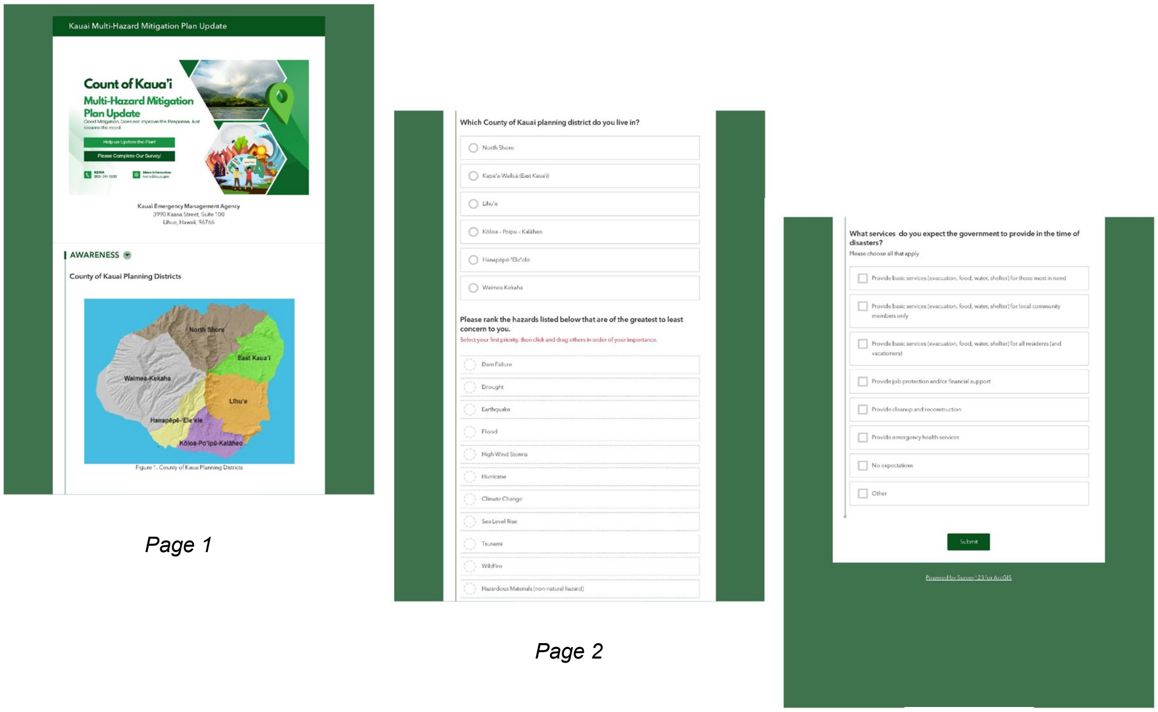
Multi- Hazard Mitigation and Resilience Plan May 2021

Multi-Hazard Mitigation and Resilience Plan May 2021 Volume #2 -Appendices

1000

Submit

Figure C-4. Survey to collect comments on the 2021 MHMRP Update.



Page 1

Page 2

Page 10

Figure C-5. Sample pages from the 2026 MHMRP Update survey.

<u>StoryMap</u>

As a complement to the County website described above, a more robust website (StoryMap) was launched in September 2025 (County of Kaua‘i 2025b). This site mirrored what had been provided during the 2021 MHMRP Update (Figure C-6). Similar to the website created for the 2021 MHMRP Update, this new site will remain active after the planning process is complete.

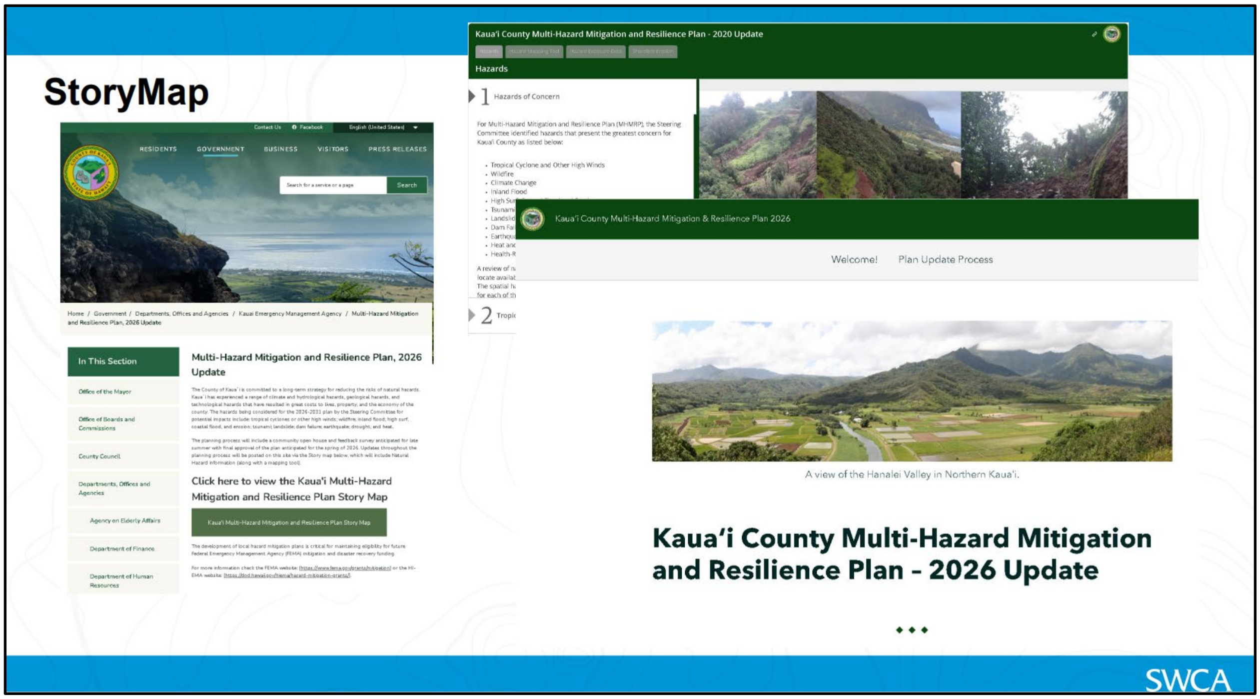


Figure C-6. The Kaua‘i Emergency Management Agency landing page, 2020 update page, and 2025 StoryMap.

Throughout the update process, these websites were used to keep the public informed on milestones and to solicit relevant input. The site’s addresses were publicized in all press releases, surveys, and public input opportunities. Kaua‘i County intends to keep both the County website and 2026 MHMRP StoryMap active after the plan’s completion to keep the public informed about successful mitigation projects and future plan updates.

Informational Videos

An informational video was developed by SWCA, KEMA, and the County of Kaua‘i’s public information officers describing the importance of hazard mitigation planning, the 2026 MHRMP Update process, the importance of public participation in the planning process, and mechanisms for participation (public comment surveys, open house, etc.). The video was posted online (https://www.facebook.com/reel/1377569527152611) and pushed through the County’s social media outlets.

Radio

The 2026 MHMRP Update was picked up by Kaua‘i Community Radio (KKCR FM), and an interview was conducted with David Kennard, KEMA Project Manager, on December 12, 2025 (https://www.kkcr.org/onair/schedules/kkcr-archives) (Kekahu Foundation Inc., dba KKCR-FM 2025). This half-hour interview provided an opportunity for an in-depth discussion on the importance of hazard mitigation planning, the 2026 MHMRP Update, and public participation.

Public Comment Period

A draft of the 2026 MHMRP Update was released for public comment in late November through December 19, 2025. The Kaua‘i Emergency Management Agency (KEMA) provided press releases notifying the public about the review period (County of Kauaʻi 2025l). The draft was made available on the MHMRP website and StoryMap. The public comment period included an open house kickoff meeting on December 10, 2025. A presentation given by SWCA and planning team members provided information on how to navigate the draft plan, hazards, and general preparedness. Attendees were given the opportunity to provide written or verbal feedback on the draft plan, with an online option encouraged. A recording of the presentation at this meeting was posted on the MHMRP website (County of Kauaʻi 2025l).

Coordination with Other Agencies

The following agencies assisted with public outreach efforts, provided data that supported the risk assessment portion of the plan, or reviewed the mitigation catalog and actions used for the development of the mitigation action plan:

- Federal Emergency Management Agency (FEMA) Region IX
- State of Hawaiʻi Emergency Management Agency (HI-EMA)
- Hawaiʻi State Department of Land and Natural Resources
- The Pacific Disaster Center
- National Weather Service
- National Oceanic and Atmospheric Association
- University of Hawaiʻi
- Kauaʻi County Planning Department
- Kauaʻi County Mayor's Office

All agencies listed above were invited by direct email to review and comment on this plan during the public comment period. Access to the draft plan was primarily through the MHMRP website (County of Kauaʻi 2025b). The complete draft plan was sent to HI-EMA, who, after completing its review, forwarded the plan to FEMA Region IX for review and approval pending adoption.

PUBLIC INVOLVEMENT

The public involvement strategy for involving the public in this plan emphasized the following elements:

- Identify and involve planning area stakeholders.
- Use surveys to gather feedback on the 2021 MHMRP Update and process as well as the 2026 MHMRP Update.
- Invite public participation at an open house public meeting.
- Attempt to reach as many planning area citizens as possible using multiple media outlets (social, print, etc.).

More detailed information about the public involvement strategy is included in the remainder of this section.

Survey

The Core Planning Team developed two hazard mitigation plan surveys with guidance from the Steering Committee. The surveys were used to gauge household preparedness for natural disasters and gather input on the 2021 and 2026 MHMRP Updates. The answers to survey questions helped guide the Steering

Committee and Core Planning Team in affirming goals and objectives, developing mitigation actions, and revising key plan parts. Multiple methods were used to solicit survey responses:

- A web-based version of each survey was made available on the MHMRP websites.
- Attendees at the open house were asked to complete a survey.
- Viewers of informational kiosks were encouraged to complete a survey.
- Press releases were distributed to local media urging residents to participate.
- The Kauaʻi County Planning Department and Mayor's Office advertised the surveys on social media.

Public Open House

The December 10, 2025, open house meeting included a presentation that allowed attendees to examine the 2026 MHMRP Update and have direct question and answer sessions with key members of the planning teams (Appendix B). Reasons for planning were shared with attendees during the presentation and interactive tools available on the StoryMap were highlighted. All attendees were asked to complete a survey and encouraged to submit additional questions or comments to KEMA. For interested individuals unable to attend, a recording of the presentation was made available online. Local media outlets were informed of the Open House by a press release from the County and an informational flyer (Figure C-7).

Figure C-7. KEMA 2026 MHMRP Update open house flyer.

Community Kiosks

Self-service kiosks that included some materials developed for the open house were set up at libraries. The kiosks were managed by the County and remained active throughout the public comment period.

Public Comment

By engaging the public through the public involvement strategy, the concept of mitigation was introduced to the public, and the Core Team received feedback that was used in developing the components of the plan. Details of the comments received are summarized in Table C-1.

Table C-1. Summary of Public Comments by Input Type

Input Type	Description	Number of Citizens in Attendance/Comments Received
Phone, email, etc.	Miscellaneous calls, emails, or conversations about the MHMRP throughout the planning process	Numerous, including two meetings with County Council members
Survey one	Input on the 2021 plan and process (open March 2025–November 2025)	11 submissions
Open house	Public meeting (December 10, 2025)	23 attendees
Survey two	Input on the 2026 plan and process (open November 2025–December 2025)	26 submissions
Total		60+

PUBLIC INVOLVEMENT RESULTS

Throughout the planning process, public involvement was encouraged. For example, an introductory email to stakeholder representatives was sent out on April 9, 2025, notifying them of the 2026 MHMRP Update and encouraging input from those they represent. Feedback was also solicited through two surveys, and the public could additionally contact KEMA directly. As comments were submitted, they were discussed with the Core Team, and subsequently some changes were made to the draft. Some comments were more general in nature and allowed KEMA the opportunity to provide informational materials or add ideas to a running list of future projects to consider. A sample of public comments and survey results is included as Attachment C-1.

PLAN DEVELOPMENT PUBLIC INVOLVEMENT CHRONOLOGY/MILESTONES

Table C-2 summarizes important public involvement milestones in the development of the plan.

Table C-2. Plan Development Milestones – Public Involvement

Date	Event	Description	Attendance/ Responses
2025			
3/31	Public outreach	Press release announcing 2026 MHMRP Update. Survey on the 2021 MHMRP Update and process goes live.	Not applicable (N/A)
11/1	Public comment period	Public comment period for draft 2026 MHMRP Update opens. Draft plan posted on plan website with press release notifying public of plan availability.	N/A
12/10	Community open house	Overview of 2026 MHMRP Update and key changes from the 2021 MHMRP Update provided. Q&A, feedback opportunities with emergency management leaders, and survey conducted.	23
12/19	Public comment period	Public comment period for draft 2026 MHMRP Update closes.	26
2026			
	Plan approval	Final draft 2026 MHMRP Update submitted to HI-EMA and FEMA Region IX for review and approval on January 19, 2026.	N/A
	Adoption	Plan adopted by Kauaʻi County on May 1, 2026.	N/A
	Final plan approval	Final 2026 MHMRP Update approved by FEMA on May 1, 2026.	N/A

Attachment C-1. Public Comments and Survey Results

Kaua‘i MHMRP Public Comment: Survey One (March 25, 2025–November 23, 2025)

During the public comment period for the 2021 MHMRP 11 submissions were received. The following are examples of the most hazard mitigation–related comments.

- *Since they re-directed the reservoir, the stream from Koloa Town to the ocean has been dry for approximately. 6 months according to long time residents. Consequently the stream bed is completely over grown. Does that pose a risk if we get big rain like last year? Also can you give evacuation map to those properties north of Poipu Road on Kiahuna Drive. They are high enough and can stay in place, and reduce the number of vehicles exiting the low level areas.*

- *During the recent tsunami evacuation, many employers kept staff at work despite sirens and an official emergency evacuation order from the Mayor. This delay created traffic congestion and left employees—many living in low-lying areas—without enough time to safely evacuate. There appears to be confusion about what a state of emergency requires from employers. I recommend that the County develop clear, mandatory evacuation protocols for businesses, provide employer education and drills, and promote public sign-up for the Kaua‘i Emergency Management Agency’s text and email alerts. Future mitigation plans should also address traffic coordination and enforce employer compliance during evacuations to help save lives.*

- *Need to address the transportation and emergency shelter issues. Add resiliency centers island wide that would be stocked with emergency supplies. Due to lack of roads and possible impaired bridges.*

- *Given the current political environment., can you create contingencies for local/state only assistance if FEMA is dismantled? mahalo...*

- *In my opinion, their needs to be a much greater focus on eliminating the fuel that provides the fires to sweep across our islands. The county needs to put forth greater effort in eliminating the dead grasses in the built up fuel underneath the ironwood forest. They also need to step up actions against the large landowners or responsible for much of this undergrowth. Until that is done, we sit in a tinder box, ready for any little spark to wipe out tens of thousands of acres.*

- *Additional road ways are definitely needed. Either redo (make drivable) to the already existing cane roads or add new ones. New ones would be much more costly. Cane roads would benefit all emergency vehicles getting from point A to B without compromising local traffic.*

- *I believe they should've made Koloa Landing an emergency shelter so that the roads don't get so tied up during evacuation*

Kaua‘i MHMRP Public Comment: Survey Two (November 23, 2025–December 19, 2025)

During the public comment period for the 2026 MHMRP Update, 26 submissions were received. The following are examples of the most hazard mitigation–related comments and are in response to hazards not adequately addressed in the draft plan and/or where the county should focus its hazard mitigation resources.

Hazards not adequately addressed:

- *Bridge collapse.*
- *Inadequate evacuation routes following a fire or or flooding in Koloa and Poipu... or tsunami*
- *Man made disasters of any sort. Either accidental or intentional- i.e. Building collapse or purposeful destruction. Biological weapons. Severe Epidemic/pandemic (Ebola outbreak for example) Massive grand scale infrastructure failures- no form of communication available…*
- *No, I could not find a thing that was left out for natural disasters except Tornado that is kind of covered in High Winds.*

Focus for County hazard mitigation resources:

- *Assist private companies with cesspool pumping for a minimal cost to homeowners.*
- *Build or resurface or maintain alternate roads located inland and away from the ocean. If the entire island is mobilizing at once to escape a hazard, there aren‘t enough roads to accommodate all the travelers. Getting stuck in traffic by the ocean in a tsunami would be real bad. More access and evacuation points.*
- *Critical infrastructure needs*
- *Drought tolerance and storm runoff capture and recovery*
- *Evacuation routes*
- *I’m not certain what or where it would be so generally speaking wherever the largest loss of life would occur in any disaster should be the first taken into consideration.*
- *In the aftermath of Hurricane Iniki, 1992, many of the utility poles around the island fell due to the intense winds. Roads were blocked primarily because of this and other debris caused by the hurricane. Could electric and associated cables be placed underground? Understanding that it is not feasible for some parts of Kauai, but for the areas that will allow, especially along the highway, access to emergency services or the ability to obtain resources would not be impeded by down poles. The cutting back or removal of large trees prone to falling or loosing branches on or near roads. A larger area or buffer could be enforced when cutting back the vegetation so that our roads are not impeded during events of severe winds or hurricanes.*
- *Not informed enough to have an opinion on this*
- *Provide a fire hydrant near our home on 2*** A , Ala Kinoiki road. we are in a high risk fire hazard zone and there are no fire hydrants near our subdivision of 8 [home subdivision].*
  We have had to evacuate 4 times since 2011 for wildfires near our home.

- *Restore the natural environment's ability to absorb the impacts.*
- *Strong communications with community. Educating community on process/expectations of government prior to event so we know how to best communicate/collaborate once event happens.*
- *Traffic was a huge issue during the last tsunami warning. Infrastructure and support services, including medical*
- *Wildfire mitigation. Cane Haul roads need to be improved so coastal roads can be bypassed in case of disruption.*

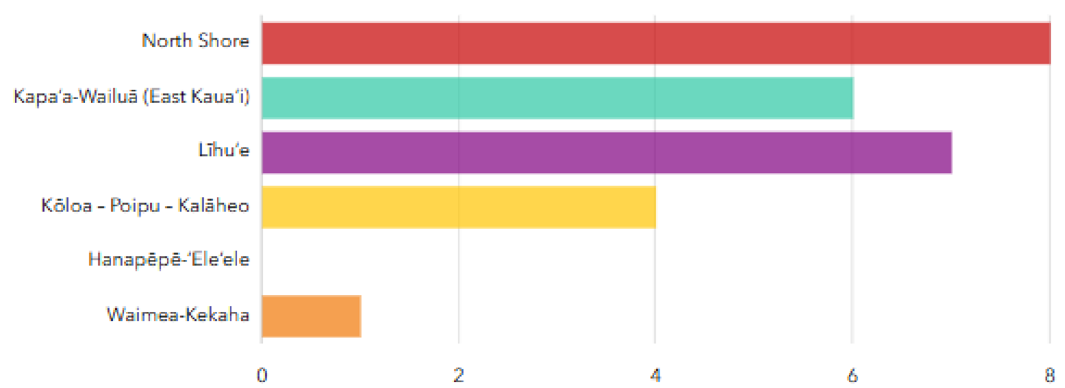
Kauaʻi MHMRP Public Comment: Survey Two Results

The following represent the most hazard mitigation-related findings from the 26 responses to Survey Two (Figures C-8 through C-14).

AWARENESS

- Which County of Kauai planning district do you live in?

Column Bar Pie Map



Hide table

Empty categories Sort

Answers	Count	Percentage
North Shore	8	30.77%
Kapa'a-Wailuā (East Kaua'i)	6	23.08%
Līhu'e	7	26.92%
Kōloa - Poipu - Kalāheo	4	15.38%
Hanapēpē-'Ele'ele	0	0%
Waimea-Kekaha	1	3.85%

Answered: 26 Skipped: 0

Figure C-8. The number of survey participants living in each County of Kauaʻi planning district.

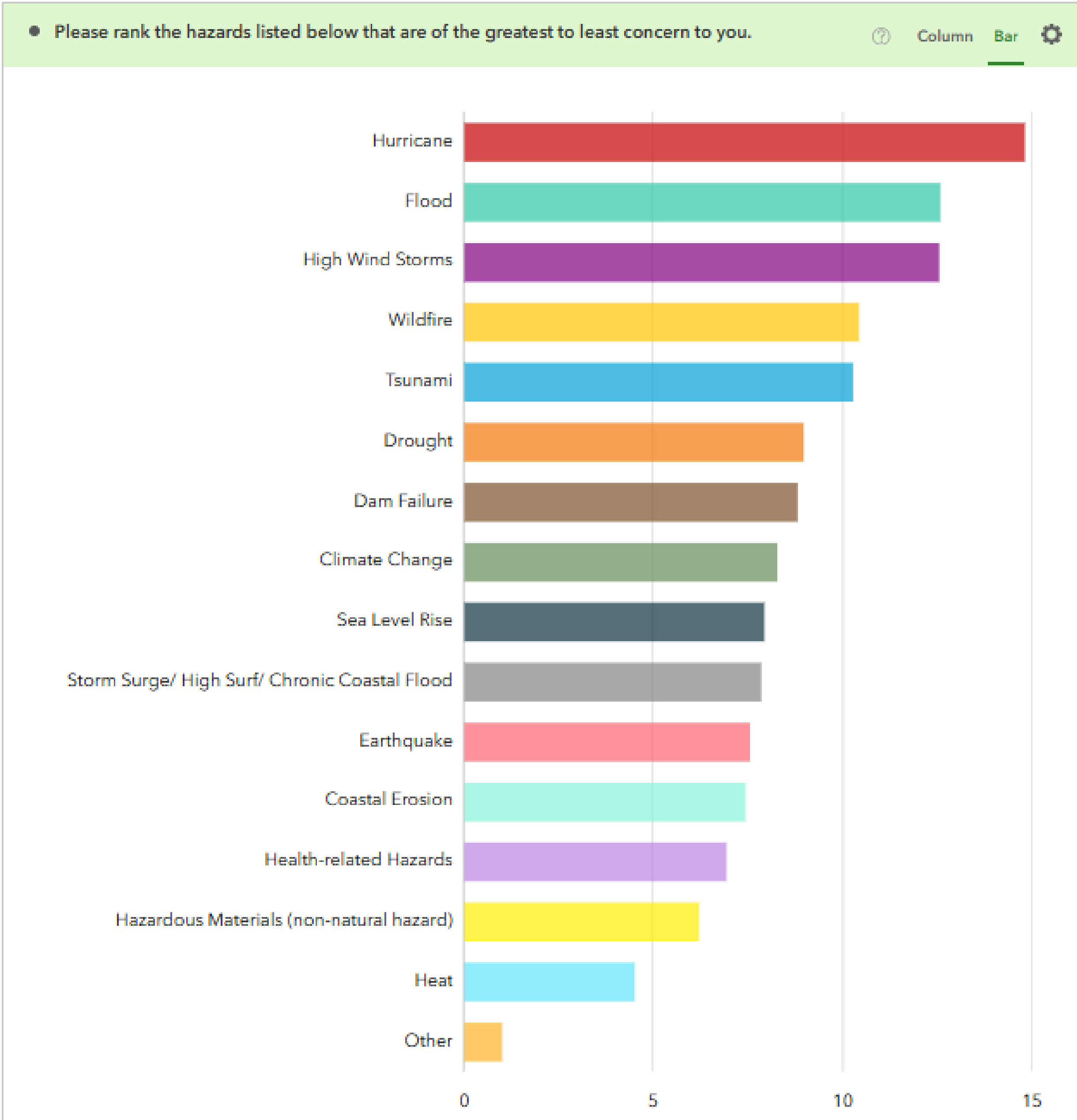
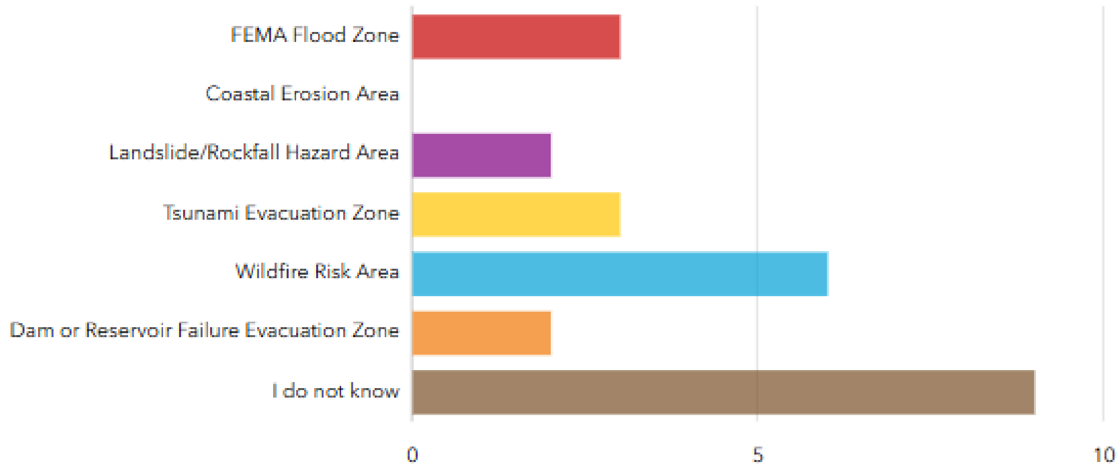


Figure C-9. Survey participants' hazard rankings from greatest to least concern.

● To the best of your knowledge, is your home located within any of the following natural hazard areas? Column Bar



Hide table ✓ Empty categories Sort

Answers	Count	Percentage
FEMA Flood Zone	3	11.54%
Coastal Erosion Area	0	0%
Landslide/Rockfall Hazard Area	2	7.69%
Tsunami Evacuation Zone	3	11.54%
Wildfire Risk Area	6	23.08%
Dam or Reservoir Failure Evacuation Zone	2	7.69%
I do not know	9	34.62%

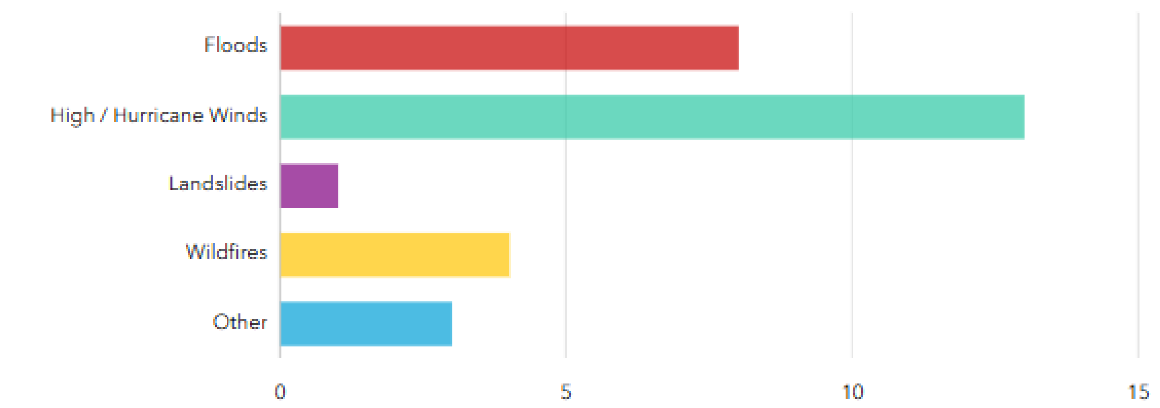
Answered: 19 Skipped: 7

Figure C-10. The number of survey participants' homes located within different natural hazard areas.

MITIGATION

- **Do you have insurance policies that provide coverage for?**

Column Bar



Hide table

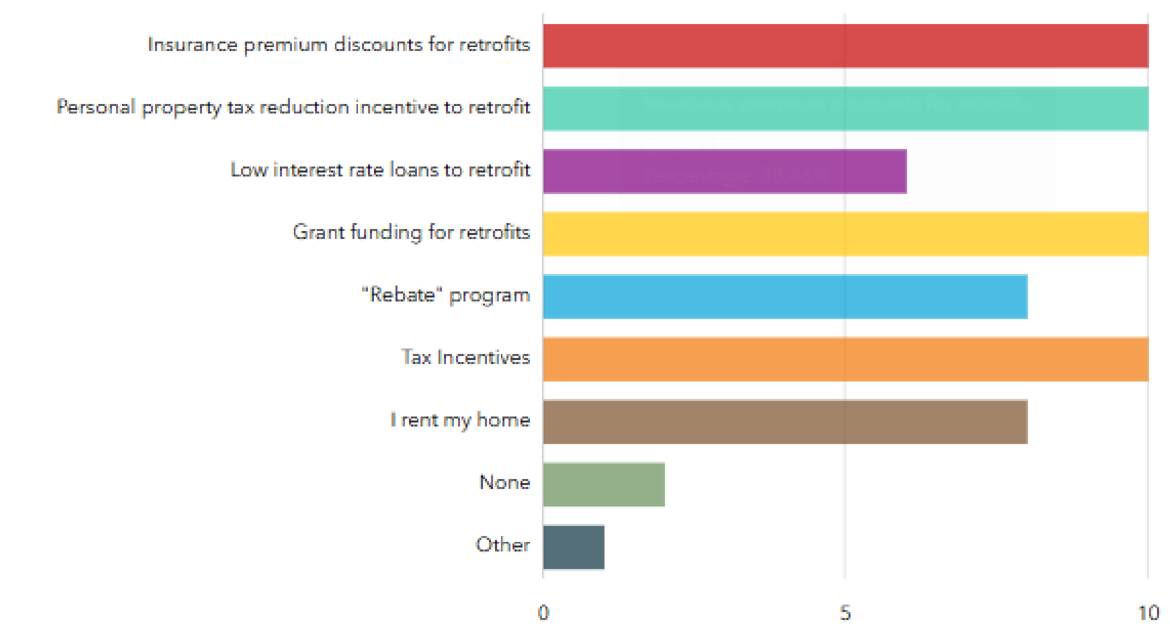
Other response Empty categories Sort

Response	Count
i rent	1
Fire	1

Answered: 18 Skipped: 8

Figure C-11. The number of survey participants with insurance coverage for various types of natural hazards.

- Which of the following incentives are you interested in to strengthen your home from a natural disaster? Column Bar



Hide table Other response Empty categories Sort

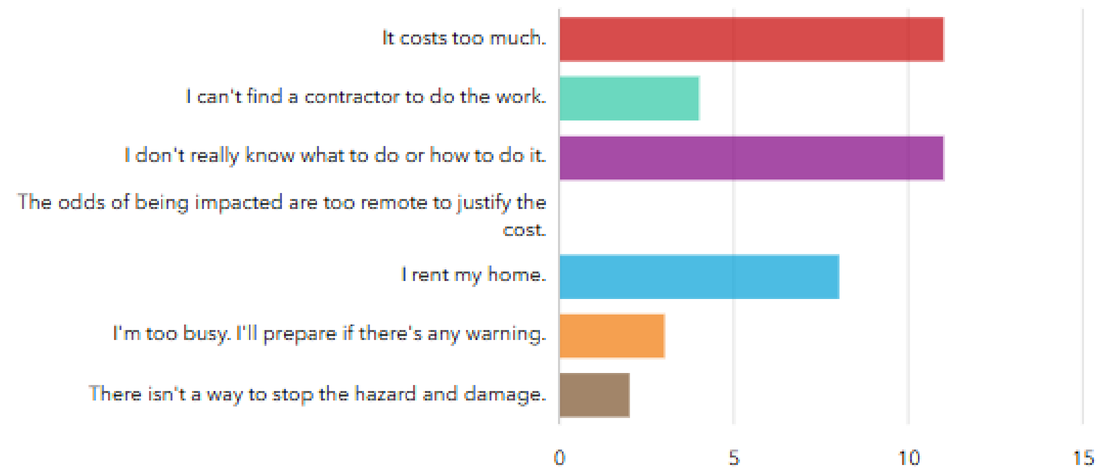
Response	Count
Ability to rent to own with affordable housing options.	1

Answered: 23 Skipped: 3

Figure C-12. The number of survey participants interested in various incentive programs to increase the resilience of their homes to a natural disaster.

- Which of the following obstacles prevent you from strengthening your home for the next disaster?

Column Bar



Hide table ✓ Empty categories ⇅ Sort

Answers	Count	Percentage
It costs too much.	11	42.31%
I can't find a contractor to do the work.	4	15.38%
I don't really know what to do or how to do it.	11	42.31%
The odds of being impacted are too remote to justify the cost.	0	0%
I rent my home.	8	30.77%
I'm too busy. I'll prepare if there's any warning.	3	11.54%
There isn't a way to stop the hazard and damage.	2	7.69%

Answered: 24 Skipped: 2

Figure C-13. The number of survey participants identifying obstacles to increasing the resilience of their home to a natural disaster.

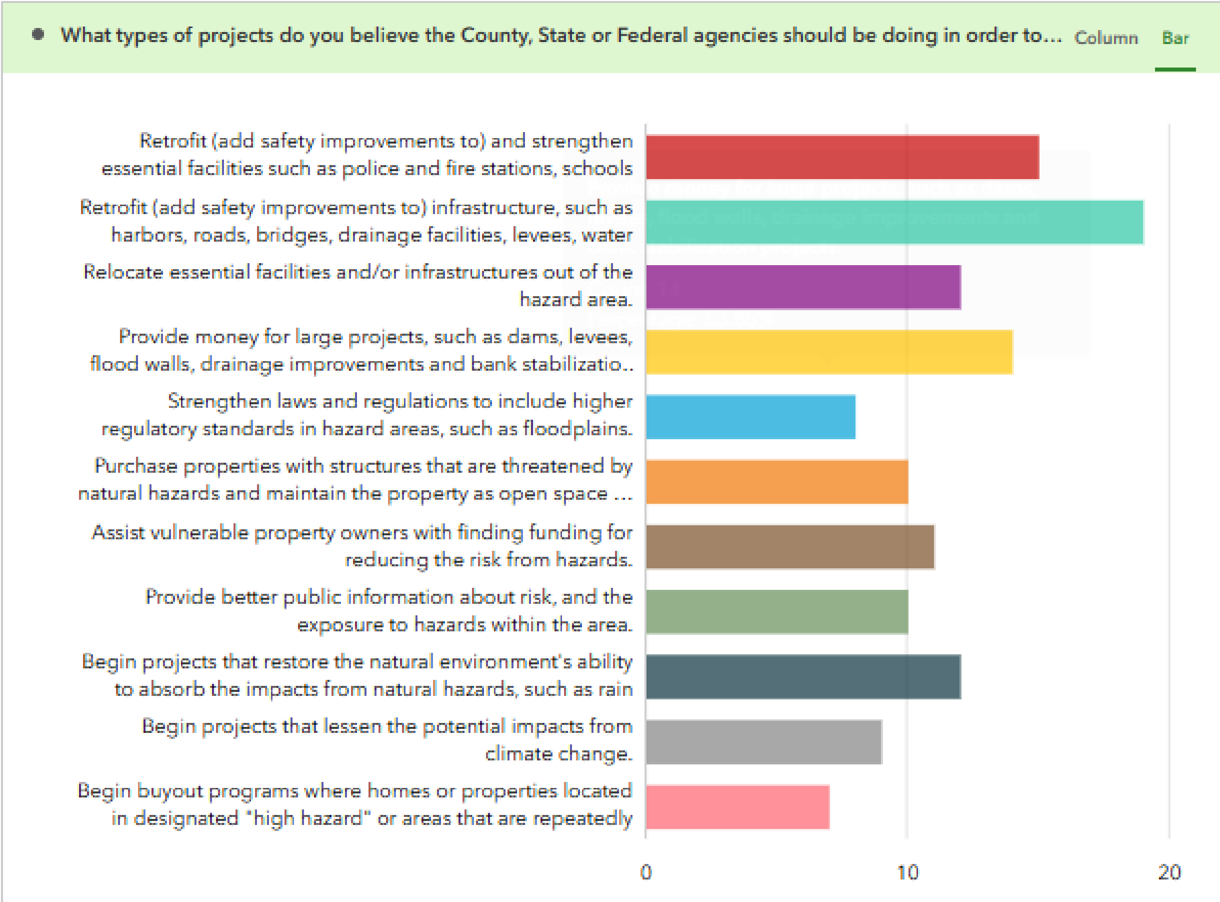


Figure C-14. The number of survey participants identifying projects that they believe the County, State, or Federal agencies should engage in to increase resilience in the planning area.

County of Kaua‘i Multi-Hazard Mitigation and Resilience Plan

Appendix D. Kaua‘i County Development Profile

D. KAUAʻI COUNTY DEVELOPMENT PROFILE

To accurately evaluate ways to protect people and property from the potential impacts of hazards, hazard mitigation requires an understanding of how development has been spread across the planning area and how it is likely to change in the future. This appendix provides a detailed review of planning area development.

CURRENT LAND USE

Hawaiʻi's State Land Use Commission, established in 1961, has defined four land use districts that provide the basic framework for land uses in the state. Most recently updated in 2020, the distribution of these districts in Kauaʻi County is as follows (State of Hawaiʻi Department of Business, Economic Development & Tourism 2023a):

- The Urban District consists of lands in urban use with sufficient reserve to accommodate foreseeable growth. In the county of Kauaʻi, this district covers 14,834 acres—4.2% of the total land area.
- The Rural District consists primarily of small farms mixed with low-density residential lots that have a minimum lot size of 0.5 acre. In the county of Kauaʻi, this district covers 1,253 acres—0.4% of the total land area.
- The Agricultural District includes lands with capacity for intensive cultivation. The minimum lot size is 1 acre. In the county of Kauaʻi, this district covers 139,044 acres—39.3% of the total land area.
- The Conservation District includes lands in forest and water reserve zones. In the county of Kauaʻi, this district covers 198,769 acres—56.2% of the total land area.

Land uses within the Urban Districts are administered primarily by the County. In the Agricultural and Rural Districts, the State Land Use Commission establishes use regulations, and the County is responsible for their administration; however, the County may adopt more stringent controls than those imposed by the State within these two districts. Land use in the Conservation District is regulated by the State Board of Land and Natural Resources, except that the County has concurrent permitting power within the Special Management Area near the coast. The County has no land use control over federal property. The Hawaiian Homes Commission has control over uses of the Hawaiian homelands leased to native Hawaiians.

Within Kauaʻi, County, desired future land use patterns were set forth in 2015 by the Kauaʻi General Plan Update Technical Study Land Use Buildout Analysis (PBR Hawaiʻi and Associates, Inc. 2015). Zoning must be consistent with the future land use designations. In the 2018 Kauaʻi County General Plan, the 2015 land use boundaries are refined based on input from community plans and neighborhood analysis areas that were delineated according to subdivision boundaries, census block groups, place types, zoning designations and state land use designations.

The future land use designations in the General Plan are as follows (County of Kaua‘i 2018):

- Natural
- Agriculture
- Homestead
- Neighborhood Center
- Neighborhood General
- Residential Community
- Urban Center
- Resort
- Industrial and Transportation
- Military
- University Zone
- Parks and Golf Courses

Table D-1 summarizes the area and location of current land uses in Kaua‘i County. Nearly 28% of the total acreage of the county (98,917 acres) is presently being used for agriculture.

Table D-1. Land Use in the County of Kaua‘i

Land Use Category	North Shore	East Kaua‘i	Līhu‘e	Kōloa-Po‘ipū-Kalāheo	Hanapēpē-‘Ele‘ele	Waimea	Total
Agricultural	11,344	11,571	15,643	9,138	3,845	10,646	61,188
Agricultural (IAL)	0	0	10,266	5,559	7,097	13,798	36,720
Golf Course	624	0	853	720	0	0	2,197
Homestead	0	3,444	0	1,828	0	0	5,271
Industrial	0	38	0	162	68	0	268
Large Town	0	0	0	177	0	0	177
Military	0	0	0	0	0	2,039	2,039
Natural	61,339	26,155	22,223	9,308	13,907	82,517	215,449
Neighborhood Center	66	211	609	84	73	110	1,153
Neighborhood General	251	601	0	195	388	329	1,764
Parks and Recreation	6,162	639	1,125	362	43	6,551	14,882
Plantation Camp	0	0	0	42	76	41	159
Residential Community	354	2,265	1,008	3,252	553	509	7,942
Resort	635	140	162	684	0	266	1,887
Small Town	0	0	0	18	0	0	18
Transportation	56	0	949	0	23	0	1,027
University Zone	0	0	241	0	0	0	241
Urban Center	0	0	1,601	0	0	0	1,601
Total	**80,831**	**45,064**	**54,681**	**31,529**	**26,073**	**116,811**	**354,985**

Source: Kaua‘i County General Plan 2018 (including the December 2020 amendment to the General Plan) (County of Kaua‘i 2018).

Notes:

IAL = Important Agricultural Lands.

Sums may not be exact due to rounding.

BUILDING COUNT, OCCUPANCY CLASS, AND ESTIMATED REPLACEMENT VALUE

Table D-2 presents planning area building counts by building occupancy class. The table also summarizes estimated replacement value for building structures and contents combined.

Table D-2. Planning Area Building Counts by Occupancy Class

	Residential	Commercial	Industrial	Agricultural	Religion	Government	Education	Total	Estimated Total Replacement Value (Structure and Contents)*
North Shore	3,675	302	30	8	10	17	10	4,052	$3,455,784
East Kauaʻi	6,996	465	87	14	23	33	12	7,630	$5,379,897
Līhuʻe	3,949	776	126	8	40	79	13	4,991	$7,408,818
Kōloa-Poʻipū-Kalāheo	4,811	306	42	7	20	22	8	5,216	$4,836,386
Hanapēpē-ʻEleʻele	933	33	10	1	3	2	1	983	$511,507
Waimea	3,128	184	22	5	33	250	8	3,630	$3,010,291
Total	**23,492**	**2,066**	**317**	**43**	**129**	**403**	**52**	**26,502**	**$24,602,683**

Note:
*Values from replacement and content costs in Hazus 6.1 (FEMA 2025a).

CRITICAL FACILITIES

Critical facilities and infrastructure are those that are essential to the health and welfare of the population. These assets become especially important after a hazard event. For this plan, the Steering Committee defined critical facilities as structures and infrastructure from which essential services and functions for victim survival, continuation of public safety actions, and disaster recovery are performed or provided.

Critical facilities provide indispensable services that enable the continuous operation of critical business and government functions and are critical to human health and safety or economic security. The risk assessment for each hazard in this plan discusses that hazard's potential impact on critical facilities. For some hazards, potential damage to critical facilities was estimated using Federal Emergency Management Agency 's Hazards U.S. (Hazus) computer model. For this reason, the list of critical facilities in the county was distributed into the following categories defined in the Hazus model:

- **Safety and Security**: Law enforcement/security, search and rescue, fire services, government service, and responder safety
- **Food, Water and Sheltering**: Evacuations, schools, food/potable water, shelter, durable goods, water infrastructure, and agriculture
- **Health and Medical**: Medical care/hospitals, patient movement, public health, fatality management, health care, and supply chain
- **Energy**: Power grid, temporary power, and fuel
- **Communications**: Infrastructure, alerts, warnings, messages, 911 and dispatch, responder communications, and financial services

- **Transportation**: Highway/roadway, mass transit, railway, aviation, maritime, and pipeline
- **Hazardous Materials**: Facilities, hazardous debris, pollutants, and contaminants

Table D-3 summarizes the number of critical facilities by Hazus-defined category. Due to the sensitivity of this information, a detailed list of facilities is not provided.

Table D-3. Critical Facilities in the Planning Area

Location	Safety and Security	Food, Water, and Shelter	Health and Medical	Energy	Communications	Transportation	Hazardous Materials	Total
North Shore	12	78	3	1	3	13	0	110
East Kauaʻi	17	124	3	0	1	12	0	157
Līhuʻe	28	116	16	8	11	13	2	194
Kōloa-Poʻipū-Kalāheo	14	89	4	0	0	10	1	118
Hanapēpē-ʻEleʻele	12	44	0	3	0	8	1	68
Waimea	17	114	4	1	2	11	2	151
Total	**100**	**565**	**30**	**13**	**17**	**67**	**6**	**798**

DEVELOPMENT TRENDS

Identifying recent development trends is achieved through a comprehensive review of permitting since completion of the previous plan and in anticipation of future development. Tracking previous and future growth in potential hazard areas provides an overview of increased exposure to a hazard within a community. Development trends are presented in Table D-4.

Table D-4. Recent and Expected Future Development Trends

<table>
<tr><th>Criterion</th><th>Response</th></tr>
<tr><td>Identify any areas targeted for development or major redevelopment in the next five years. Briefly describe, including whether any of the areas interface with known hazard risk areas.

Additional information about development that is underway or planned in the county can be found in Section 1.3.1.</td><td>Within the next 5 years (2026–2030), there are several areas where development or redevelopment may occur. The list below includes only major projects with existing zoning. Other areas seeking development require State Land Use District boundary amendments and zoning amendments, which are lengthy processes.

Waimea 400 – This community-driven development project encompasses 417 acres that the County of Kauaʻi purchased in 2019. Based on community feedback, affordable housing will comprise roughly 60 acres of the site. Sea level rise could have major impacts on a large portion of the project site; however, all residential development is outside the anticipated coastal flooding areas, even when combined with 3.2 feet of sea level rise, which is a moderate estimate of the sea level rise the county may experience by the end of the century. Areas of the Waimea 400 project exposed to coastal flooding and sea level rise are expected to have land uses suited to either frequent or intermittent flooding based on their location, including natural habitat, recreation spaces, and agricultural spaces. More information is available in the Waimea 400 Final Conceptual Master Plan Report (PBR Hawaiʻi and Associates, Inc. 2022).

Līhuʻe Town Core – The Līhuʻe Town Core comprises four neighborhoods with the Special Planning Area designation. Infrastructure and facilities have been put in place that will facilitate private investment and residential development. A zoning amendment increased allowable residential density to 40 units per acre in some areas. The Līhuʻe Town Core is not in any known hazard area.

Greater Līhuʻe – The greater Līhuʻe area includes greenfield development on Grove Farm–owned property with existing residential and commercial zoning. This area is outside any known hazard zones.

Kōloa Town – The Kōloa Special Planning Area was established through the South Kauaʻi Community Plan. A form-based code was implemented to allow additional building types with a scale compatible to the existing historic town. Some parts of the Kōloa area are within the flood zone. It is outside the tsunami zone and sea level rise exposure areas.</td></tr>
<tr><td>How many permits for new construction were issued in the County since the preparation of the previous hazard mitigation plan?</td><td>
<table>
<tr><th></th><th>2020</th><th>2021</th><th>2022</th><th>2023</th><th>2024</th></tr>
<tr><td>Single Family</td><td>144</td><td>158</td><td>157</td><td>146</td><td>144</td></tr>
<tr><td>Multifamily</td><td>23</td><td>10</td><td>9</td><td>47</td><td>23</td></tr>
<tr><td>Other
(commercial, mixed use, etc.)</td><td>58</td><td>58</td><td>58</td><td>61</td><td>51</td></tr>
<tr><td>Total</td><td>225</td><td>226</td><td>224</td><td>254</td><td>218</td></tr>
</table>
</td></tr>
<tr><td>Describe the level of buildout in the County, based on a buildable lands inventory. If no such inventory exists, provide a qualitative description.</td><td>The County’s Buildout Analysis was conducted in 2015 (PBR Hawaiʻi and Associates, Inc. 2015). In summary, most of the county’s residentially zoned parcels that have been subdivided are developed (no longer vacant). Most of the county’s vacant residentially zoned land without subdivision is in the Līhuʻe area. This area has the potential to accommodate approximately 1,000 or more units.</td></tr>
</table>

County of Kauaʻi Multi-Hazard Mitigation and Resilience Plan

Appendix E. Kauaʻi County Demographic Profile

E. Kauaʻi County Demographic Profile

POPULATION CHARACTERISTICS

The U.S. Census Bureau estimates Kauaʻi County's total resident population at 73,840 as of July 1, 2024 (U.S. Census Bureau 2025a). As of April 1, 2020, the population census was 73,298, which is when the most recent Census County Division (CCD) data were collected. Table E-1 presents population estimates for the subdivision units within Kauaʻi County defined by the CCD.

Table E-1. 2020 Population of Kauaʻi County by Census-Defined County Subdivision

Subdivision	Population	Subdivision	Population
Hanalei	8,107	Kōloa-Poʻipū	6,474
Wailua-Anahola	13,967	ʻEleʻele-Kalāheo	9,019
Kapaʻa	8,970	Kaumakani-Hanapēpē	3,769
Puhi-Hanamāʻulu	10,482	Kekaha-Waimea	5,971
Līhuʻe	6,455	**County Total***	**73,214**

Source: U.S. Census Bureau (2025a).

*Total Kauaʻi County population excludes the 84 residents of Niʻihau. Total Kauaʻi County population for 2020 differs between this table and Table E-2 because data are from different sources.

Table E-2 shows the population in Kauaʻi County and the state of Hawaiʻi from 1980 through 2024 (State of Hawaiʻi Department of Business, Economic Development & Tourism [DBEDT] 2025b). The average growth rate over that period for the county and state is shown on Figure E-1 (DBEDT 2025c).
The county's average 5 year population growth was nearly 16% in the late-1980s but dropped significantly in the late 1990s. It rose again in the first 5 years of the 2000s but declined steadily until a significant drop in 2015–2020. The state growth followed a similar trend, with a consistently lower growth rate than the county over the period shown.

Table E-2. Annual Population Data

Year	Kauaʻi County	State of Hawaiʻi	Year	Kauaʻi County	State of Hawaiʻi
1980	39,400	968,500	2015	71,736	1,446,452
1985	44,357	1,039,698	2016	72,389	1,456,816
1990	51,676	1,113,491	2017	72,782	1,458,161
1995	57,068	1,196,854	2018	73,367	1,459,965
2000	58,568	1,213,519	2019	73,395	1,456,943
2005	62,863	1,292,729	2020*	73,209	1,451,252
2010	67,241	1,365,117	2021	73,851	1,447,029
2011	68,057	1,385,141	2022	73,823	1,440,359
2012	68,973	1,405,255	2023	73,933	1,441,387
2013	70,076	1,423,345	2024	73,840	1,446,146
2014	70,869	1,434,323			

Source: DBEDT (2025b).

*Total Kauaʻi County population for 2020 differ between this table and Table E-1 because estimates for the two tables are from different sources.

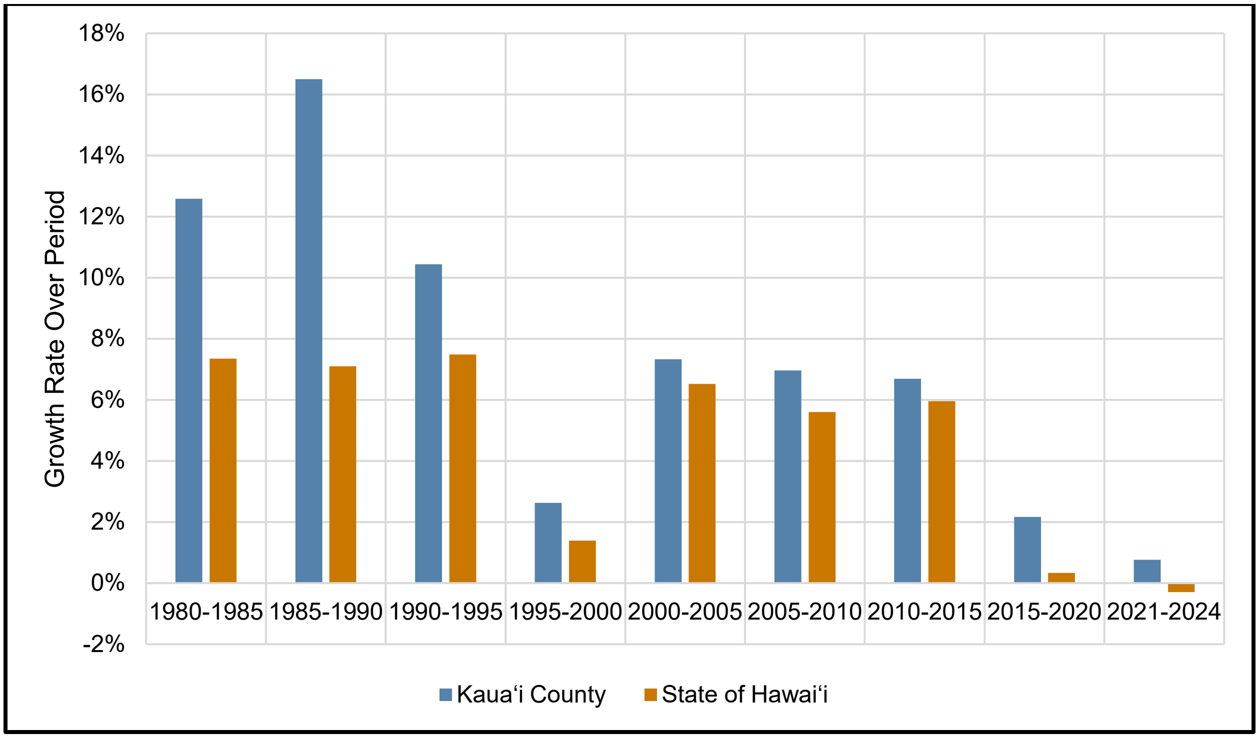


Figure E-1. State of Hawai‘i and Kaua‘i County population growth.

DEMOGRAPHIC INDICATORS FOR SOCIAL VULNERABILITY

Some populations are at greater risk from hazard events because of decreased resources or physical abilities that lower their capability to mitigate and respond to hazard events. For instance, people living near or below the poverty line, the elderly, individuals with disabilities, caretakers, children, ethnic minorities, and renters are all groups that may experience, to some degree, more severe effects from disasters than the general population. These vulnerable populations may vary from the general population in risk perception, living conditions, access to information before, during and after a hazard event, capabilities during an event, and access to resources for post-disaster recovery. Indicators of vulnerability, such as disability, age, poverty, and minority race and ethnicity, often overlap spatially with the geographically most vulnerable locations.

Detailed spatial analysis to locate areas where there are higher concentrations of vulnerable community members can help to focus public outreach and education on the most vulnerable citizens. An analysis such as this was conducted for the Kaua‘i Climate Adaptation and Action Plan (KCAAP) to produce a social vulnerability index (SVI) uniquely tailored to Kaua‘i (County of Kaua‘i 2022b). The SVI from the KCAAP was used in the 2026 MHMRP Update to assess social vulnerability to each of the hazards analyzed and produce a qualitative discussion of possible hazard impacts on socially vulnerable populations. A discussion of how each of the 13 indicators used in the SVI may impact a community's vulnerability to a given hazard can be found in the vulnerability assessment for the respective hazard. A description of how the SVI was used in the risk assessment can be found in Appendix H.

Several indicators from the U.S. Census that are commonly used to analyze social vulnerability are discussed in additional detail below. These descriptions provide further insight into the factors that can contribute to increased vulnerability during hazard events.

- **Population Under 15 Years of Age:** Children, especially in the youngest age groups, often cannot protect themselves during a disaster because they lack the necessary resources, knowledge, or life experiences to effectively cope with the situation. Hazard mitigation planning needs to be tailored such that the community is prepared to ensure that children are safe during disaster events and that families with children have access to necessary information and tools.
- **Population Over 65 years of Age:** People 65 years old and older are likely to require financial support, transportation, medical care, or assistance with ordinary daily activities, especially during disasters. They are more likely to be vision, hearing, and/or mobility impaired, more likely to experience mental impairment or dementia, and more likely to live in assisted-living facilities where emergency preparedness is at the discretion of facility operators. Hazard mitigation needs to account for such needs.
- **People of Color:** Social and economic marginalization of certain racial and ethnic groups, including real estate discrimination, has resulted in greater vulnerability of these groups to all types of hazards. Based on data from a number of studies, African Americans, Native Americans, and populations of Asian, Pacific Islander, or Hispanic origin are likely to be more vulnerable than the broader community. Research shows that minorities are less likely to be involved in pre-disaster planning and experience higher mortality rates during disaster events. Post-disaster recovery often exhibits cultural insensitivity. Because higher proportions of minorities live below the poverty line than the majority white population, poverty can compound vulnerability. Hazard mitigation plans need to identify the spatial distribution of these population groups and direct resources to reduce their vulnerability to hazards.
- **Limited English-Speaking Households:** For populations with limited English proficiency, disaster communication may be difficult, especially in communities for whom translators and accurate translations of advisories may be scarce. Such households are likely to rely on relatives and local social networks (i.e., friends and neighbors) for information for preparing for a disaster event.
- **Persons with Disabilities:** Persons with disabilities or other access and functional needs are more likely to have difficulty responding to a hazard event than the general population. Family, neighbors, and local government are the first level of response to assist these individuals, and coordination of efforts to meet their access and functional needs is paramount to life safety efforts. Emergency managers need to distinguish between functional and medical needs to plan for incidents that require evacuation and sheltering. Knowing the percentage of population with access and functional needs allows emergency management personnel and first responders to anticipate the services needed by that population.
- **Families Below the Poverty Level:** Economically disadvantaged families have limited ability to absorb losses due to hazard impacts. Wealth enables families to absorb and recover from losses more quickly, due to insurance, savings, and often the availability of low-cost credit. People with lower incomes tend not to have access to these resources. At the same time, poorer families are likely to inhabit poor quality housing and reside in locations that are most vulnerable to hazard events. Economically disadvantaged neighborhoods are also likely to have relatively poor infrastructure and facilities, which exacerbate the disaster consequences for residents there.

These factors were selected based on the likelihood to influence vulnerability, the equity priorities established by the County, and the availability of datasets at a small enough resolution to determine probable characteristics of populations within identified hazard areas. The following sections estimate the age, race, language and disability indicators for Kaua'i County; poverty levels are presented in Appendix F.

Age Distribution

The overall age distribution for the county is shown in Figure E-2 (DBEDT 2023b). Based on 2024 U.S. Census estimates, 23.6% of the county's population is 65 or older, higher than the state average of 21.5% (DBEDT 2024b). Census data show that 31.6% of the over-65 population has disabilities of some kind and 8.9% have incomes below the poverty line. The data show that 17.5% of the population is 14 or younger, about the same as the state average of 18.1%. Children under the age of 18 account for 11.2% of individuals living in households below the poverty line (U.S. Census Bureau 2025a).

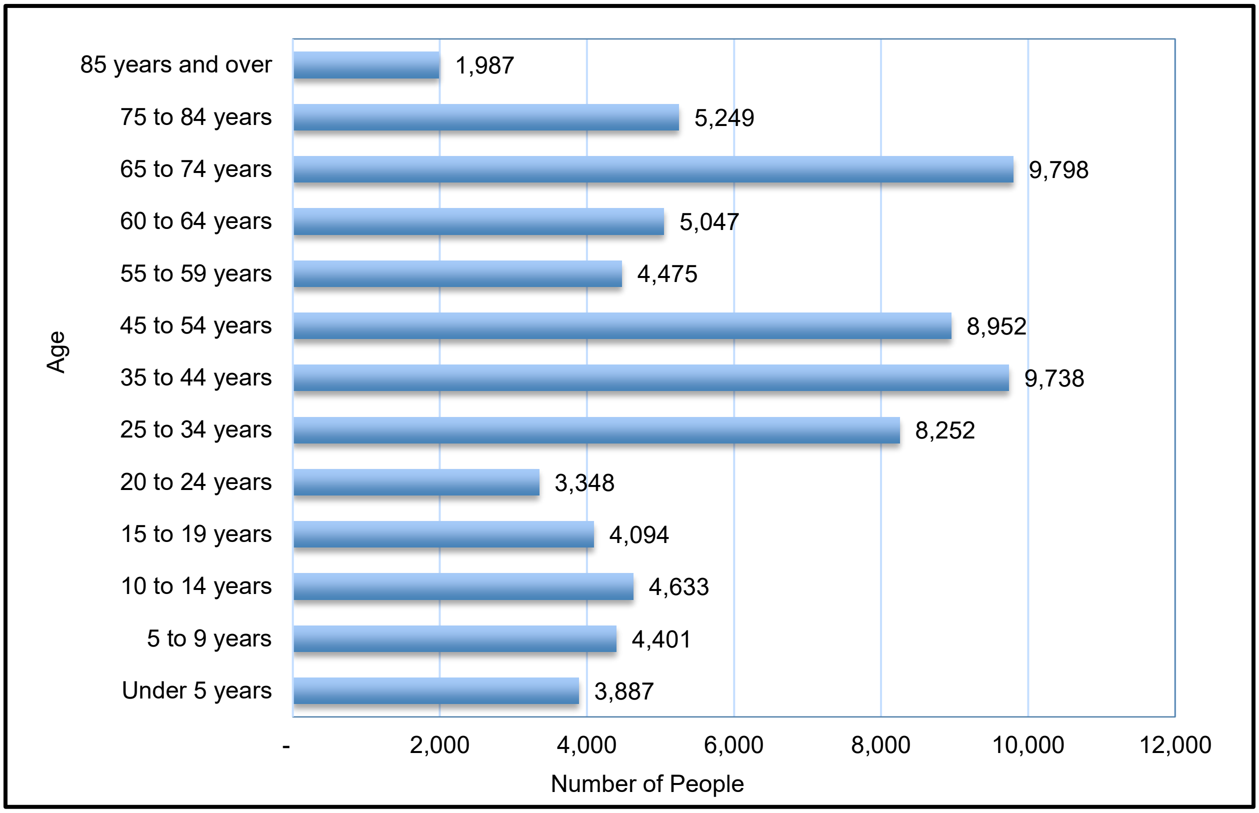


Figure E-2. Kaua'i County 2023 age distribution.

Race, Ethnicity, and Language

According to 2020 U.S. Census data, the racial composition of the county is predominantly white, at 31.7%, and Asian, at 28.8% (Figure E-3) (U.S. Census Bureau 2025a). The largest minority population is Native Hawaiian or other Pacific Islander at 9.9%. Figure E-3 shows the racial distribution in the planning area. The Hispanic or Latino population, which is considered an ethnic designation rather than a race, is nearly 11% of the total.

The planning area has a 14.6% foreign-born population. Other than English, the most commonly spoken languages in the planning area are Asian and Pacific Island languages. The Census estimates 8.6% of the residents speak English "less than very well" (U.S. Census Bureau 2025a).

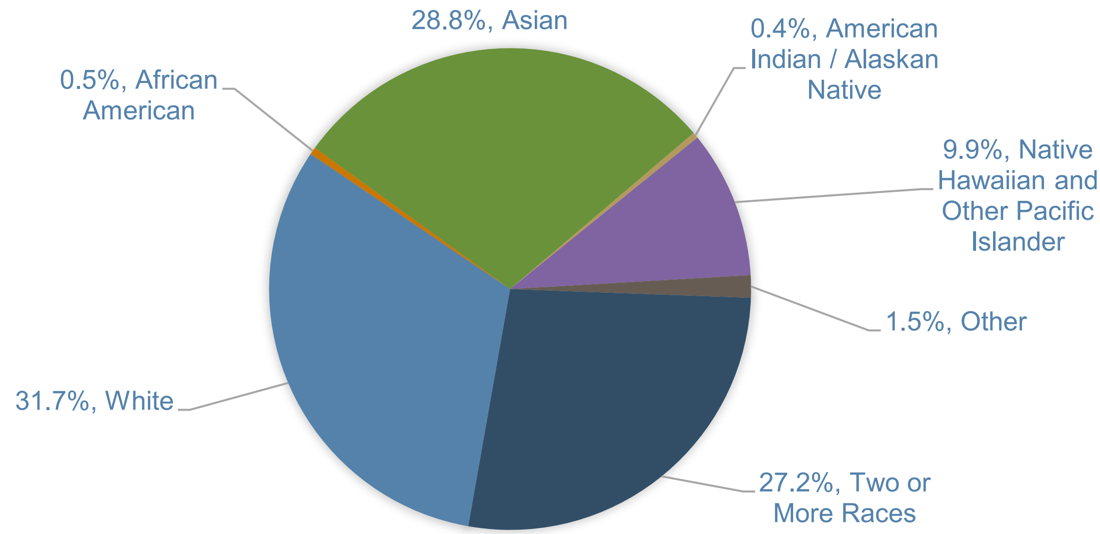


Figure E-3. Kauaʻi County race distribution as of 2020.

Persons with Disabilities or with Access and Functional Needs

According to the 2023 American Community Survey (ACS) estimates, persons with disabilities or with access and functional needs make up 12.1% of the total civilian noninstitutionalized population of Kauaʻi County (U.S. Census Bureau 2025b).

County of Kaua‘i Multi-Hazard Mitigation and Resilience Plan

Appendix F. Kaua‘i County Economic Profile

F. Kauaʻi County Economic Profile

The State of Hawaiʻi is dependent on off-island sources for energy, food, construction materials, and common daily goods. The local community has expressed a desire for the local economy to be more self-reliant, which would mean expanding agriculture, aquaculture, manufacturing, and renewable-energy sectors. By working toward self-sufficiency, Hawaiʻi's economy could diversify and offer additional opportunities for employment and income (State of Hawaiʻi Office of Planning and Sustainable Development [OPSD] 2025a). The County of Kauaʻi (County) Office of Economic Development works in partnership with the community to create economic opportunities for balanced growth in the county (County of Kauaʻi 2025f).

Over the long-term (2022–2050), the county has a projected annual job growth rate of 0.6% (State of Hawaiʻi Department of Business, Economic Development and Tourism [DBEDT] 2024a). The tourism industry plays a dominant role in Kauaʻi County's economy; however, current growth projections in this sector are sluggish, with construction continuing to be a source of strength (Economic Research Organization at the University of Hawaiʻi [UHERO] 2024). Despite the projected job growth, the high cost of living in the county offsets economic opportunity. Kauaʻi's median household income is typically less than the state average, so many residents work multiple jobs, supplement income with homegrown food or cottage industries, and have long work commutes from neighborhoods with affordable housing (County of Kauaʻi 2018).

INCOME

To some extent, individual households are generally expected to use private resources to prepare for, respond to and recover from disaster events, which means that households living in poverty are disadvantaged when confronting hazards. Additionally, the poor typically occupy more poorly built and inadequately maintained housing. Mobile or modular homes, for example, are more susceptible to damage in earthquakes and floods than other types of housing. Furthermore, residents below the poverty level are less likely to have insurance to compensate for losses incurred from natural disasters.

This means that residents below the poverty level have a great deal to lose during a natural-hazard event and are the least prepared to deal with potential losses. Past natural disaster events in the United States have shown that personal household economics significantly impact people's decisions on evacuation. If the level of risk is not perceived as high, people often choose to "ride out" the impacts of such events. Individuals who cannot afford gas for their cars will likely decide not to evacuate.

Based on U.S. Census Bureau estimates, the Kauaʻi County median household income was $93,612 in 2023 (Neilsburg Research 2025). It is estimated that 24.7% of households receive an income between $100,000 and $149,999 per year, and 27.2% of household incomes are above $150,000 annually. Households in the planning area making less than $25,000 per year are estimated at 9.7% (U.S. Census Bureau 2025a).

The State of Hawaiʼi Data Book shows that 6% of all families in the county and 8.3% of individuals had incomes that fell below the poverty line (DBEDT 2023a). As presented in the State of Hawaiʻi's *Self-Sufficiency Income Standard*, Kauaʻi County had the highest self-sufficiency income requirements of all counties in the state for one-adult families without children, two-adult couples without children, and two-adult couples with two children (DBEDT 2023c). Kauaʻi County's self-sufficiency family budgets were impacted by the relatively high costs in transportation and food. Table F-1 illustrates the estimated self-sufficiency income requirements for 2022.

Table F-1. 2022 Self-Sufficiency Income Requirement – Kauaʻi County

Basis	One Adult	Two-Adult Family	One Adult + One Preschooler	One Adult + One Preschooler + One School Age	Two Adult + One Preschooler + One School Age
Hourly	$21.35	$13.91	$33.27	$42.45	$23.75
Monthly	$3,758	$4,896	$5,856	$7,471	$8,359
Annual	$45,092	$58,756	$70,272	$89,648	$100,312

It is important to note that the U.S. Census Bureau's official poverty thresholds do not account for Hawaiʻi's higher cost of living, which is estimated to be about 15% above the national average. Consequently, these statistics may understate the actual prevalence of poverty in the state.

EMPLOYMENT BY SECTOR

Based on U.S. Census data, the county's economy is strongly based on the accommodation and food service sector, followed by the health care and social assistance industry (U.S. Census Bureau 2025b). Figure F-1 shows the breakdown of industry types in Kauaʻi County.

Agriculture is an important element in Kauaʻi's identity as a rural place, and it represents the greatest opportunity for economic diversification and food self-sufficiency. The era of sugar and pineapple plantations has come to an end, but the remaining infrastructure and still undeveloped swaths of agricultural land provide for today's agricultural activity and opportunities for new enterprise to thrive. Traditional agricultural products, such as taro, coconut, and breadfruit, are still in demand and synonymous with regional identity (County of Kauaʻi 2018).

LARGE EMPLOYERS

Hawaiʻi state data include 14 employers in Kauaʻi County with 250 or more employees as of December 2019 (State of Hawaiʻi 2019):

- More than 1,000 employees:
  - Grand Hyatt Kauaʻi Resort and Spa (including Ilima Terrace and Business Center)
- 500 to 999 employees:
  - Kauaʻi Marriott Resort
- 250 to 499 employees:
  - Wilcox Memorial Hospital
  - St. Regis Princeville Resort
  - Walmart
  - Wyndham Vacation Rentals
  - Sheraton Kauaʻi Resort
  - Kauaʻi Medical Clinic
  - Kauaʻi Veterans Memorial Hospital
  - Kauaʻi Coast Resort at the Beachboy
  - Quintas Resorts LLC
  - Aqua Kauaʻi Beach Resort

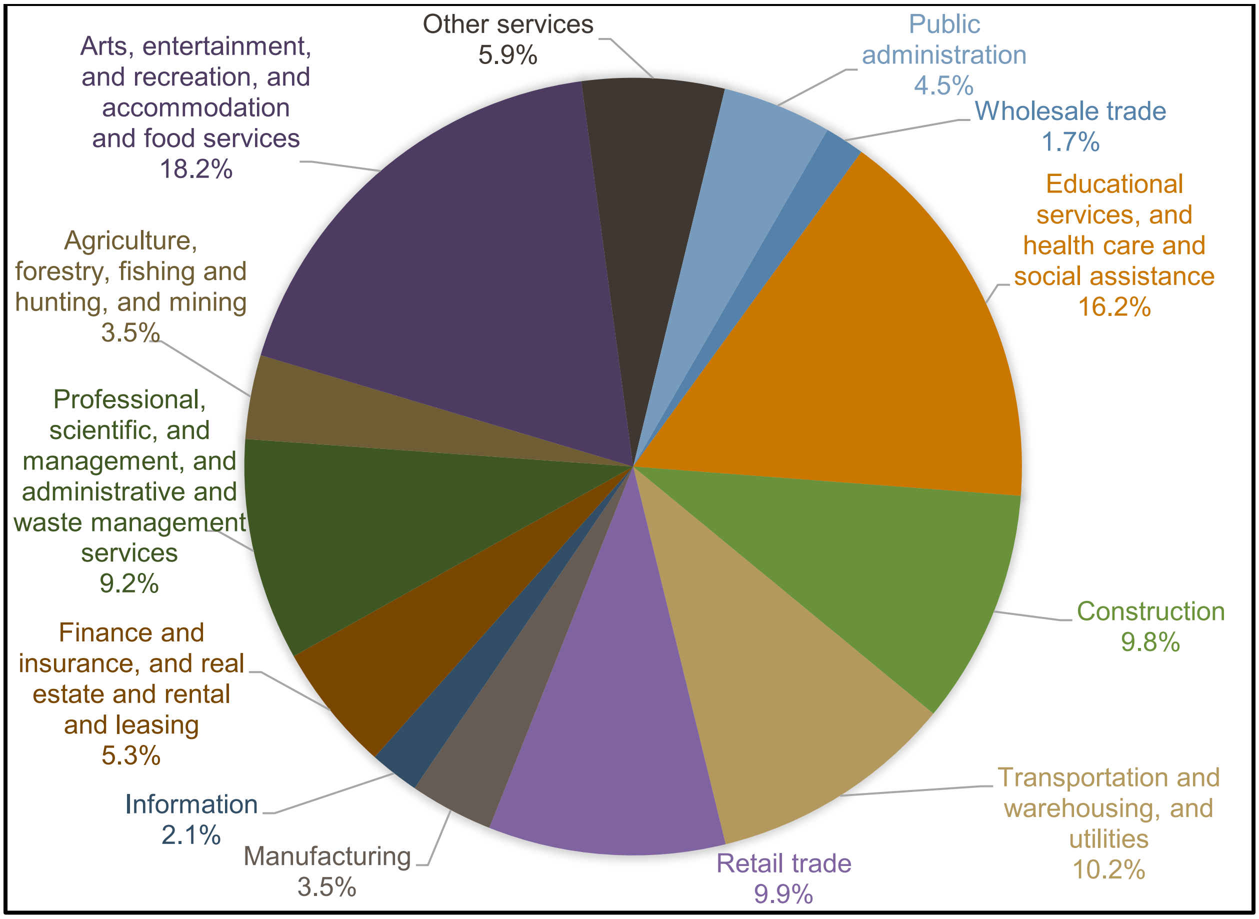


Figure F-1. Industry in Kaua'i County (based on U.S. Census 2023 5-year estimates).

EMPLOYMENT BY OCCUPATION

Service occupations, management/business/science/arts occupations, and sales/office occupations make up 20%, 33%, and 25% of the jobs in the planning area, respectively (U.S. Census Bureau 2025a). Only about 7% of employment in the county is in the production/transportation/moving occupations. Natural resources/construction/maintenance makes up 15% of the jobs in the planning area (Figure F-2).
The U.S. Census estimates that about 74.1% of workers in the county commute alone (by car, truck, or van) to work.

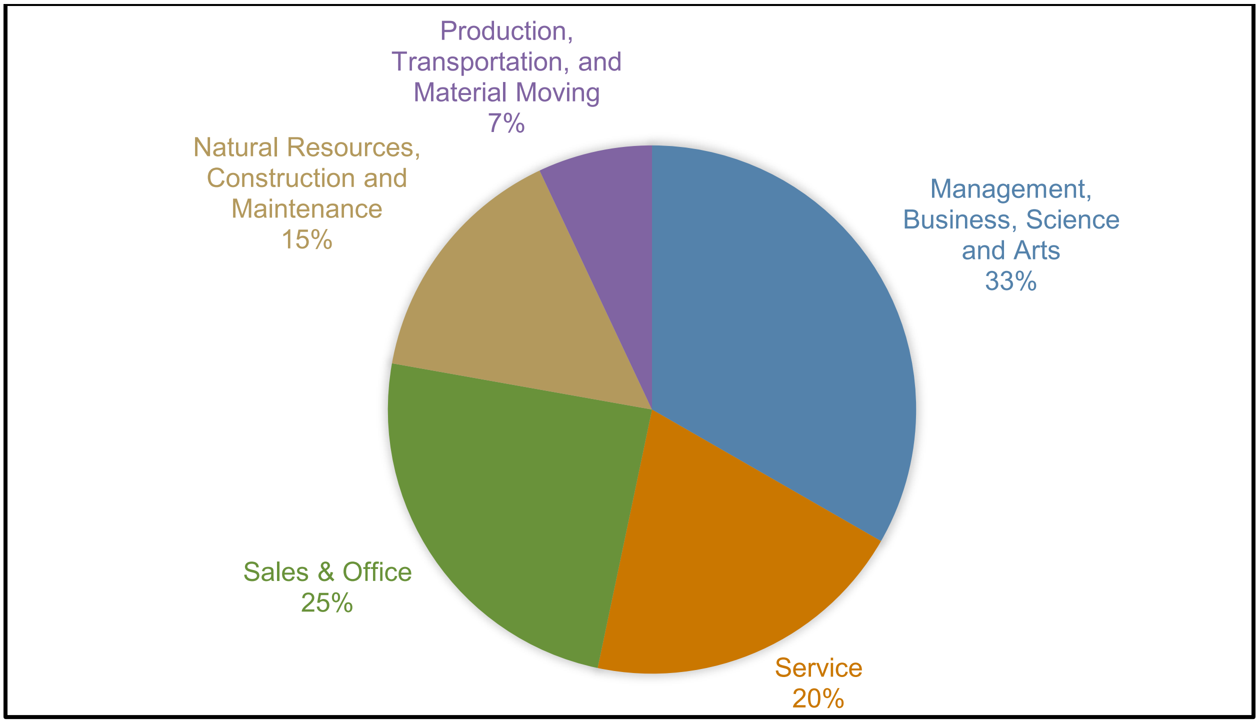


Figure F-2. Occupations in Kaua'i County (Based on U.S. Census 2023 5-year estimates).

UNEMPLOYMENT

According to the 2023 American Community Survey, 62.9% of the county's population 16 and older is in the labor force (U.S. Census Bureau 2025b). Figure F-3 compares unemployment trends from the State of Hawai'i and Kaua'i County from 2010 through 2024 (Bureau of Labor Statistics [BLS] 2025a, 2025b). For that time period, Kaua'i County's unemployment rate dropped to a historic low of 2.4% in 2017, with a historic high of 13.6% in 2020. These figures reflect the significant impact of the COVID-19 pandemic on Kaua'i's economy in 2020, particularly due to its reliance on tourism. The subsequent years show a steady recovery, with unemployment rates gradually returning to pre-pandemic levels (BLS 2025a, 2025b). The state unemployment rate was historically lower than that of the county until 2017 when they became nearly equal. The state unemployment rate now exceeds that of Kaua'i.

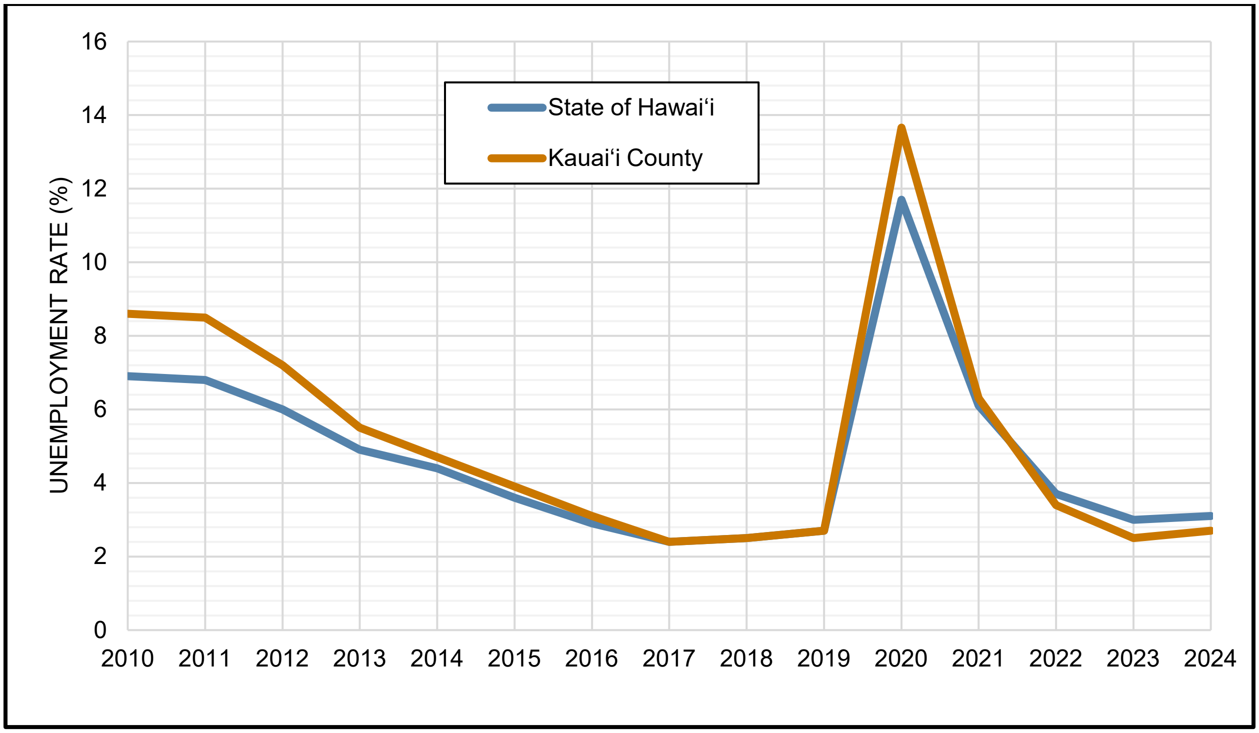


Figure F-3. State of Hawai‘i and Kaua‘i County unemployment rate.

County of Kaua‘i Multi-Hazard Mitigation and Resilience Plan

Appendix G. Relevant Agencies, Programs, and Regulations

G. RELEVANT AGENCIES, PROGRAMS, AND REGULATIONS

Existing laws, ordinances, plans, and programs at the local, state and federal levels can support or impact hazard mitigation actions identified in this 2026 MHMRP Update. Hazard mitigation plans (HMPs) are required to include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information as part of the planning process (44 Code of Federal Regulations [CFR] 201.6(b)(3)). This appendix describes programs that may interface with the risk assessment and mitigation strategy identified in this 2026 MHMRP Update. For instance, many of the programs listed enhance capabilities to implement mitigation actions or have a nexus with a mitigation action in the 2026 MHMRP Update.

LOCAL

Kaua‘i Kākou—Kaua‘i County General Plan

Kaua‘i Kākou–Kaua‘i County General Plan (County General Plan), adopted in 2018, is a long-term comprehensive blueprint for the physical, economic, and environmental development and cultural identity of Kaua‘i County (County of Kaua‘i 2018). The County General Plan outlines the County’s vision for growth through 2035.

The County General Plan contains goals and measurable sustainability objectives along with policies and actions to achieve these objectives. Decisions on land use will be governed by this and other County planning documents. The 2026 MHMRP Update will work together with these plans to support wise land use in the future by providing vital information on the risk associated with natural hazards across Kaua‘i. The results of the risk assessment will be integrated into the County General Plan, which will ensure that all future trends in development can be established with the benefits of the information on risk and vulnerability to natural hazards identified in this 2026 MHMRP Update.

There has been one update to County General Plan since it was adopted in 2018. The 2020 update adopted the West Kaua’i Community Plan (County of Kaua‘i 2020a) and did not include updates to the main body of the plan.

Community Plans

Kaua‘i County’s community plans translate broad County General Plan goals, policies, and standards into implementation actions as they apply to specific geographical regions around the island. Community plans also serve as a forum for community input into land use, delivery of government services, and any other matters relating to the planning area. Community plans cover the following areas:

- North Shore (County of Kaua‘i 1980)
- South Kaua‘i (County of Kaua‘i 2015b)
- Līhu‘e (County of Kaua‘i 2015c)
- West Kaua‘i (County of Kaua‘i 2020a)
- East Kaua‘i (County of Kaua‘i 2025j)

The South Kaua‘i and Līhu‘e Community Plans were updated in 2015, and the West Kaua’i Community Plan was updated in 2020 (County of Kaua‘i 2015b, 2015c, 2020a). These three plans each contain a discussion of the impacts of climate change and natural hazards in their respective communities. The West Kaua‘i Community Plan additionally implements a Special Treatment Coastal Edge ordinance to restrict development likely to be impacted by coastal hazards including sea-level rise (County of Kaua’i 2020a).

The other two community plans are the Kapa‘a-Wailua Development Plan, which was developed in 1973 (County of Kaua‘i 1973), and the North Shore Development Plan, which was developed in 1980 (County of Kaua‘i 1980). The County is currently in the process of updating the Kapa‘a-Wailua Development Plan as the East Kaua‘i Community and Traffic Circulation Plan with the goal of adopting the plan by the end of 2025 (County of Kaua‘i 2025j). This 2026 MHMRP Update will help to address several choke points in this area of the island, which will facilitate evacuations or recovery efforts during future hazard events. The North Shore Development Plan will also be updated in the coming years as the North Shore Community Plan.

Kaua‘i County Code

The Kaua‘i County Code is a compilation of all ordinances of a general and permanent nature, with some exceptions. Ordinances relating to the County budget, appropriations, the issuance of bonds, state land use boundary amendments, improvement districts, salary ordinances, and emergency ordinances are not included in the code. Likewise, the County General Plan and community plans are adopted by reference but published as separate documents. The 1987 Kaua‘i County Code, as amended, contains all ordinances enacted through July 11, 2024. It includes 26 chapters of code as well as a code adoption ordinance, an ordinance list and disposition table, and an alert for recently passed ordinances.

Comprehensive Zoning Ordinance (Ordinance No. 935)

Kaua‘i County applies zoning (under Ordinance No. 935 of the County Code) to promote the health, safety, and general welfare of the county. County zoning regulates and restricts the height and size of buildings and other structures, the percentage of a building site that may be occupied, off-street parking, setbacks, size of yards, courts, and other open spaces, the density of population, and the location and use of buildings, structures, and land for trade, industry, residence, or other purposes. The zoning regulations are applied and administered within the framework of the County General Plan.

The County building official enforces zoning provisions relative to building construction and occupancy. The County Planning Department director enforces all other provisions pertaining to land use. All County departments, officials, and public employees authorized to issue permits or licenses must conform to the provisions of zoning code, and no permit or license for any use, building, or other purpose may be issued where the license or permit would be in conflict with zoning provisions.

The zoning code divides the lands in the county into the following zoning districts:

- Residential – R
    - R-1
    - R-2
    - R-4
    - R-6
    - R-10
    - R-20

- Resort – RR
    - RR-10
    - RR-20
- Commercial – C
    - Neighborhood Commercial – CN
    - General Commercial – CG
- Agriculture – A
- Industrial – I
    - Limited Industrial – IL
    - General Industrial – IG
- Open – O
- Special Treatment – ST
    - Public Facilities – ST-P
    - Cultural/Historic – ST-C
    - Scenic/Ecological – ST-R
    - Open Space – ST-O
- Constraint – S
    - Drainage – S-DR
    - Flood – S-FL
    - Shore – S-SH
    - Slope – S-SL
    - Soils – S-SO
    - Tsunami – S-TS

Kauaʻi County has adopted a number of zoning ordinances to prepare for climate change. These efforts include establishing a Special Treatment Coastal Edge district in West Kauaʻi with urban development controls; updating and strengthening shoreline setbacks; establishing a Sea Level Rise Constraint District; and promoting regulatory review of the statewide outdoor warning siren systems.

The County has also amended zoning codes to facilitate the housing development. These new ordinances have expanded the areas in which multifamily housing and guest houses can be developed. They have facilitated mixed use development. These ordinances have generally reduced permitting barriers, which will likely lead to increased development and may place additional individuals in hazard exposure areas.

Kauaʻi County Sea Level Rise Constraint District Ordinance (Ordinance 1134)

This ordinance was put in place as part of the Kauaʻi County Code in August 2022 with the purpose of preparing the county for future sea level rise. The ordinance places constraints on development in the area expected to be exposed to sea level rise through the end of the century based on an estimate of 3.2 feet of sea level rise by 2100. The ordinance is intended to achieve several goals. It reduces public health and safety risks as well as future rescue and relief needs by discouraging people from living in areas that will be exposed to sea level rise and thus high surf and coastal flooding inundating further inland. It also seeks to increase awareness and responsibility among individuals living or building in the Sea Level Rise

Constraint District. The ordinance also seeks to reduce the need for future flood control projects by specifying requirements for the development, improvement, and repair of structures in areas that will be exposed to sea level rise. This ordinance makes the county more resilient to future sea level rise and has received national awards for its long-term planning.

According to the ordinance, all new construction and substantial improvements to buildings, which include repairs to structures with substantial damage (see Ordinance 1134 in the Kauaʻi County Code for definitions of these terms), in the Sea Level Rise Constraint District must meet the following criteria:

- Residential structures must have their lowest floor, including basements, 2 feet above the highest sea level rise flood elevation that intersects the building footprint
- Nonresidential structures must have their lowest floor, including basements, 1 foot above the highest sea level rise flood elevation that intersects the building footprint
- Residential and nonresidential buildings must be anchored
- If a building is overlapped by the Sea Level Rise Constraint District Ordinance and Floodplain Management Ordinance, the stricter of the two ordinances is applied to the property.

Whether a structure has been substantially damaged or whether substantial improvements will be made is based on the determination of Kauaʻi County's Department of Public Works – Engineering Division. Individuals building or making improvements to structures in the sea level rise constraint district are also required to use the Sea Level Rise Constraint District Viewer to view their property and determine the strictest contour elevation that intersects the property. The ground elevation must also be provided on plans for these constructions or improvements. The Kauaʻi County Department of Public Works, which houses the county's floodplain manager, is also in the process of procuring a software application called Forerunner that would display the Floodplain Base Flood Elevation and Sea Level Rise Constraint District elevation side-by-side in a user-friendly interface that allows for an assessment of properties' exposure to these hazards.

Kauaʻi County Plantation Camp Districts Wildfire and Wildland Urban Interface Ordinance

This ordinance was put in place in September 2025 and integrates wildfire mitigation into zoning and permitting in West Kauaʻi's plantation camp districts (County of Kauaʻi 2025h). The ordinance requires that new construction include home hardening measures, such as fire-resistant roofs and screened crawl spaces, along with defensible space around homes. Houses are required to have no vegetation within 5 feet and maintain vegetation within 30 feet with adequate spacing. For new development, this ordinance extends beyond initial construction to continued maintenance to mitigate wildfire risk. This ordinance represents a significant step towards increasing wildfire safety in Kauaʻi and is the first in the state to bring together wildfire safety, zoning, and permitting in the wildland urban interface (WUI).

Kauaʻi County Capital Improvement Program

All County capital improvements are sanctioned and primarily funded by the County's Capital Improvement Program and budget. The Capital Improvement Program and budget must clearly set forth the qualification of each budgeted item and its priority in the County General Plan, community plan, or special purpose plans such as this 2026 MHMRP Update. The County Planning Department director prioritizes lists of capital improvement projects based on the following:

- **Funding source**: The capacity of a funding source available to a proposed improvement may be a factor in determining priority. The capital budget may not exceed prudent debt service limits that affect the borrowing capacity of the County.
- **Action Committee recommendations**: County action committees may provide their priorities for the fiscal year to the director.
- **Project delivery phases**: All phases of a project, including planning, land acquisition, design, construction, equipment and furnishing, must be addressed in the Capital Improvement Program.
- **Deferred maintenance**: Deferred maintenance of existing facilities should be considered a high priority for facilities intended to remain in active, long-term service.
- **Level of service**: The County General Plan's level of service standards should be considered.
- **Land use policies**: Higher priority may be given to improvements that influence growth patterns consistent with the County General Plan or community plans.

The County General Plan calls for hazard mitigation projects to be prioritized in the County's capital improvements program. A number of projects have been funded through this program and are reaching completion to address the devasting flooding that occurred in April 2018 on Kauaʻi. Additionally, the County's Capital Improvement Program funded development of the *Kauaʻi County Climate Adaptation and Action Plan* (KCAAP), which analyzes how climate change is anticipated to worsen the impacts of natural hazards on Kauaʻi and lays out adaptation measures to implement to better protect the County's residents, infrastructure, property, and resources (County of Kauaʻi 2025d).

Kauaʻi County Climate Adaptation and Action Plan

The KCAAP prepares the county to address climate change threats through climate adaptation and mitigation measures with particular emphasis on transitioning to clean energy (County of Kauaʻi 2022a, 2025d). The plan's vision is to make Kauaʻi more resilient and equitable. The KCAAP is separated into two components. The first is oriented toward the public while the second contains 21 action plans refined for specific county departments to help them implement the KCAAP.

The KCAAP assesses changing trends in natural hazards as a result of climate change and their likely impacts on county vulnerability. This analysis is used to inform the selection of 79 climate adaptation and mitigation strategies the County will strive to implement in future years. The strategies are organized into six categories: 1) assessment and planning, 2) capital improvements, 3) land use and building regulation, 4) program and policy development, 5) County leadership, and 6) community capacity. A guiding force in implementing these strategies is attempting to reduce disproportionate climate change impacts among the county's vulnerable populations.

Kauaʻi County Pre-Disaster Recovery Framework

Kauaʻi County developed a Pre-Disaster Recovery Framework (PDRF) in 2025 to help the County prepare for disaster recovery in advance of disaster occurrence (County of Kauaʻi 2025g). The plan lays out three phases of recovery following the disaster and initial response: short-term, intermediate, and long-term recovery. The first phase deals with efforts to assess damage, return the functionality of essential infrastructure and services, and ensure the population is safe and their basic needs are met. The second phase focuses on returning the disaster area to a functional state. The third phase involves complete restoration of the recovered area and can include planning and implementation of actions to increase resilience. The PDRF also lays out the responsibilities of different government entities following a disaster to facilitate an easier recovery process along with strategies for funding recovery efforts. Included within this framework are considerations of natural and cultural resources, housing assistance, infrastructure systems, health and social services, economic recovery, and community planning in the disaster recovery process.

Kauaʻi County Community Wildfire Protection Plan

Kauaʻi County developed their first *Community Wildfire Protection Plan* (CWPP) in 2009. An update was conducted for the plan in 2016 with an additional update to priority projects listed in the CWPP in 2024 (Hawaiʻi Wildfire Management Organization 2016). The purpose of the CWPP is to assess the county's wildfire risk and identify strategies for mitigation. Analysis conducted for the CWPP shows wildfire incidences and ignitions have historically been most frequent along the island's east and south coasts with additional events occurring along the north coast and Kōkeʻe Road on the island's west side. Further, wildfires on the island are most frequently human-caused—even if unintentional—and occur along roadsides or in the WUI where developed areas meet undeveloped areas.

The principal concern of individuals who participated in the planning process was fuels management followed by access, water resources, planning, and community awareness and education. Management priorities identified by participants included agriculture/grazing, increasing capacity, vacant/fallow lands, planning, enforcement, and fuel management in higher risk areas (i.e., roads and WUI). Participants included members of the public. The CWPP also lays out an action plan to mitigate wildfire risk with near- and long-term action items. Near-term actions focus on raising awareness about wildfires and drought through education and outreach as well as helping communities apply for funding for fuel removal projects. Long-term actions involve data collection, fuel reduction through grazing, additional outreach and education, improvements to water storage, and other efforts to expand fire response capacity and pre-wildfire mitigation efforts. The findings of the CWPP analysis of wildfire risk and mitigation actions have been integrated into this 2026 MHMRP Update to better protect Kauaʻi County from wildfires.

The 2024 update to the Kauaʻi CWPP only included the addition of priority projects. A more comprehensive update was underway at the time of writing the 2026 MHMRP Update. A crucial source to be integrated into the CWPP update will be the *Maui Wildfires – Mitigation Assessment Team Compendium Report P-2425* (FEMA 2025i). This report will help inform the development of the wildfire mitigation efforts proposed in the CWPP. Once the Kauaʻi CWPP mitigation actions are finalized, they will be integrated into the Kauaʻi MHMRP.

Kauaʻi County Water Use and Development Plan

The County updated the *Kauaʻi Water Use and Development Plan Update – Hawaiʻi Water Plan* (WUDP) in 2024, with the original plan adopted in 1990 (Fukunaga & Associates, Inc. 2024). The County WUDP is required as part of the Hawaiʻi Water Plan under the State Water Code. Kauaʻi's WUDP assesses the status of water resources in the county, including the location of water sources, their primary uses, and land development impacts on them. The WUDP also looks to the future by examining anticipated land use changes that may affect water use as well as any regional plans dealing with water development. The plan breaks this examination down by aquifer system areas (ASYAs), of which there are 13 in Kauaʻi. Where applicable, water use is projected to be sustainable in each aquifer system with anticipated future development laid out in the County General Plan and zoning; however, conserving water and using alternative water sources are still suggested. Another recommendation highlighted for Kauaʻi in their WUDP is for the highest-quality water sources to be made available for the most essential needs such as drinking water. The current status and anticipated future status of water use in Kauaʻi's

ASYAs are important considerations in assessing the impacts of natural hazards on the county, particularly their capacity to endure periods of drought and suppress wildfires.

Waimea 400 Master Plan

The *Waimea 400 Master Plan* was published in 2022 and lays out a plan for approximately 400 acres of land that the County purchased in 2019 (PBR Hawaiʻi and Associates, Inc. 2022). The area is between Kekaha and Waimea, and plans for the area's development were based on extensive community engagement efforts. The County's intention is to transition this area into a mixture of affordable housing, agricultural land, restored wetlands, paths and trails, and other community amenities. This area is along the coast and exposed to sea level rise and coastal flooding; however, the County has planned for these impacts by dividing land usage up based on hazard exposure to prevent incompatible land uses.

Kauaʻi Island Utility Cooperative Strategic Plan Update

The Kauaʻi Island Utility Cooperative developed the *Strategic Plan Update 2022–2023* in which they laid out their challenges, opportunities, and goals for the following years (Kauaʻi Island Utility Cooperative 2023). The plan discusses the environment of the global energy market. It also lists challenges and opportunities the utility faces that are unique to Kauaʻi, including maintaining financial stability with rising costs and supply chain disruptions; attaining 100% renewable energy production; reducing climate change impacts; maintaining reliability of their services; navigating state and federal regulations; and cybersecurity threats. There strategic goals are to 1) provide reliable electricity at lower costs, 2) reduce the utility's carbon emissions, and 3) increase their resiliency and reliability. These goals align with increasing the ability of the utility to maintain or quickly restore service following hazard events, including those brought about by climate change.

Lahaina Fire Reports and Recovery Phases

The *Lahaina Fire Incident Analysis Report* was published in 2024 to examine the conditions that led to the severity of the 2023 Maui wildfires (Kerber and Alkonis 2024). The report makes clear that the disaster is not attributable to a specific factor or group of factors but rather to a situation in which many direct and indirect factors compounded to be devasting. The report describes how four wildfires ignited on a day with high winds. According to the report, the high winds, vegetative fuel, and dry conditions allowed the fires to spread rapidly. Unmanaged vegetation coupled with dry conditions was an issue throughout the state. Additionally, the high winds knocked down power lines, which combined with the other weather conditions, impeded the efforts of the Maui Fire Department to suppress the wildfires. This complex interaction of factors also impeded evacuation and assistance from other islands and was made worse as fire hydrants lost pressure, and the fire department's limited resources were spread thin due to the number of wildfires. Despite the immensely difficult circumstances, first responders went to extreme measures to protect community members. The disaster was worsened by a lack of planning and risk reduction efforts prior to the wildfire occurrences. Although this disaster happened on Maui, similar conditions exist or could occur throughout the state leading to other disasters if mitigation actions are not taken.

Following the Lahaina Fire Incident Analysis Report, the State of Hawaiʻi published a document with 10 priorities for increasing wildfire safety in the state (Underwriters Laboratories [UL] Research Institutes 2024):

1. Engage in action planning and assign accountability, based on the results of the Lahaina Fire Incident Analysis Report
2. Hire a state fire marshal to lead the first priority effort
3. Provide wildfire education programs for residents across the state
4. Increase the resiliency of outdoor warning systems
5. Increase the resiliency of and lower risks associated with public electric and water utilities
6. Implement efforts to better assess when weather conditions pose a high fire risk
7. State and County work together to create standardized evacuation plans for areas with substantial wildfire risk
8. Improve codes and standards to reduce wildfire risk
9. Enhance the preparedness of emergency responders and other relevant entities for wildfire response
10. Create and implement a framework for vegetation and land management

These priorities are integrated into the action plan section of the 2026 MHMRP Update.

Waimea River Flood Control Modification Report

The Waimea River Flood Control Modification report was currently under development at the time of the 2026 MHMRP Update. Only the *Draft Waimea River Flood Control Modification Feasibility Study Report*, which is the initial document produced for the study, is available for integration into the 2026 MHMRP Update. The Draft Feasibility Report lays out a timeline for the project along with the project's purpose, objectives, constraints, and strategies (U.S. Army Corps of Engineers [USACE] 2025c). The main goal of the report is to improve the Waimea River Flood Control Project by reducing the risk of flooding behind the Waimea River levee system, which will increase public safety behind the levee and reduce the risk of property and infrastructure damage. More information on the contents of the report can be found in Section 10.1.3, National Flood Insurance Program.

STATE

Hawaiʻi Coastal Zone Management Program

In response to the federal Coastal Zone Management Act, the State of Hawaiʻi established its coastal zone management (CZM) program in 1977 (Hawaiʻi Revised Statutes [HRS] Chapter 205A). Managed by the State Office of Planning, the CZM program provides a common framework for state and county management actions that affect water and land resources. Under the CZM program, entities must take a holistic, ecosystem-wide perspective to coastal resource management instead of focusing on a specific species or resource. The CZM law requires state and county agencies to comply legally and operationally with the CZM. All agencies must align their statutes, ordinances, rules, and actions with the CZM program. In doing so, the program seeks to build upon state and county agencies' existing efforts to form a statewide network engaged in coastal management (State of Hawaiʻi Office of Planning and Sustainable Development [OPSD] 2025b).

The CZM covers all the land in the state, as any given point is 30 miles or less from the ocean. Due to this close proximity, actions on land including mountainous areas are intricately tied to and impact the state's coastal resources. The CZM reaches as far into the sea as the extent of the state's police authority. According to the OPSD, the way this ocean boundary is legally defined supports Hawai'i's traditional claims over archipelagic waters, based on historic transportation pathways and underwater territories (OPSD 2025b).

Changes are occasionally made to the state's CZM program. Changes were approved by the National Oceanic and Atmospheric Administration (NOAA) in 2022, and additional changes submitted in early 2025 received approval in September 2025 (OPSD 2025e). Some of the more recent changes include refining development definitions and standards for seawalls.

Hawai'i Hazards Awareness and Resilience Program

The aim of the Hawai'i Hazards Awareness and Resilience Program (HHARP) is to help communities prepare to be self-reliant during and after natural hazard events, improve their ability to take care of their own needs, and reduce the negative impacts of disasters. The program aims to enhance community resilience through education and outreach sessions that build awareness and understanding of hazard mitigation, preparedness, response, and recovery through partnerships between state and county emergency management agencies and community leaders. Hanapēpē and 'Ele'ele jointly participated in the HHARP and are the only communities in the county that participated. HHARP, including the Storm Ready/Tsunami Ready program that was administered as a part of it, is inactive as of the final drafting of the 2026 MHMRP Update. The State of Hawai'i intends to reengage the program in the coming years.

Hawai'i State Grants-in-Aid for Capital Improvement Projects

The Hawai'i State Legislature makes appropriations for grants in accordance with HRS Chapter 42F. The grants support events, programs, and facilities that benefit the community. There are two types of grants: operating grants and capital improvement project grants. Funds are available on a reimbursement basis, and payments are contingent upon fulfillment of the terms and conditions of the grant agreement. Grantees must submit documents to verify that they meet the standards for the award of grants.

Hawai'i State Plan

The Hawai'i State Plan is required through the Hawai'i State Planning Act (OPSD 2025c). The State Plan is a long-range, comprehensive plan that lays out a vision for the state through objectives and policies. It also defines planning mechanisms to achieve implementation of the state vision. The plan establishes priority guidelines that are intended to assist in managing priority concerns. The State Plan is implemented via functional plans and the counties' general plans. The OPSD states that the Hawai'i State Plan achieves the following (OPSD 2025c):

- Serves as a guide for the future long-range development of the state
- Identifies the goals, objectives, policies, and priorities for the state
- Provides a basis for determining priorities and allocating limited resources, such as public funds, services, human resources, land, energy, water, and other resources
- Improves coordination of federal, state, and county plans, policies, programs, projects, and regulatory activities
- Establishes a system for plan formulation and program coordination to provide for an integration of all major state, and county activities.

More detailed descriptions of the three parts of the State Plan from the OPSD are included below:

- Part I lists the State Plan’s overall theme and goals. Objectives and policies focus on general topic areas, including population, economy, physical environment, facility systems, and socio-cultural advancement.
- Part II establishes a statewide planning system to coordinate and guide all major state and county activities and to implement the overall theme, goals, objectives, policies, and priority guidelines. The system implements the State Plan through the development of functional plans and county general plans.
- Part III establishes overall priority guidelines to address areas of statewide concern. This part lays out the overall direction for the state in five major areas of statewide concern: economic development, population growth and land resource management, affordable housing, crime and criminal justice, and quality education.

A Phase 1 Update to the Hawai‘i State Plan was published in 2018. No additional updates have been published since 2018 though the state legislature is working through the process of setting up a Phase II update (Hawai‘i House Bill 1925).

Ocean Resources Management Plan

The Ocean Resources Management Plan is a comprehensive plan for conservation and sustainability of ocean and coastal resources (HRS Chapters 205A and 225M). Hawai‘i is facing pressures that will have a significant impact on ocean and coastal environments—urbanization, tourism, recreational and commercial ocean uses, sea level rise, and other natural hazards, including beach erosion, inundation of land, increased flood and storm damage, coral bleaching, marine debris, and invasive species, and more frequent and more powerful weather events. The Ocean Resources Management Plan was updated in 2020 to address these issues. The primary change made to the plan through the update was the establishment of three focus areas—land-based pollution, marine ecosystems, and development and coastal hazards.

State Building Code and Design Standards

In 2007, the State Legislature created State Building Code Council (SBCC) with the authority to establish codes applicable to all construction in the state of Hawai‘i (HRS Chapter 107). The SBCC evaluates model building codes and develops amendments necessary to make the codes appropriate for conditions in Hawai‘i. Once the SBCC develops and approves a code for Hawai‘i, it is legally adopted into the Hawai‘i Administrative Rules (HAR). Counties have 2 years from the date of establishment of the HAR State Building Code to adopt the State Building Code as local County code, with the addition of any locally approved County amendments. The process has successfully enabled a unified set of nearly comprehensive building codes to be adopted by the state and the counties.

The most recent state building code amended by the SBCC is from 2018. The SBCC has been suspended since 2023 by the Governor’s proclamations on affordable housing, which has led to code amendments not being adopted; however, an unamended building code went into effect in 2021 based on the 2021 International Building Code. Additionally, the SBCC is not expected to meet for the foreseeable future, which means it is unlikely there will be new state-amended code adoptions that would apply to the county.

State General Flood Control Plan

As authorized by HRS Chapter 179 Flood Control and Flood Water Conservation, the State General Flood Control Plan (SGFCP) serves as a guide for linking partnering agencies and community groups (State of Hawai‘i Department of Land and Natural Resources [DLNR] Engineering Division 2025b). The SGFCP provides these stakeholders with the data and tools required to strategize flood improvement needs and goals.

The most recent update allows all stakeholders to view and analyze flood-prone areas and/or flood mitigation needs. The updated SGFCP also enables users to locate project partners and build on current or previously completed flood improvement efforts. The plan update increases each stakeholder’s ability to complete projects by integrating best practices and lessons learned from other partner agencies and through resource sharing.

There have been no changes made to the SGFCP, but the State is in the beginning stages of planning a major update that will be integrated into future Kaua‘i County MHMRPs once it is available.

State of Hawai‘i Hazard Mitigation Plan

The *State of Hawai‘i 2023 Hazard Mitigation Plan* identifies the major natural hazards that affect Hawai‘i, assesses the risk that each hazard poses, analyzes the vulnerability of people, property and infrastructure to the specific hazard, and recommends actions that can be taken to reduce the risk and vulnerability to the hazard (State of Hawai‘i Emergency Management Agency [HI-EMA] 2023). The State Hazard Mitigation Plan also contains a description of programs, policy, statues and regulations applicable to hazard mitigation statewide. This document is referenced throughout the 2026 Kaua‘i MHMRP Update and has been an excellent source of background information.

State of Hawai‘i Land Use Law

The Hawai‘i State Legislature adopted the State Land Use Law (HRS Chapter 205) in 1961. The Land Use Commission administers statewide zoning established in the State Land Use Law. The law classifies lands throughout the state into one of four districts:

- **Urban District**: Generally includes lands characterized by “city-like” concentrations of people, structures and services. This district also includes vacant areas for future development. Jurisdiction of this district lies primarily with counties.
- **Rural District**: Consists primarily of small farms intermixed with low-density residential lots with a minimum size of 0.5 acre. The Land Use Commission and County governments share jurisdiction over rural districts. Permitted uses include those relating or compatible with agricultural use and low-density residential lots.
- **Agricultural District**: Land with significant potential for agriculture uses as well as lands used for the cultivation of crops, aquaculture, raising livestock, wind energy generation, timber cultivation, and agriculture-support (mills, employee quarters, etc.). Uses permitted in the highest productivity agricultural categories (A or B) are governed by statute. Uses in lower-productivity categories (C, D, E, or U) include those allowed on A or B lands as well as uses stated under HRS Section 205-4.5.
- **Conservation District**: Lands in existing forest and water reserve zones. These include areas necessary for protecting watersheds and water sources; scenic and historic areas; parks, wilderness, open space and recreational areas; habitats of endemic plants, fish and wildlife; submerged lands seaward of the shoreline; and lands subject to flooding and soil erosion. The State Board of Land and Natural Resources administrates conservation districts.

Hawaiʻi Green Infrastructure Authority HI C-PACER Program

Hawaiʻi's Commercial Property Assessed Clean Energy and Resiliency (HI C-PACER) program is a state-sponsored program managed by the Hawaiʻi Green Infrastructure Authority. The program connects owners of qualifying properties with private lenders to finance certain improvements to existing properties or as part of new construction projects. These improvements include supporting energy efficiency, clean energy, water quality or management improvements, and hazard mitigation actions to protect properties from natural hazards. For instance, improvements that increase the ability of a property to withstand sea level rise, hurricanes, floods, wildfires, and seismic events are all eligible for financing through the program.

FEDERAL

Americans with Disabilities Act

The Americans with Disabilities Act (ADA) seeks to prevent discrimination against people with disabilities in employment, transportation, public accommodation, communications, and government activities. Title II of the ADA deals with compliance with the Act in emergency management and disaster-related programs, services, and activities. It applies to state and local governments as well as third parties, including religious entities and private nonprofit organizations.

The ADA has implications for sheltering requirements and public notifications. During an emergency alert, officials must use a combination of warning methods to ensure that all residents have all necessary information. Those with hearing impairments may not hear radio, television, sirens, or other audible alerts, while those with visual impairments may not see flashing lights or other visual alerts. Two technical documents for shelter operators address physical accessibility needs of people with disabilities, as well as medical needs and service animals.

The ADA intersects with disaster preparedness programs with respect to transportation, social services, temporary housing, and rebuilding. Persons with disabilities may require additional assistance in evacuation and transit (e.g., vehicles with wheelchair lifts or paratransit buses). Evacuation and other response plans should address the unique needs of residents. Local governments may be interested in implementing a special-needs registry to identify the home addresses, contact information, and needs for residents who may require more assistance.

Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant Program (HMGP) applications require full compliance with applicable federal acts. Any action identified in this 2026 MHMRP Update that falls within the scope of this act will need to meet its requirements.

Bureau of Land Management

The U.S. Bureau of Land Management (BLM) funds and coordinates wildfire management programs and structural fire management and prevention on BLM lands. BLM works closely with the U.S. Forest Service (USFS) and state and local governments to coordinate fire safety activities. The Interagency Fire Coordination Center in Boise, Idaho, serves as the center for this effort.

Civil Rights Act of 1964

The Civil Rights Act of 1964 prohibits discrimination based on race, color, religion, sex or nation origin and requires equal access to public places and employment. The Act is relevant to emergency management and hazard mitigation in that it prohibits local governments from favoring the needs of one population group over another. Local government and emergency response must ensure the continued safety and well-being of all residents equally, to the extent possible. FEMA HMGP applications require full compliance with applicable federal acts. Any action identified in this 2026 MHMRP Update that falls within the scope of this act will need to meet its requirements.

Clean Water Act

The federal Clean Water Act (CWA) employs regulatory and nonregulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's surface waters so they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."

Evolution of CWA programs over the last decade has included a shift from a program-by-program, source-by-source, and pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach, equal emphasis is placed on protecting healthy waters and restoring impaired ones. Numerous issues are addressed, not just those subject to CWA regulatory authority. Involvement of stakeholder groups in the development and implementation of strategies for achieving and maintaining water quality and other environmental goals is a hallmark of this approach.

The CWA is important to hazard mitigation in several ways. There are often permitting requirements for any construction within 200 feet of waters of the United States, which may have implications for mitigation projects identified by a local jurisdiction. Additionally, CWA requirements apply to wetlands, which serve important functions related to preserving and protecting the natural and beneficial functions of floodplains and are linked with a community's floodplain management program. Finally, the National Pollutant Discharge Elimination System is part of the CWA and addresses local stormwater management programs. Stormwater management plays a critical role in hazard mitigation by addressing urban drainage or localized flooding issues within jurisdictions.

FEMA HMGP applications require full compliance with applicable federal acts. Any action identified in this 2026 MHMRP Update that falls within the scope of this act will need to meet its requirements.

Community Development Block Grant Disaster Resilience Program

In response to disasters, Congress may appropriate additional funding for the U.S. Department of Housing and Urban (HUD) Development Community Development Block Grant programs to be distributed as Disaster Recovery grants (CDBG-DR). These grants can be used to rebuild affected areas and provide seed money to start the recovery process. CDBG-DR assistance may fund a broad range of recovery activities, helping communities and neighborhoods that otherwise might not recover due to limited resources. CDBG-DR grants often supplement disaster programs of FEMA, the Small Business Administration, and the USACE. HUD generally awards noncompetitive, nonrecurring CDBG-DR grants by a formula that considers disaster recovery needs unmet by other federal disaster assistance programs. To be eligible for CDBG-DR funds, projects must meet the following criteria:

- Address a disaster-related impact (direct or indirect) in a presidentially declared county for the covered disaster
- Be a CDBG-eligible activity (according to regulations and waivers)
- Meet a national objective

Incorporating preparedness and mitigation into these actions is encouraged, as the goal is to rebuild in ways that are safer and stronger. CDBG-DR funding is a potential alternative source of funding for actions identified in this 2026 MHMRP Update.

Disaster Mitigation Act

The Disaster Mitigation Act (DMA) is the current federal legislation addressing hazard mitigation planning. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before FEMA Hazard Mitigation Assistance (HMA) grant funds are available to communities. This 2026 MHMRP Update is designed to meet the requirements of DMA, improving eligibility for future hazard mitigation funds.

Emergency Relief for Federally Owned Roads Program

The Emergency Relief for Federally Owned Roads (ERFO) Program was created to help federal agencies repair or rebuild tribal transportation facilities, federal lands transportation infrastructure, and other federally owned roads that are accessible to the public and have experienced significant damage due to widespread natural disasters or catastrophic events. This program provides funding for both immediate emergency repairs and long-term permanent restoration (U.S. Department of Transportation – Federal Highway Administration 2025). Eligible activities under this program meet some of the goals and objectives for this plan and the program is a possible funding source for actions identified in this 2026 MHMRP Update.

Emergency Watershed Program

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) administers the Emergency Watershed Protection (EWP) Program, which responds to emergencies created by natural disasters. Eligibility for assistance is not dependent on a national emergency declaration. The program is designed to help people and conserve natural resources by relieving imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. EWP is an emergency recovery program. Financial and technical assistance are available for the following activities (NRCS 2016):

- Remove debris from stream channels, road culverts, and bridges
- Reshape and protect eroded banks
- Correct damaged drainage facilities
- Establish cover on critically eroding lands
- Repair levees and structures
- Repair conservation practices

This federal program could be a possible funding source for actions identified in this 2026 MHMRP Update.

Endangered Species Act

The federal Endangered Species Act (ESA) was enacted in 1973 to conserve species facing depletion or extinction and the ecosystems that support them. The ESA sets forth a process for determining which species are threatened and endangered and requires the conservation of the critical habitat in which those species live. The ESA provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species and contains exceptions and exemptions. It is the enabling legislation for the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Criminal and civil penalties are provided for violations of the ESA and Convention.

Federal agencies must seek to conserve endangered and threatened species and use their authorities in furtherance of the ESA's purposes. The ESA defines three fundamental terms:

- **Endangered:** A species of fish, animal or plant is "in danger of extinction throughout all or a significant portion of its range." (For salmon and other vertebrate species, this may include subspecies and distinct population segments.)
- **Threatened**: A species "is likely to become endangered within the foreseeable future." Regulations may be less restrictive for threatened species than for endangered species.
- **Critical Habitat:** "Specific geographical areas that are . . . essential for the conservation and management of a listed species, whether occupied by the species or not."

Five sections of the ESA are of critical importance to understanding it:

- **Section 4 – Listing of a Species:** The NOAA Fisheries Service is responsible for listing marine species; the U.S. Fish and Wildlife Service (USFWS) is responsible for listing terrestrial and freshwater aquatic species. The agencies may initiate reviews for listings, or citizens may petition for them. A listing must be made "solely on the basis of the best scientific and commercial data available." After a listing has been proposed, agencies receive comment and conduct further scientific reviews for 12 to 18 months, after which they must decide if the listing is warranted. Economic impacts cannot be considered in this decision, but it may include an evaluation of the adequacy of local and state protections. Critical habitat for the species may be designated at the time of listing.
- **Section 7 – Consultation:** Federal agencies must ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed or proposed species or adversely modify its critical habitat, which includes private and public actions that require a federal permit. Once a final listing is made, nonfederal actions are subject to the same review, termed a "consultation." If the listing agency finds that an action will "take" a species, it must propose mitigations or "reasonable and prudent" alternatives to the action; if the proponent rejects these, the action cannot proceed.
- **Section 9 – Prohibition of Take**: It is unlawful to take an endangered species, including killing or injuring it or modifying its habitat in a way that interferes with essential behavioral patterns, including breeding, feeding or sheltering.
- **Section 10 – Permitted Take**: Through voluntary agreements with the federal government that provide protections to an endangered species, a nonfederal applicant may commit a take that would otherwise be prohibited as long as it is incidental to an otherwise lawful activity (such as developing land or building a road). These agreements often take the form of a Habitat Conservation Plan.
- **Section 11 – Citizen Lawsuits**: Civil actions initiated by any citizen can require the listing agency to enforce the ESA's prohibition of taking or to meet the requirements of the consultation process.

FEMA HMGP applications require full compliance with applicable federal acts. Any action identified in this 2026 MHMRP Update that falls within the scope of this act will need to meet its requirements.

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) cooperates with a large number of federal and state agencies to ensure and promote dam safety. More than 3,000 dams are part of regulated hydroelectric projects in the FERC program. Two-thirds of these are more than 50 years old. As dams age, concern about their safety and integrity grows, thus oversight and regular inspection are important. FERC inspects hydroelectric projects on an unscheduled basis to investigate the following:

- Potential dam safety problems
- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with the terms and conditions of a license

Every 5 years, an independent engineer approved by FERC must inspect and evaluate projects with dams higher than 32.8 feet (10 meters) or with a total storage capacity of more than 2,000 acre-feet.

FERC monitors seismic research and applies it in performing structural analyses of hydroelectric projects. FERC also evaluates the effects of potential and actual large floods on the safety of dams. During and following floods, FERC visits dams and licensed projects, determines the extent of damage, if any, and directs any necessary studies or remedial measures the licensee must undertake. The FERC publication Engineering Guidelines for the Evaluation of Hydropower Projects guides the FERC engineering staff and licensees in evaluating dam safety. The publication is frequently revised to reflect current information and methodologies.

FERC requires licensees to prepare emergency action plans and conducts training sessions on how to develop and test these plans. The plans outline an early warning system if there is an actual or potential sudden release of water from a dam due to failure. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that everyone knows what to do in emergency situations.

Federal Wildfire Management Policy and Healthy Forests Restoration Act

Federal Wildfire Management Policy and Healthy Forests Restoration Act (2003) documents call for a single comprehensive federal fire policy for the U.S. Department of the Interior and USDA (the agencies using federal fire management resources). They mandate community-based collaboration to reduce risks from wildfire.

Rehabilitation of High Hazard Potential Dam Grant Program

FEMA's Rehabilitation of High Hazard Potential Dam (HHPD) Grant Program offers federal funding via grants for technical, planning, design, and construction assistance to rehabilitate high hazard potential dams that do not meet their state's dam safety standards and have deficiencies creating an unacceptable threat to the public. States with state dam safety programs can apply for this funding (which includes Hawaiʻi) (FEMA 2025b). Only states may apply for funds directly, but subrecipients on grants can include local governments and nonprofit organizations. Local governments and nonprofit organizations may also apply for funding as subrecipients on behalf of private dam owners who are ineligible to apply on their own. A FEMA-approved HMP for the jurisdiction where the dam is located is a requirement for dams to receive funding under the HHPD Grant Program.

Hazard Mitigation Assistance Grant Programs

FEMA HMA grant programs to state and county agencies and qualifying nonprofits include the HMGP, Pre-Disaster Mitigation (PDM) Grant Program, and Flood Mitigation Assistance (FMA) Grant Program.[1] Although eligibility differs for each grant program, the following natural hazard risk reduction activities qualify for funding:

- Hazard mitigation planning
- Retrofit of critical facilities
- Acquisition, elevation, relocation or drainage improvements of repetitive flood loss structures
- Wildfire risk reduction such as fuels reduction like thinning, creating defensible space, and use of low-combustible building materials.
- Watershed and landslide stabilization
- Construction or upgrade of general population shelters
- Enhancement of development codes and standards
- Safe rooms and storm shelters
- Generators for critical facilities
- Warning systems

In Hawaiʻi, HI-EMA administers the HMA grant programs. State and county agencies are eligible to apply for all three programs (HMGP, PDM and FMA). Certain private, nonprofit organizations are eligible to apply for HMGP only. Individuals and businesses are not eligible to apply directly; however, an eligible applicant may apply on behalf of individuals or businesses.

National Dam Safety Act

Potential for catastrophic flooding due to dam failures led to passage of the National Dam Inspection Act in 1972, creation of the National Dam Safety Program (NDSP) in 1996, and reauthorization of the program through the Dam Safety Act in 2006. The NDSP, administered by FEMA, requires a periodic engineering analysis of the majority of dams in the country; exceptions include the following:

- Dams under jurisdiction of the Bureau of Reclamation, Tennessee Valley Authority, or International Boundary and Water Commission
- Dams constructed pursuant to licenses issued under the Federal Power Act
- Dams that the Secretary of the Army determines do not pose any threat to human life or property.

The goal of this FEMA-monitored effort is to identify and mitigate the risk of dam failure so as to protect lives and property of the public. The NDSP is a partnership among the states, federal agencies, and other stakeholders that encourages individual and community responsibility for dam safety. Under FEMA's

[1] As of October 2025, HMA grants are being analyzed for improvements and modifications.

leadership, state assistance funds have allowed all participating states to improve their programs through increased inspections, emergency action planning, and purchases of needed equipment. FEMA has also expanded existing and initiated new training programs. Grant assistance from FEMA provides support for improvement of dam safety programs that regulate most of the dams in the United States.

National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires federal agencies to consider the environmental impacts of proposed actions and reasonable alternatives to those actions, alongside technical and economic considerations. NEPA established the Council on Environmental Quality, whose regulations (40 CFR 1500–1508) set standards for compliance. Consideration and decision-making regarding environmental impacts must be documented in an environmental impact statement or environmental assessment. Environmental impact assessment requires the evaluation of reasonable alternatives to a proposed action, solicitation of input from organizations and individuals that could be affected, and an unbiased presentation of direct, indirect, and cumulative environmental impacts. FEMA HMGP applications require full compliance with applicable federal acts. Any action identified in this 2026 MHMRP Update that falls within the scope of this act will need to meet its requirements.

National Fire Plan (2001)

The 2001 National Fire Plan was developed based on the National Fire Policy. A major aspect of the National Fire Plan is joint risk reduction planning and implementation carried out by federal, state and local agencies and communities. The National Fire Plan presented a comprehensive strategy in five key initiatives:

- **Firefighting:** Be adequately prepared to fight fires each fire season.
- **Rehabilitation and Restoration:** Restore landscapes and rebuild communities damaged by wildfires.
- **Hazardous Fuel Reduction:** Invest in projects to reduce fire risk.
- **Community Assistance:** Work directly with communities to ensure adequate protection.
- **Accountability:** Be accountable and establish adequate oversight, coordination, program development, and monitoring for performance. (U.S. Department of the Interior [DOI] and USFS 2002)

National Flood Insurance Program

The National Flood Insurance Program (NFIP) makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities that enact floodplain regulations. Participation and good standing under NFIP are prerequisites to grant funding eligibility under the Robert T. Stafford Act.

For most participating communities, FEMA has prepared a detailed Flood Insurance Study. The study presents water surface elevations for floods of various magnitudes, including the 1% annual chance flood and the 0.2% annual chance flood. Base flood elevations and the boundaries of the flood hazard areas are shown on Flood Insurance Rate Maps (FIRMs), which are the principal tool for identifying the extent and location of the flood hazard. FIRMs are the most detailed and consistent data source available, and for many communities they represent the minimum area of oversight under the local floodplain management program. In recent years, FIRMs have been digitized, making them more accessible to residents, local governments, and stakeholders.

Minimum Requirements

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 1% annual chance flood.
- New floodplain development must not aggravate existing flood problems or increase damage to other properties.
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

NFIP Participation in Hawai‘i

In the State of Hawai‘i, the DLNR is the coordinating agency for floodplain management. DLNR works with FEMA and local governments by providing grants and technical assistance, evaluating community floodplain management programs, reviewing local floodplain ordinances, and participating in statewide flood hazard mitigation planning. Compliance is monitored by FEMA regional staff and by DLNR. Maintaining compliance under the NFIP is an important component of flood risk reduction.

Repetitive Loss

A repetitive loss property is defined by FEMA as an NFIP-insured property that has experienced any of the following since 1978, regardless of any changes in ownership:

- Four or more paid losses in excess of $1,000
- Two paid losses in excess of $1,000 within any rolling 10-year period
- Three or more paid losses that equal or exceed the current value of the insured property

The government has instituted programs encouraging communities to identify and mitigate the causes of repetitive losses. Studies have found that many of these properties are outside any mapped 1% annual chance (100-year) floodplain. The key identifiers for repetitive loss properties are the existence of flood insurance policies and claims aid by the policies.

National Incident Management System

The National Incident Management System (NIMS) is a systematic approach for the government, nongovernmental organizations, and the private sector to work together to manage incidents involving hazards. The NIMS provides a flexible but standardized set of incident management practices. Incidents typically begin and end locally, and they are managed at the lowest possible geographical, organizational, and jurisdictional levels. In some cases, success depends on the involvement of multiple jurisdictions, levels of government, functional agencies, and emergency response disciplines. These cases necessitate coordination across a spectrum of organizations. Communities using NIMS follow a comprehensive national approach that improves the effectiveness of emergency management and response personnel across the full spectrum of potential hazards including natural, technological, and human-caused hazards, regardless of size or complexity.

Although participation is voluntary, federal departments and agencies are required to make adoption of NIMS by local and state jurisdictions a condition to receive federal preparedness grants and awards.

The content of this 2026 MHMRP Update is considered to be a viable support tool for any phase of emergency management. The NIMS program is considered as a response function, and information in this 2026 MHMRP Update can support the implementation and update of all NIMS-compliant plans within the planning area.

Presidential Executive Order 11988 – Floodplain Management

Executive Order 11988 requires federal agencies to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. It requires federal agencies to provide leadership and take action to reduce the risk of flood loss, minimize the impact of floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values of floodplains. The requirements apply to the following activities:

- Acquiring, managing, and disposing of federal lands and facilities
- Providing federally undertaken, financed, or assisted construction and improvements
- Conducting federal activities and programs affecting land use, including water and related land resources, planning, regulation, and licensing.

Presidential Executive Order 11990 – Protection of Wetlands

Executive Order 11990 requires federal agencies to provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. The requirements apply to the following activities:

- Acquiring, managing, and disposing of federal lands and facilities
- Providing federally undertaken, financed, or assisted construction and improvements
- Conducting federal activities and programs affecting land use, including water and related land resources, planning, regulation, and licensing. (U.S. National Archives 2016)

All actions identified in this 2026 MHMRP Update will seek full compliance with all applicable presidential executive orders.

U.S. Army Corps of Engineers National Dam Safety Program

The USACE operates and maintains approximately 700 dams nationwide under the National Dam Safety Program (USACE 2025d). It is also responsible for safety inspections of some federal and nonfederal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. The USACE has inventoried dams; surveyed each state and federal agency's capabilities, practices and regulations regarding design, construction, operation and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety. The USACE maintains the National Inventory of Dams, which contains information about a dam's location, size, purpose, type, last inspection, and regulatory status (USACE 2025e).

U.S. Army Corps of Engineers Flood Hazard Management

The USACE has several civil works authorities and programs related to flood risk and flood hazard management:

- The Floodplain Management Services program offers 100% federally funded technical services, such as development and interpretation of site-specific data related to the extent, duration, and frequency of flooding. Special studies—including flood hazard evaluation, flood warning and preparedness, and flood modeling—may be conducted to help a community understand and respond to flood risk.

- For more extensive studies, the USACE offers a cost-share program called Planning Assistance to States and Tribes. Studies under this program generally range from $25,000 to $100,000, with the local jurisdiction providing 50% of the cost.
- The USACE has several cost-share programs (typically 65% federal and 35% nonfederal) aimed at developing, evaluating, and implementing structural and nonstructural capital projects to address flood risks at specific locations or within a specific watershed:
    - The Continuing Authorities Program for smaller-scale projects includes Section 205 for Flood Control, with a $7 million federal limit and Section 14 for Emergency Streambank Protection with a $1.5 million federal limit. These programs can be implemented without specific authorization from Congress.
    - Larger scale studies, referred to as General Investigations, and projects for flood risk management, for ecosystem restoration or for addressing other water resource issues, can be pursued through a specific authorization from Congress and are cost-shared, typically at 65% federal and 35% nonfederal.
    - Watershed management planning studies can be specifically authorized and are cost-shared at 50% federal and 50% nonfederal.

The USACE provides emergency response assistance during and following natural disasters. Public Law (PL) 84-99 enables the USACE to assist state and local authorities in flood-fight activities and cost-share in the repair of flood-protective structures. Assistance is provided in the flowing categories:

- **Preparedness**: The Flood Control and Coastal Emergency Act establishes an emergency fund for preparedness for emergency response to natural disasters; for flood-fighting and rescue operations; for rehabilitation of flood control and hurricane protection structures. Funding for USACE emergency response under this authority is provided by Congress through the annual Energy and Water Development Appropriation Act. Disaster preparedness activities include coordination, planning, training and conduct of response exercises with local, state and federal agencies.
- **Response Activities**: PL 84-99 allows the USACE to supplement state and local entities in flood-fighting urban and other nonagricultural areas under certain conditions (Engineering Regulation 500-1-1 provides specific details). All flood-fight efforts require a project cooperation agreement signed by the public sponsor and the sponsor must remove all flood-fight material after the flood has receded. PL 84-99 also authorizes emergency water support and drought assistance in certain situations and allows for "advance measures" assistance to prevent or reduce flood damage conditions of imminent threat of unusual flooding.
- **Rehabilitation**: Under PL 84-99, an eligible flood protection system can be rehabilitated if damaged by a flood event. The flood system would be restored to its pre-disaster status at no cost to the federal system owner and at 20% cost to the eligible nonfederal system owner. All systems considered eligible for PL 84-99 rehabilitation assistance have to be in the Rehabilitation and Inspection Program prior to the flood event. Acceptable operation and maintenance by the public levee sponsor are verified by levee inspections conducted by the USACE on a regular basis. The USACE has the responsibility to coordinate levee repair issues with interested federal, state, and local agencies following natural disaster events where flood control works are damaged.

All these authorities and programs are available to the County to support any intersecting mitigation actions.

U.S. Fire Administration

There are federal agencies that provide technical support to fire agencies/organizations. For example, the U.S. Fire Administration, which is a part of FEMA, provides leadership, advocacy, coordination, and support for fire agencies and organizations.

U.S. Fish and Wildlife Service

The USFWS fire management strategy employs prescribed fire to maintain early successional fire-adapted grasslands and other ecological communities throughout the National Wildlife Refuge System.

County of Kaua‘i Multi-Hazard Mitigation and Resilience Plan

Appendix H. Risk Assessment Methodology

H. RISK ASSESSMENT METHODOLOGY

Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards. It allows emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. The process focuses on the following elements:

- **Hazard identification:** Use all available information to determine what types of disasters may affect a jurisdiction, how often they can occur, and their potential severity.
- **Vulnerability identification:** Determine the impact of natural hazard events on the people, property, environment, economy, and lands of the region.
- **Cost evaluation:** Estimate the cost of potential damage or cost that can be avoided by mitigation.

The risk assessment for this 2026 Multi-Hazard Mitigation and Resilience Plan (MHMRP) Update evaluates the risk of natural hazards prevalent in the planning area and meets the requirements of the DMA (44 Code of Federal Regulations 201.6(c)(2)).

RISK ASSESSMENT TOOLS

Mapping

A review of national, state, and county databases was performed to locate available spatially based data relevant to this planning effort. Maps were produced using geographic information systems (GIS) software to show the spatial extent and location of identified hazards when such data were available. These maps are included in the hazard profile chapters of this document.

Modeling

Overview

In 1997, the Federal Emergency Management Agency (FEMA) developed the standardized Hazards U.S.-Multi-Hazard (Hazus) model to estimate losses caused by earthquakes and identify areas that face the highest risk and potential for loss. Hazus was later expanded into a multi-hazard methodology, Hazus, with new models for estimating potential losses from hurricanes and floods.

Hazus is a GIS-based software program used to support risk assessments, mitigation planning, and emergency planning and response. It provides a wide range of inventory data, such as demographics, building stock, critical facility, transportation and utility lifeline, and multiple models to estimate potential losses from natural disasters. The program maps and displays hazard data and the results of damage and economic loss estimates for buildings and infrastructure. Its advantages include the following:

- Provides a consistent methodology for assessing risk across geographic and political entities.
- Provides a way to save data so that it can readily be updated as population, inventory, and other factors change and as mitigation planning efforts evolve.
- Facilitates the review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.

- Supports grant applications by calculating benefits using FEMA definitions and terminology.
- Produces hazard data and loss estimates that can be used in communication with local stakeholders.
- Is administered by the local government and can be used to manage and update a hazard mitigation plan throughout its implementation.

Levels of Detail for Evaluation

Hazus provides default data for inventory, vulnerability and hazards; this default data can be supplemented with local data to provide a more refined analysis. The model can carry out three levels of analysis, depending on the format and level of detail of information about the planning area:

- **Level 1:** All of the information needed to produce an estimate of losses is included in the software's default data. These data are derived from national databases and describe in general terms the characteristic parameters of the planning area.
- **Level 2:** More accurate estimates of losses require more detailed information about the planning area. Level 2 estimates of losses can include detailed information such as local geology, hydrology, hydraulics, and building inventory as well as data about utilities and critical facilities. This information is needed in a GIS format. All Hazus analyses conducted for the 2026 MHMRP Update were Level 2 analyses.
- **Level 3:** This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize the analysis for the planning area.

RISK ASSESSMENT APPROACH

The risk assessments in this 2026 MHMRP Update describe the risks associated with each identified hazard of concern. Each chapter describes the hazard, the planning area's vulnerabilities, and probable event scenarios. The following steps were used to define the risk of each hazard:

- **Identify and profile each hazard**—The following information is given for each hazard:
  - A summary of past events that have impacted the planning area
  - Geographic areas most affected by the hazard
  - Event frequency estimates
  - Severity descriptions
  - Warning time likely to be available for response
- **Determine exposure to each hazard**—Exposure was determined by overlaying hazard maps with an inventory of structures, facilities, and systems to determine which of them would be exposed to each hazard.
- **Assess the vulnerability of exposed facilities**—The vulnerability of exposed structures and infrastructure was determined by interpreting the probability of occurrence of each event and assessing structures, facilities, and systems that are exposed to each hazard. Tools such as GIS and Hazus were used to perform this assessment for the dam failure, flood, earthquake, tropical cyclone, and tsunami hazards. Outputs similar to those from Hazus were generated for other hazards, using maps generated through GIS.

Hazard Profile Development

Hazard profiles were developed through research and review of previously developed reports and plans, including county and community plans plus state and local hazard mitigation plans. Frequency and severity indicators include past events, anticipated future conditions, and the expert opinions of emergency management specialists and other subject matter experts.

Each hazard profile consists of the following:

- **Description:** Information about the hazard
- **Past Events:** Hazard events that occurred since the last recorded event in the 2021 MHMRP Update for each hazard through December 31, 2024. The date that data collection ended in the 2021 MHMRP Update differed by hazard, and this approach was employed to capture all events that occurred over the past 5 years. Additionally, notable events that occurred outside of this time period or outside county boundaries were included.
- **Location:** Where the hazard is anticipated to occur throughout the planning area
- **Frequency:** How often the hazard has occurred and how often it will likely continue to occur
- **Severity:** Range or scale of the magnitude (or severity) of the hazard or that could realistically be experienced within the planning area
- **Climate Change and Future Conditions:** Likely impacts of climate change on the hazard and how this will affect the hazard’s impact to Kaua‘i

The method used to determine the number of past events since the 2021 MHMRP Update planning period was to begin recording events after the last recorded date of a hazard event in the 2021 MHMRP Update. This means the date data collection began differed slightly by hazard. This approach was taken over selecting a single start date for data collection to ensure all events were captured. Based on this approach, the number of years since the last recorded event in the 2021 MHMRP Update for each hazard was used to determine the likely number of events expected to occur each year. This represented the probability of future events. Data collection ended for all hazard events on December 31, 2024, with the exception of notable events that occurred after this time during the development of the 2026 MHMRP Update. For example, one high-wind event fitting this description occurred in January 2025; this event is included in Section 6, Tropical Cyclones and Other High Winds.

Exposure and Vulnerability

Dam Failure, Earthquake, Flood, Tropical Cyclone, and Tsunami

The following hazards were evaluated using Level 2 Hazus analyses for the general building stock and critical facilities exposed to each hazard:

- **Dam Failure:** An analysis was performed to estimate the damage that would result from a flood. Hazus uses predefined relationships between flood depth at a structure and resulting damage, with damage given as a percent of total replacement value. Curves defining these relationships have been developed for damage to structures and for damage to typical contents within a structure. By inputting flood depth data and known property replacement cost values, dollar-value estimates of damage were generated.
- **Earthquake:** An analysis was performed to assess earthquake exposure and vulnerability for the 500-year probabilistic earthquake.

- **Inland Flooding (including coastal flooding):** An analysis was performed using the same flood methodology as for dam failure. Current flood mapping for the planning area was used to delineate flood hazard areas and estimate potential losses from the 1% annual chance and 0.2% annual chance flood events.
- **Tropical Cyclone and Other High Winds:** An analysis was performed to assess tropical cyclone wind and storm surge exposure and vulnerability for a Category 4 event with a storm track crossing the island from the southwest to the northeast.
- **Tsunami:** An analysis was performed to assess tsunami exposure and vulnerability. Tsunami inundation area mapping for the planning area was used to estimate potential losses.

Wildfire, Landslide, High Surf, and Sea Level Rise

For wildfire, landslide, high surf, and sea level rise, historical data were generally not adequate to model future losses. However, areas and inventory susceptible to wildfires, landslides, and sea level rise were mapped via GIS without the use of Hazus, and their exposure was evaluated. No data were available that specifically modeled the high surf hazard, though coastal flooding models consider high wave action and capture a significant amount of the area exposed to this hazard.

Heat and Drought

The risk assessment methodologies for most hazards in this 2026 MHMRP Update included damage to structures. Because data on the drought and heat impact to structures were not readily available, the risk assessments for these two hazards were more limited and qualitative.

SOURCES OF DATA USED IN VULNERABILITY ASSESSMENT

Building and Cost Data

Replacement cost values derived from tax assessor parcel and residential and commercial building data from the County of Kauaʻi (County) were input into Hazus for the 2021 MHMRP Update. The resulting dataset was provided by the County for use in this 2026 MHMRP Update. This dataset was used in the vulnerability assessment for all applicable hazards that could not be analyzed in Hazus. The hazards analyzed through Hazus used the Hazus general building stock to estimate all other exposure and losses in the county. An inventory of critical facilities provided by the County was also used to determine exposure to both Hazus and non-Hazus analyzed hazards.

The building data used included replacement costs, which is the cost to replace the entire structure with one of equal quality and utility. Replacement cost is based on industry-standard cost estimation models published in *Square Foot Costs with RSMeans Data* (Gordian 2020). It is calculated using the RSMeans square foot cost for a structure, which is based on the Hazus occupancy class (i.e., multi-family residential or commercial retail trade), multiplied by the square footage of the structure from the tax assessor data. The construction class and number of stories for single-family residential structures also factor into determining the square foot costs. While this was the data available, the Steering Committee noted that the replacement values were likely significantly underestimated.

It is significant to note that replacement values are derived from tax assessor's data. The Kauaʻi County Assessor's Office does not have data on the value of government facilities; therefore, replacement values for critical facilities are not available and are not included in the vulnerability assessment. Critical facilities exposed to each hazard are still presented despite monetary loss estimates being unavailable.

Additionally, Hazus models the percentage of each facility likely to be damaged during a given hazard scenario for some hazards. These results are presented in Part 2, Risk Assessment where available.

Hazus Data Inputs

The following hazard data sources were used for the analyses conducted for the risk assessment:

- **Dam failure:** Dam failure inundation area data were provided by the State of Hawai'i Department of Land and Natural Resources (DLNR). Using the inundation area boundaries and a 1/9th ArcSecond U.S. Geological Survey (USGS) digital elevation model (DEM), inundation depth grids were generated and integrated into the Hazus model. Depth grids were generated for the dam failure inundation areas and combined into one depth grid for analysis purposes.
- **Earthquake:** Earthquake probabilistic data prepared by the USGS were used for the analysis of this hazard.
- **Flood:** The effective Digital Flood Insurance Rate Maps (DFIRM) for the planning area, replaced with the preliminary DFIRM data where applicable, was used to delineate flood hazard areas and estimate potential losses from the 1% annual chance and 0.2% annual chance flood events. The DFIRM is effective as of November 26, 2010, with Letters of Map Revision (LOMRs) as September 8, 2016, incorporated. The preliminary DFIRM is dated May 25, 2019. Using the DFIRM floodplain boundaries and the 3-meter project DEM, flood depth grids were generated and integrated into the Hazus model.
- **Tropical cyclone (wind):** Category 4 wind field import files provided by the Pacific Disaster Center were used for the analysis of this hazard. The wind field files were created for the Hawai'i Catastrophic Hurricane Plan.
- **Tsunami:** Tsunami inundation area data was provided by the County. The data was created for the 2009 Hawai'i Tsunami Mapping Project. The maximum flow depth area was computed from the 1946 Aleutian, 1952 Kamchatka, 1957 Aleutian, 1960 Chile and 1964 Alaskan Tsunamis simulated at both mean sea level (MSL) and high tide conditions.

Other Local Hazard Data

Locally relevant information on hazards was gathered from a variety of sources. Frequency and severity indicators include past events and the expert opinions of geologists, emergency management specialists, and others. Data sources for specific hazards were as follows:

- **Climate change:** Sea level rise data compiled for the Hawai'i Sea Level Rise Vulnerability and Adaptation Report were used for the exposure analyses. The Sea Level Rise Exposure Area (SLR-XA) 3.2-foot scenario represents future chronic coast flooding. The 1% annual chance Coastal Flood Zone + 3.2-foot SLR scenario represents event-based coastal flooding plus sea level rise.
- **Landslide:** The USGS landslide susceptibility dataset was used to determine the areas where landslides are likely to occur. This dataset is a model that estimates landslide susceptibility based on past landslide events and the topography of an area. Susceptibility classes are based on the USGS Slope-Relief Threshold Landslide Susceptibility Models for the United States and Puerto Rico (Belair et al. 2024). The nonlinear model (n10) was used. The model measures landslide susceptibility by determining the number of 10-square-meter (m^2) cells susceptible to landslides within a larger 90-m^2 cell with a range from 0 to 81. For instance, a value of 40 would indicate that 40 of the 10-m^2 cells within the larger 90-m^2 cell are susceptible to landslides. While landslides can occur in cells with susceptible terrain, those with the highest concentration

(or number of cells) capture the majority of landslides, thus representing higher susceptibility areas. A cell count of 0 represents a cell with no chance of landslides. Mirus et al. (2024) was used to determine how to assign landslide susceptibly levels; 90-m^2 cells with a 10-m^2 cell count of 1 to 15 were assigned a classification of relatively Low. Remaining classifications were as follows: Moderate (16 to 31 10-m^2 cells), High (32 to 47 cells), Higher (48 to 63 cells), and Highest (64 to 81 cells). The specific cut-offs for each classification are arbitrary to some degree, as data are not available to determine which cell cut-offs constitute each level of susceptibility (Mirus et al. 2024). Additionally, the Moderate classification was limited to less than or equal to 31 to reflect a precautionary approach to measuring landslide susceptibility.

- **Tropical cyclone (storm surge):** Sea, Lake, and Overland Surges from Hurricane (SLOSH) data provided by the National Oceanic and Atmospheric Administration (NOAA) were used for the exposure analysis. The data consist of the maximum of maximums for a Category 4 hurricane and were created by running multiple analyses for hurricanes approaching from different directions and retaining the highest value at a given location. The storm surge inundation is from wave action and does not include freshwater inundation.
- **Wildfire:** The layer used for the Communities at Risk from Wildfire (CARW) was the same layer used in the Kaua'i Climate Adaptation and Action Plan (KCAAP; County of Kaua'i 2025d). This layer is largely the same as the CARW produced by DLNR Division of Forestry and Wildlife (DOFAW) and the Hawai'i Wildfire Management Organization (HWMO) with a few minor differences. The data were categorized as fire risk ratings of high, medium, and low using the CARW map. High and medium categories were used for the exposure analysis.

Social Vulnerability

Vulnerability to each hazard was broken out into sections for people, property, critical facilities, and the environment, with social vulnerability discussed in detail for each hazard. Social vulnerability data used in the 2026 MHMRP Update came from the social vulnerability index (SVI) developed for the KCAAP. This dataset was developed through a review of social vulnerability metrics to determine a set of indicators that would accurately reflect the unique factors impacting social vulnerability in Kaua'i (County of Kaua'i 2022b).

The SVI produced for the KCAAP was overlaid with the exposure areas for each hazard to qualitatively assess where high levels of social vulnerability intersected areas of hazard exposure. Where applicable, the likely severity of the hazard event was factored into this analysis. For instance, medium and high wildfire risk zones were analyzed in conjunction with high social vulnerability, but low wildfire risk zones were not considered in the analysis. This analysis reflected a similar analysis conducted in the KCAAP for the hazards that were examined in that plan (i.e., wildfires, flooding, landslides, and sea level rise). It also expanded upon the analysis conducted in the KCAAP to include the additional hazards discussed in this 2026 MHMRP Update (i.e., Tropical Cyclones and Other High Winds, Tsunamis, Dam Failure, Earthquake, Drought, and Heat).

The identification of areas where hazards pose a large threat due to the intersection of high social vulnerability and hazard exposure areas was followed by a discussion of how social vulnerability may impede the ability of a community to mitigate or respond to a given hazard. This discussion was broken down by the four social vulnerability categories used in the SVI and their indicators:

- **Household characteristics:** Percent age 65 or older and age 17 or younger, percent with any disability
- **Socioeconomic status:** Percent age 35 or older with less than a bachelor's degree, percent of households with income below $75,000, and percent of outdoor workers

- **Race and ethnicity:** Percent population identifying as Native Hawaiian or Pacific Islander, percent with linguistic isolation (speak English less than well)
- **Physical conditions:** Percents of renter-occupied housing units, rent-burdened households, pre-1970 housing, mobile homes, no vehicle households

Each category and indicator are discussed under Social Vulnerability for each hazard. While many factors shape the social vulnerability of a community, these were the focus of the social vulnerability analysis for the 2026 MHMRP Update. For more information on how the SVI was developed for the KCAAP, please see Appendix A in the Vulnerability and Equity Analysis component of the KCAAP.

Data Source Summary

Table H-1 summarizes the data sources used for the risk assessment for this 2026 MHMRP Update.

Table H-1. Hazus Model Data Documentation

Data	Source	Date	Format
Property parcels	County of Kaua'i	2020	Digital (GIS)
Residential and commercial real property data (including use description, square footage, year built, number of stories, and foundation type)	County of Kaua'i	2020	Digital (text)
Building footprints	County of Kaua'i	2020	Digital (GIS)
Building replacement cost	Gordian (updated RSMeans values)	2020	Digital (text)
American Community Survey 5-year Population Estimates at the Census block group level	U.S. Census Bureau (U.S. Census Bureau 2025b)	2023	Digital (GIS)
Kaua'i General Plan land use	County of Kaua'i	2018	Digital (GIS)
Kaua'i General Plan land use	County of Kaua'i (County of Kaua'i 2025m)	2025	Digital (GIS)
Sea Level Rise Exposure Area (SLR-XA) 3.2-foot	Hawai'i Statewide GIS Program (Tetra Tech 2022)	2022	Digital (GIS)
1%-Annual-Chance Coastal Flood Zone + 3.2-foot SLR	Hawai'i Sea Level Rise Vulnerability and Adaptation Report (Hawai'i Climate Change Mitigation and Adaptation Commission 2017)	2017	Digital (GIS)
Dam failure inundation areas	DLNR (Dam Safety Unit Engineer 2025)	2009	Digital (GIS)
Probabilistic earthquake data	Hazus 6.1 (FEMA 2025a)	2019	Digital (GIS)
Effective DFIRM	FEMA (FEMA 2021b)	2021	Digital (GIS)
Landslide susceptibility	USGS (Belair et al. 2024)	2020	Digital (GIS)
Hazus wind field import files for the Hawai'i Catastrophic Hurricane Plan	Pacific Disaster Center	2015	Hazus import
SLOSH model data for the state of Hawai'i	NOAA National Hurricane Center, Storm Surge Unit	2018	Digital (GIS)
2009 Hawai'i Tsunami Mapping Project tsunami inundation areas	University of Hawai'i	2013	Digital (GIS)
Communities at Risk from Wildfire	Provided by County of Kaua'i from the KCAAP and originally developed by HWMO in conjunction with DLNR DOFAW (County of Kaua'i 2022c)	2022	Digital (GIS)
Coastal 3-meter DEM	NOAA Office for Coastal Management	2013	Digital (GIS)

Data	Source	Date	Format
1/9th ArcSecond USGS DEM	Available from USGS and created by NOAA (NOAA 2023c)	2020	Digital (GIS)
Makani Pahili 2017 Emergency Power Prioritization Workshop Series Final Report (critical facilities including airports, animal shelters, banks, communications sites, community health care facilities, emergency medical services, extended care facilities, fire stations, food banks, dialysis centers, liquefied natural gas storage, motor vehicle fueling stations, petroleum product bulk terminals and offices, public health agencies, radio/TV stations, treatment centers, and waste water treatment plants.)	Hawai'i Emergency Management Agency (HI-EMA)	2017	Digital (GIS)
County civic facilities (Critical facilities including police stations, fire stations, civic facilities, base yards and maintenance shops, post offices, schools, neighborhood centers, hospitals, airports, boat harbors, county parks, and landfill/transfer stations.)	County of Kaua'i	2020	Digital (GIS)
Street addresses for various critical facilities (Including community healthcare facilities, correction institutions, extended care facilities, hospice facilities, treatment centers, urgent care centers, and utility administrative offices)	County of Kaua'i	2020	Digital (text)
Electric power facilities	County of Kaua'i	2020	Digital (GIS)
Waste water treatment plants	County of Kaua'i	2019	Digital (GIS)
Water pumps	County of Kaua'i	2020	Digital (GIS)
Water tanks	County of Kaua'i	2020	Digital (GIS)
Wells	County of Kaua'i	2020	Digital (GIS)
Waste water pump stations	County of Kaua'i	2006–2015	Digital (GIS)
Bridges	State of Hawai'i Office of Planning	2018	Digital (GIS)
Facility Registry Service–Toxic Release Inventory facilities	U.S. Environmental Protection Agency	2020	Digital (GIS)

LIMITATIONS

Loss estimates, exposure assessments and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct a study
- Incomplete or outdated inventory, demographic or economic parameter data
- The unique nature, geographic extent and severity of each hazard
- Mitigation measures already employed
- The amount of advance notice residents have to prepare for a specific hazard event

These factors can significantly affect loss estimates. Therefore, potential exposure and loss estimates are approximate and should be used only to understand relative risk. Over the long term, Kaua'i County will collect additional data to assist in estimating potential losses associated with other hazards.

HAZARD SCREENING FORM

The Hazard Screening Tool used by the planning team to determine the hazards included in the 2026 MHMRP Update is shown below.

Multi-Hazard Mitigation and Resilience Plan

Kaua‘i County Hazard Screening Tool

Please enter your name, community or organization you represent, and email/phone number.

* Required

1. Name: *

2. Community or organization you represent:

3. Email:

4. Phone number:

5. **Please rank the following in order of importance.** *

- Tropical Cyclones and Other High Winds
- Wildfire
- Inland Flood
- High Surf, Coastal Flood, and Erosion
- Tsunami
- Landslide
- Dam Failure
- Earthquake
- Drought
- Heat

6. **If you have any additional hazards that should be considered, please list them here. Also include where they should fall in the ranking above.**

7. **Would you prefer Heat and Drought be profiled together or independently?** *

- ◯ Keep them together as one hazard
- ◯ Split them up into two separate hazards

This content is neither created nor endorsed by Microsoft. The data you submit will be sent to the form owner.

Microsoft Forms

County of Kaua‘i Multi-Hazard Mitigation and Resilience Plan

Appendix I. Hazard Profile Details

I. HAZARD PROFILE DETAILS

WILDFIRE

Hazard Description

Wildfires pose a threat to people, property, infrastructure, and natural and cultural resources in Kauaʻi County. National Oceanic and Atmospheric Administration (NOAA) identifies four types of wildfires which are based on position relative to the ground (Figure I-1):

- **Ground wildfires:** These wildfires burn in natural litter, duff, roots, or sometimes high-organic soils. Once they start, they are very difficult to detect and control. In addition, ground fires may rekindle.
- **Surface wildfires:** These wildfires burn in grasses and low shrubs (up to 4 feet tall) or in the lower branches of trees. Surface wildfires may move rapidly, and the ease of control depends upon the fuel involved.
- **Crown wildfires:** These wildfires burn on the tops of trees. Once started, they are very difficult to control since wind plays an important role in their spread.
- **Spotting wildfires:** These wildfires occur when large burning embers are thrown ahead of a crown fire by wind and atmospheric conditions. Once spotting begins, the wildfire is very difficult to control.

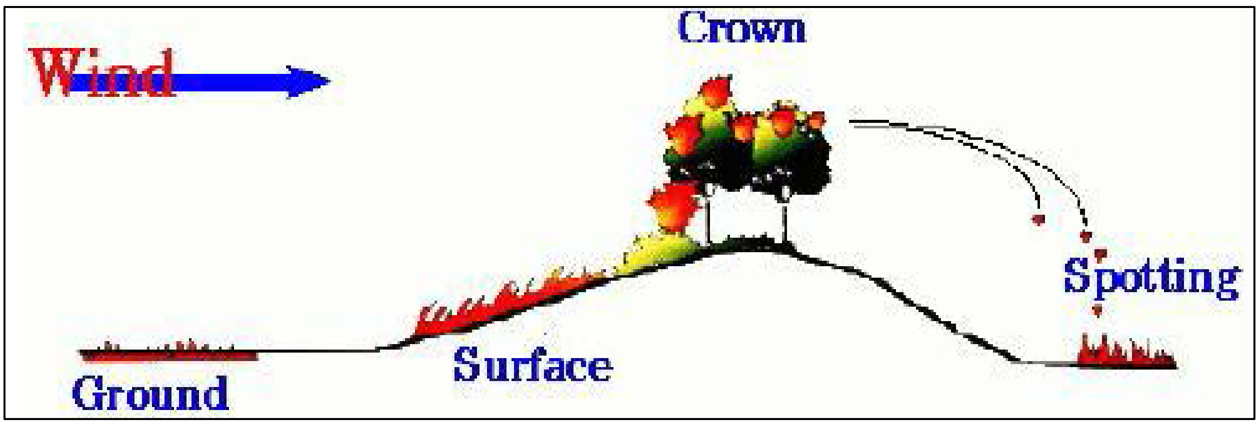


Figure I-1. Types of wildfires (County of Maui 2015).

The National Wildfire Coordinating Group (NWCG) provides some useful additional wildfire-related definitions based on location, severity, or purpose (NWCG 2025):

- **Wildland fires:** Wildland fires are fueled by vegetation and natural fuels, and do not include structure fires. Prescribed burns and wildfires are both types of wildland fires.
- **Wildland Urban Interface (WUI) fires:** These are fires that occur where the built environment meets or is interspersed with undeveloped areas, which often contain some amount of vegetative fuels.

- **Firestorms:** Firestorms consist of intense fire activity over a large area, resulting in convection. Firestorms also tend to have strong indrafts around the fire's perimeter. These events are violent and destructive.
- **Conflagration:** Conflagrations are intense, destructive fires that generally have a moving front. The destructive 2023 Lahaina wildfires are an example of an urban conflagration (Kerber & Alkonis 2024).
- **Prescribed fires and natural burns:** A prescribed fire is a wildland fire that is intentionally set in line with relevant laws, policies, and regulations to accomplish a given purpose, which is often to reduce the risk of wildland fires occurring in the future under more dangerous conditions.

Hazard Profile

Past Events

Table I-1 lists recorded wildfire events in Kauaʻi County between 2011 and 2024. Events prior to 2020 were recorded in the 2021 MHMRP Update (Tetra Tech 2021) and have not been included in the 2026 MHMRP Update. For wildfire events since 2020, only those that burned more than 20 acres or were included in a state emergency proclamation are included in Table I-1. The cutoff of 20 acres was chosen as wildfires greater than 20 acres exceed the Kauaʻi Fire Department's (KFD's) normal response.
In addition to the wildfires listed in this table, an average of about 225 brushfires smaller than 20 acres have occurred per year since 2020.

Table I-1. Significant Wildfires in Kauaʻi County, 2011–2024

Date Started	Area	Acres Burned*	Impacts†
08/17/2011	Kōloa	50	Dry brush burned; 2 homes burned, 3 damaged, 8 people left homeless
05/28/2012	Na Pali-Kona Forest Reserve	40	Dry grass and slash pine burned
06/25/2012	West of Waimea Canyon State Park	650	Dry brush and eucalyptus burned
08/17/2012	Near Kekaha	3,000	Dry brush burned; power poles destroyed
09/21/2013	Near Wailua	42	Brush burned
12/22/2014	Near Anahola	25	Dry brush burned; residents evacuated
03/23/2015	Waimea Canyon Drive	200	Dry brush burned
03/31/2015	Kōloa	100	Dry brush burned
05/19/2015	Hanamāʻulu	70	Dry brush burned
06/05/2015	Pōkiʻi Ridge	400	Dry brush burned
07/18/2015	Behind Līhuʻe Airport	40	Brush burned; diverted 3 flights to Honolulu
05/15/2017	Above Waimea town	750	Dry grass and shrubs burned
09/24/2017	Near Poʻipū	215	Dry brush burned; base-yard machinery, trucks, and equipment damaged
09/25/2017	Makana Mountain	100	Dry brush and vegetation burned
06/11/2019	Near Poʻipū	500	Dry brush burned; residents evacuated; roads closed
05/04/2020‡	Kukuihale Rd and Pilipoli	40	N/A
09/07/2020‡	Area Makai of Līhuʻe Airport	400	N/A

Date Started	Area	Acres Burned*	Impacts†
10/26/2021‡	Kūhiō Highway south of Anahola	40	N/A
10/27/2021‡	Anahola vicinity of mile marker 12 on Kūhiō Highway	40	N/A
06/04/2022‡	Glass Beach Cemetery	25	N/A
08/20/2022‡	Previous burn area behind Ehukai Road	25	N/A
06/25/2023‡	Waimea Canyon Drive at mile marker 3	30	N/A
06/13/2024‡	Waimea Canyon Drive near mile marker 2	500	N/A
07/11/2024 ‡ §	West Kaua’i; Pacific Missile Range	0.10*	N/A
7/11/2024 §	West Kaua‘i	3–5*	N/A
07/15/2024 ‡ § ¶ #	Between Hanapēpē and Kaumakani	1,100	Dry vegetation burned; residents evacuated; roads closed; preventive power outage; one structure destroyed;† ‡ $50,000 in property damage reported§
07/16/2024‡	Kaumuali‘i Highway past mile marker 17	1,000	N/A
7/18/2024 ‡ §	Near Kōke‘e Road in the direction of Waimea	1,500	$20,000 in property damage reported§
09/18/2024	Near Keālia and Hauaala Roads	25	N/A
09/19/2024	Mauka of Haena	25	N/A

* Wildfires under 20 acres are not included in the table unless referenced in a state emergency proclamation

† No injuries or fatalities were associated with the listed events that occurred since the 2021 MHMRP Update.

‡ Kaua‘i Fire Department Chief (2025)

§ State of Hawaii Office of the Governor (2024)

¶ NOAA (2025c)

Hawaii News Now (2024)

Detailed accounts of several of the 2024 wildfire events, provided by the KFD Chief, are presented below (Kaua‘i Fire Department Chief 2025).

On June 13, 2024, the Waimea Canyon Drive brushfire ignited 300 acres of brush (fallow), which exceeded the KFD’s resources. Waimea Canyon Drive was shut down by the Kaua‘i Police Department (KPD) while KFD conducted ground and air operations. KFD, with the assistance of the Kaua‘i Emergency Management Agency (KEMA), coordinated resource ordering for the incident out of the emergency operating center. Total accompaniment of resources included four Type 1 fire engines, two brush trucks (300-gallon capacity), two water tenders (3,000-gallon capacity), three helicopters, and four bulldozers. The fire was originally reported at 3:00 a.m. and was completely extinguished 1 day later at 7:00 p.m. No evacuations were ordered for the area, and property loss was listed as $0 (fallow pastureland).

On July 15, 2024, the Hanapēpē Heights brushfire ignited 1,100 acres of brush (fallow), which exceeded KFD’s resources. Kaumuali‘i Highway (the only access road between Hanapēpē and Waimea) was shut down by KPD in both directions while KFD conducted ground and air operations. The Kaumakani community was evacuated as fire encroached upon the neighborhood (evacuees were directed to shelters or other safe areas). Evacuations were done by KPD and Gay/Robinson representatives, as well as the

Kauaʻi Humane Society. Power throughout the area was shut down by the Kauaʻi Island Utility Cooperation (KIUC). Resource ordering was done through KEMA and included six Type 1 fire engines, six brush trucks, seven helicopters, four bulldozers, four water tenders, one refueling tender, Salvation Army, State Department of Education, Department of Forestry and Wildlife, and the Kauaʻi Humane Society. The fire was originally reported at 12:00 p.m. and was completely extinguished by 12:00 p.m. the following day. Property loss for this brushfire included six utility poles and a garage shed that was destroyed. Rough estimates for property loss totaled approximately $50,000. The fire was attributed to an accidental ignition due to a mechanical malfunction.

On July 16, 2024, the Kapaʻa Bypass brushfire ignited 10 acres of brush (fallow/invasive species), which exceeded KFD's resources due to difficult terrain to access the fire. The Kapaʻa Bypass was shut down for approximately 3 hours by KPD as KFD conducted ground and air operations. Kapaʻa Middle School was evacuated as it was in direct line with the prevailing fire. Fire engines as well as water tenders were strategically placed to protect the school. Resource ordering was done through KEMA and included three Type 1 fire engines, three brush trucks, five water tenders, and two helicopters. The fire was reported at 12:00 p.m. and was completely extinguished at 4:00 p.m. the same day. The fire was attributed to an accidental ignition due to a mechanical malfunction. The total property loss was $0.

On July 18, 2024, the Kōkeʻe Road brushfire ignited 1,600 acres of brush (fallow/heavy timber), which exceeded KFD's resources and took 4 days to completely extinguish. Evacuations and road closures were conducted by KPD and the National Guard, including shutting off both access routes to Kōkeʻe State Park. Resource ordering was done through KEMA and included 7 Type 1 fire engines, six brush trucks, six water tenders, seven helicopters, one refueling tender, and six bulldozers. The fire was extremely difficult to contain because of the topography of the land with many deep valleys. Infrastructure was also threatened, including National Guard tracking stations, water tanks, electrical poles and lines, and the cabins at Kōkeʻe State Park. The total property loss was approximately $20,000 for four utility poles damaged by fire. Arson was the suspected cause of this fire.

Location

Wildfire potential varies with location based on the following factors:

- **Fuel:** Fuel may include living and dead vegetation on the ground, along the surface as brush and small trees, and above the ground in tree canopies. Lighter fuels such as grasses, leaves and needles quickly expel moisture and burn rapidly, while heavier fuels such as tree branches, logs and trunks take longer to warm and ignite. Trees killed or defoliated by forest insects and diseases are more susceptible to wildfire.
- **Weather:** Relevant weather conditions include temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount and duration, lightning, and the stability of the atmosphere. Strong, dry winds produce extreme fire conditions. Such winds generally reach peak velocities during the night and early morning hours.
- **Terrain:** Topography includes slope and elevation. The topography of a region influences the amount and moisture of fuel; the impact of weather conditions such as temperature and wind; potential barriers to fire spread, such as highways and lakes; and elevation and slope of landforms (fire spreads more easily uphill than downhill).

Steep slopes, rough terrain, difficult access, and an increase of nonnative high fire-intensity plants, coupled with warm weather, recurring droughts, changes in land use, and a history of human-caused fires puts the county at risk of wildfire (Hawaiʻi Wildfire Management Organization [HWMO] 2016).

HWMO has developed mapping of Communities at Risk from Wildfire (CARW), which was used for the wildfire risk assessment. CARW maps delineate communities that share similar environmental conditions, land use characteristics, fuel types, hazards, and general wildfire issues. They provide ratings to characterize generalized hazards in each area. The State of Hawaiʻi Department of Land and Natural Resources (DLNR) has developed streamlined community boundaries for its CARW maps. Figure I-2 shows the original 2013 CARW map for Kauaʻi County. Section 5, Wildfire: Figure 5-2 presents a 2022 version of the map with minor updates to the community boundaries and risk ratings.

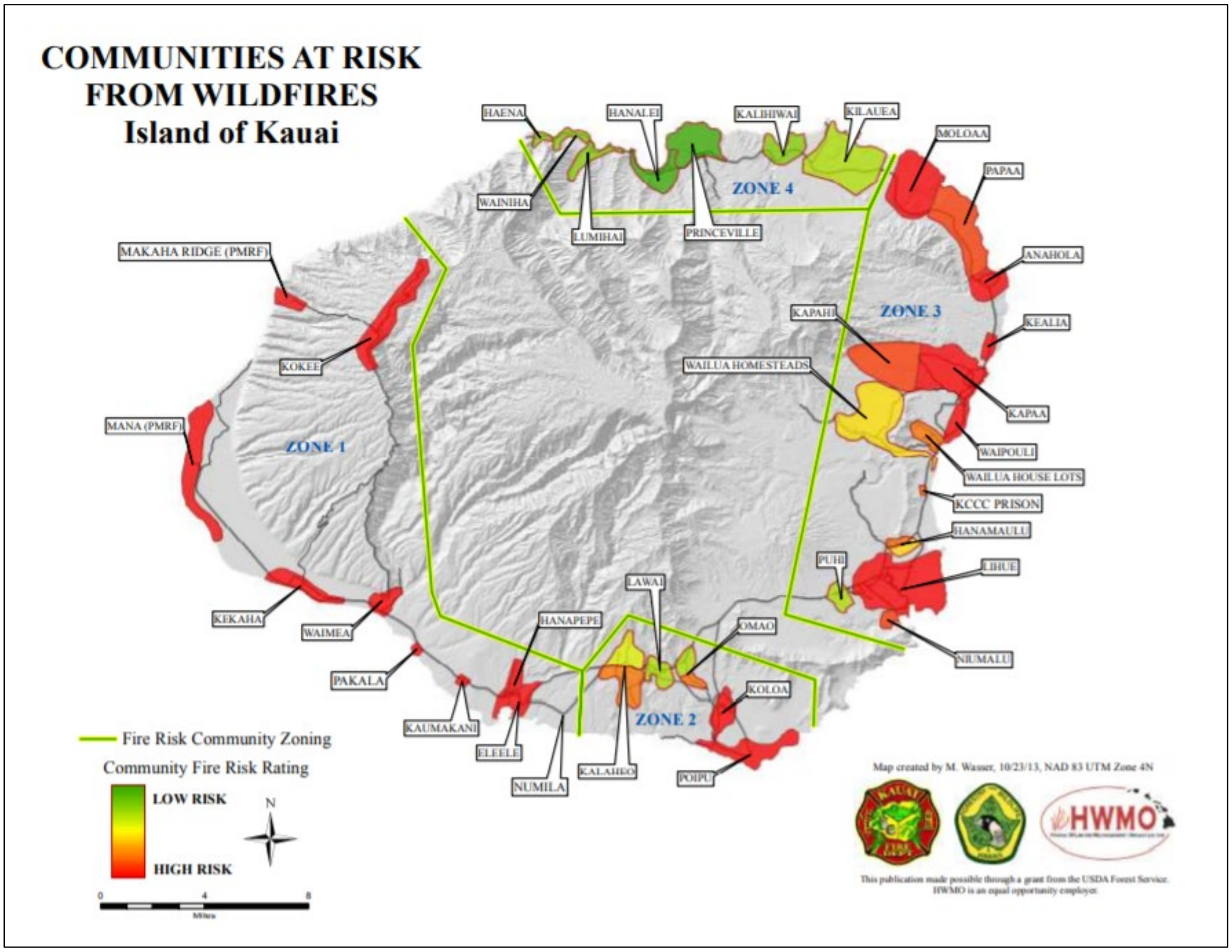


Figure I-2. Communities at risk from wildfire (HWMO 2016).

Frequency

Naturally occurring wildfires are most likely in dry periods. In Hawaiʻi, the fire season typically consists of the dry months of April through October. However, periods of drought can extend the season. According to government authorities, humans caused the highest percentage of wildfires in Kauaʻi County either accidentally or intentionally, especially near developments and power line rights-of-way, and along roadsides. Sprawling dray nonnative grasslands surround many communities. Wildfires are usually extinguished while smaller than 1 acre but can spread to thousands of acres.

The frequency with which wildfires occur in Kauaʻi County was determined by first breaking wildfires into a smaller and a larger category. The cutoff for this decision was 20 acres as fires larger than this exceed the KFD normal response. The frequency of wildfire events was then calculated as the average number of small and large wildfire events per year that have occurred in the period since the 2021 MHMRP Update. This was compared to the frequency spanning back to 2011 (the period covered by the 2021 MHMRP Update) for larger wildfires, but data earlier than 2020 were not available for smaller wildfires.

A limitation in this frequency calculation is that data are not available to quantitatively predict the frequency with which wildfires are likely to occur in future years due to climate change. Wildfire frequency is tied to drought frequency. As droughts become more common in the county due to climate change, the frequency of wildfires is likely to increase. For this reason, estimates of drought frequency based on prior occurrences are likely to underestimate the frequency of future events.

Severity

The CARW mapping originally produced by HWMO rates wildfire risk for communities. The CARW maps were originally created in 2013 with slight modifications made since then. The data reported in this 2026 MHMRP Update are from the 2022 iteration of the map for Kauaʻi used in the Kauaʻi Climate Adaptation and Action Plan (KCAAP). The map shows that risk ratings across the county range from low to high.

The severity of wildfires in the county was also examined for the 2026 MHMRP Update through the damage caused by and spatial extent of past wildfire events. Acreage burned, property damage, injuries, and fatalities were considered in determining the severity of wildfires that may occur in the county. The 2023 Maui Wildfires, though not occurring in Kauaʻi County, warranted inclusion in the examination of wildfire severity due to their unprecedented magnitude and damages along with the potential for a similar wildfire to occur on Kauaʻi.

Similar to frequency, climate change is likely to impact the severity of wildfire events. This poses a limitation in assessing severity as past events cannot account for changing future conditions, and data are not currently available to analyze how future conditions will impact severity quantitatively.

Warning Time

Since the 2021 MHMRP Update, the County of Kauaʻi (County) has updated its wildfire mitigation strategy to incorporate improved forecasting capabilities and communication systems to better prepare for and respond to fire threats. With assistance from the National Weather Service (NWS), the County monitors dry lightning and severe weather forecasts, which can provide 24 to 48 hours of advance warning. This window enables the KEMA and firefighting services to alert communities, stage resources, institute severity staffing, and prepare for potential evacuations. Technological advancements such as satellite burn monitoring and enhanced two-way radio communication have further improved the County’s ability to detect and respond to wildfires quickly and efficiently.

Ongoing coordination between KEMA, fire departments, KPD, the County Public Works Department, state agencies, and nongovernment organizations ensures that drought and fire hazard conditions are continuously assessed. In times of elevated risk, measures such as burn bans and activity restrictions are enacted and communicated through multiple platforms including radio, news outlets, social media, and digital channels. KEMA is also integrating an automated alert systems and community-based response plans to support rapid evacuation when needed. These proactive steps reflect the County’s continued commitment to protecting life, property, and natural resources through updated, data-driven wildfire mitigation efforts.

TROPICAL CYCLONE AND OTHER HIGH WINDS

Hazard Description

Wind Pressure

Wind is one of the costliest hazards to insured property, causing more damage than earthquakes or other natural hazards. Wind pressure, not wind speed, is the primary cause of damage. There are three types of wind pressure:

- **Positive wind pressure** is the direct pressure from the force of the wind pushing inward against walls, doors and windows.
- **Negative wind pressure** occurs on the sides and roof of buildings as wind blows past. Air moving parallel to a surface reduces the air pressure on the surface, resulting in a force pulling the surface outward toward the moving air. Negative pressure causes buildings to lose all or a portion of their roofs and side walls and pulls storm shutters off the leeward side of a building (the side sheltered from wind).
- **Interior pressure** increases dramatically when a building loses a door or window on its windward side. The roof is placed under tremendous internal pressures pushing up from inside of the building together with the negative wind pressure lifting the roof from the outside.

Besides the high wind pressures exerted on structures during windstorms, and especially during tropical cyclones, windborne debris can be a major factor in causing damage. Debris includes flying objects such as tree limbs, outdoor furniture, signs, roofs, gravel, and loose building components.

Wind Speed

Wind speeds vary with height above ground—the higher the elevation, the stronger the wind. Figure I-3 shows the average wind speed for Kaua‘i County at 50 meters (165 feet) above the ground. Wind forces increase proportionally to the wind speed squared, so any increase in wind speed may significantly increase its effects.

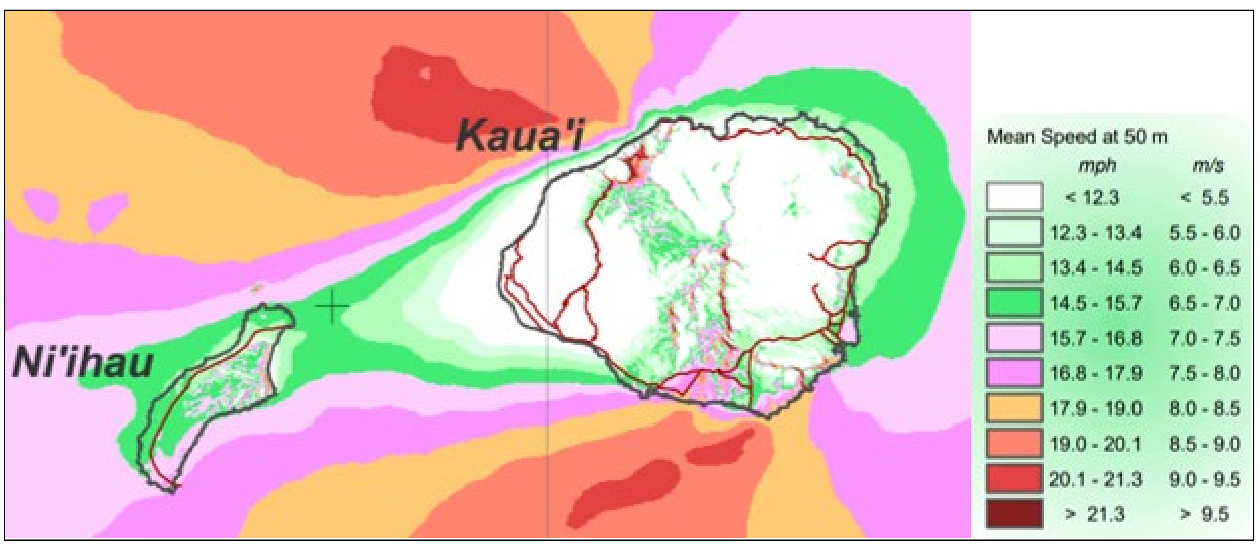


Figure I-3. Average wind speed at 50 meters above the ground (Hawaiian Electric Company 2004).

There are many ways to measure wind speed:

- **Fastest-mile wind speed** is the highest recorded speed during a time interval in which one mile of wind passes a fixed measuring point. The measurement is taken at a height of 33 feet above ground in open terrain. The fastest-mile wind speed measurement has been historically used in many building codes and design standards such as the Uniform Building Code.
- **Sustained wind** is the wind speed averaged over 1 minute.
- **Peak gusts** are the maximum wind gust speeds averaged over a period of 2 to 5 seconds.

Specific Wind Event Types

Tropical Cyclones

Hawai'i lies in the Central Pacific, which, on average, experiences four to five tropical cyclones every year. Almost all tropical cyclones in the Pacific basin form between June 1 and November 30. This timeframe is known as hurricane season. August and September are peak months for hurricane development (County of Maui 2015).

In the United States, forecast centers classify tropical cyclones in the following categories according to their maximum sustained winds:

- **Tropical depression:** A weak tropical cyclone with a surface circulation including one or more closed isobars (lines or curves of constant pressure) and highest sustained winds (measured over one minute or more) of less than 38 miles per hour (mph). Tropical depressions are assigned a number denoting their chronological order of formation in a given year.
- **Tropical storm:** A tropical cyclone with highest sustained winds between 39 and 73 mph.
- **Hurricane:** A tropical cyclone with highest sustained winds greater than 74 mph. Intensity is quantified by the Saffir-Simpson Hurricane Scale, based on a hurricane's sustained wind speed. Table I-2 presents this scale, which is used to estimate the potential property damage and flooding expected when a hurricane makes landfall. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous and require preventive measures.

Table I-2. The Saffir-Simpson Hurricane Scale

Category	Wind Speed	Expected Damage
1	74–95 mph	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap, and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last several days.
2	96–110 mph	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected, with outages that could last from several days to weeks.
3 (major)	111–129 mph	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130–156 mph	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted, and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	>157 mph	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: NWS (2025b).

The threats caused by an approaching hurricane can be divided into three main categories:

- **Wind Damage:** The force of wind can quickly decimate the tree population, down power lines and utility poles, knock over signs, and damage/destroy homes and buildings. Flying debris can also harm both structures and people. When hurricanes first make landfall, tornadoes can form, causing severe localized wind damage.
- **Storm Surge:** A storm surge is a rise in the water level caused by wind forces driving water against the coast (wind setup) or by wave forces (wave setup). This advancing surge combines with the normal tides to create the hurricane storm tide, which can increase the mean water level 15 feet or more. The water rise enables the storm waves to reach further inland with the associated scouring and erosion caused by the wave forces. Storm surge is responsible for nearly 90% of all hurricane-related deaths and injuries.
- **Rainfall/Flooding:** The torrential rains that normally accompany a hurricane can cause serious flooding. Whereas the storm surge and high winds are concentrated around the "eye," the rain may extend for hundreds of miles and may last for several days, affecting areas well after the hurricane has diminished.

Storm surge levels are determined by modeling water depth, wind speed, vegetative cover and other factors to determine how far inland waves will reach and the height, speed, and slope of waves and how they differ from the still-water elevation. Figure I-4 illustrates how a storm surge can cause flooding in areas typically above the normal tide and dry. Estuaries or bays can cause a funneling or amplification effect on storm surge. Storm surge occurring with high tide will also increase surge height.

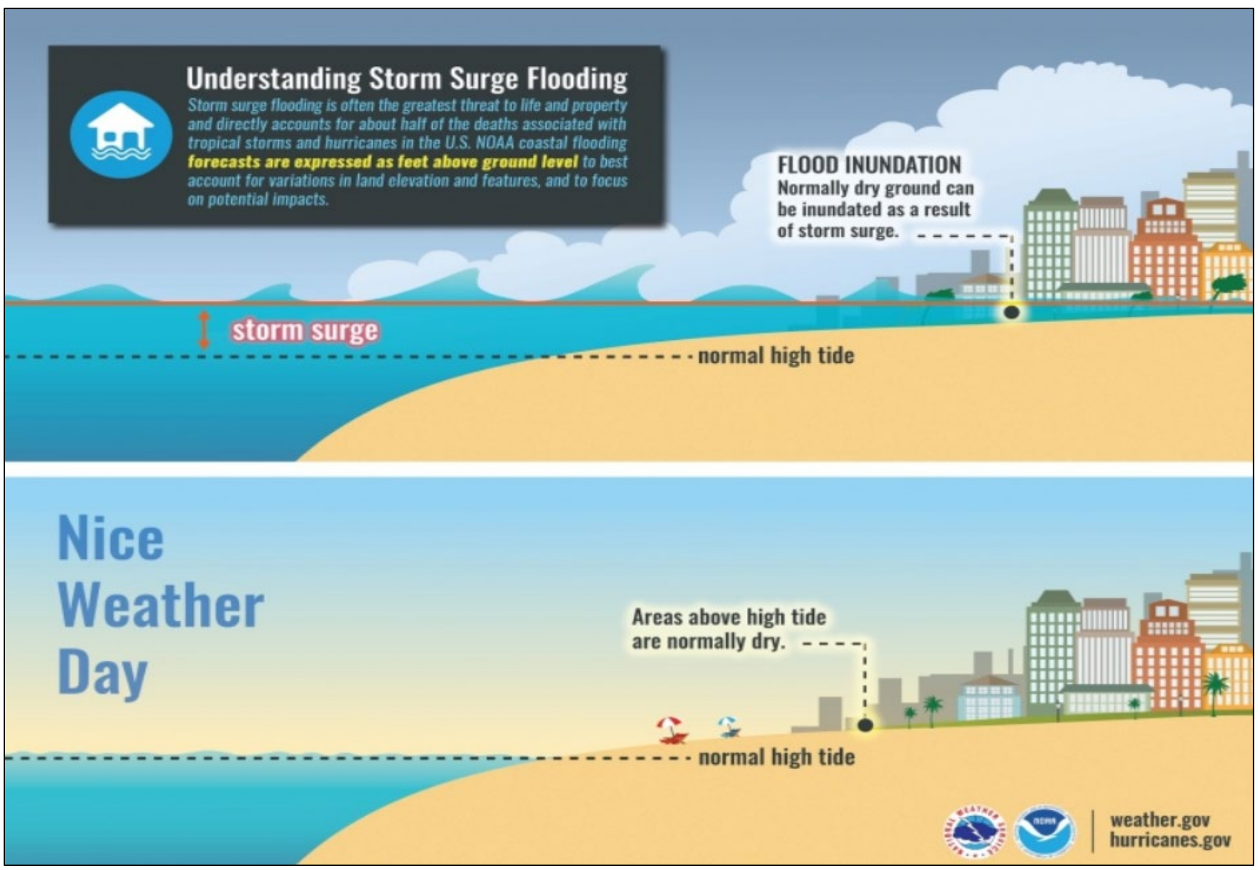


Figure I-4. Storm surge impacts and flood inundation (NOAA Office of Response and Restoration 2020).

Storm surges normally hit coasts ahead of high winds, as waves move faster than a hurricane advances. Locally intense rainfall may occur as the hurricane makes landfall. History has shown that the Hawaiian Islands do not have to take a direct landfall from a cyclone to sustain a high level of damage. Wind strength, storm radius of maximum winds, timing, and proximity are important factors that control storm impact. The winds can affect all parts of an island and can be intensified by mountain ranges (orographic or topographic amplification). Hurricane winds, blowing from variable directions, will experience topographic amplification, so a minimal hurricane or tropical storm can have significant wind effects on land.

Trade Winds

Trade winds are the most common winds over Hawaiian waters. These persistent winds blow 70% of the time from the northeast or east-northeast and generally range from 10 to 25 mph. Occasional extreme events reach 40 to 50 mph when a subtropical high-pressure cell north of the islands intensifies. Trade winds occur up to 90% of the time in summer (June through August) and 50% of the time in winter (December through January). North Pacific high-pressure systems can cause gusty trade wind episodes over Hawaiian waters, which commonly persist for several days.

Kona Winds

Kona winds are rain-bearing winds that blow over the islands from the southwest or south-southwest. The western sides of the islands become windward during kona winds, as the trade wind pattern is reversed. Kona winds occur as light and variable winds during winter when trade wind circulation diminishes, and as strong generally southerly winds when storm systems move across Hawaiian waters. Strong kona winds are most likely when a system with an unusually low central pressure is located within 500 miles northwest of the islands. Kona storms move erratically with a slow tendency toward the west.

Damaging kona winds have reached velocities of 50 mph for several days. Though most strong kona wind episodes last no more than a day, some last up to 2 weeks. During this time, considerable damage can be inflicted to boats caught in the open ocean or anchored in southwest-exposed anchorages.

The effects of kona winds on land can also be severe. Winds can accelerate down the slopes of mountains, hills, and escarpments to over 100 mph. Winds with these speeds can be very destructive when they reach heavily populated low-lying areas. It is common for trees to be uprooted, for signs and utility poles to be overturned, and for residential roofs to be blown off.

Hazard Profile

Past Events

Tropical Cyclones

Little was recorded of hurricanes striking Hawaiʻi before the last half of the twentieth century. Until 1950, tropical storms hitting the Hawaiian Islands were not classified as hurricanes. It was not until the advent of weather satellites that the storms in this part of the world were understood to be hurricanes. The only documented hurricane before 1950 was the Kohala Cyclone of 1871, which was believed to be a minimal hurricane that affected Maui and Hawaiʻi.

Since 1950 when adequate records began, approximately 35 tropical cyclones have come within 150 miles of the state of Hawaii; 14 of these storms reached hurricane status within 150 miles of the state (NOAA 2025b). NOAA’s Historical Hurricane Tracks viewer was used to determine the number of trackers within this distance (NOAA 2025b). Several caused severe damage, while others would have caused greater damage had their paths been closer to the islands. Figure I-5 depicts storm tracks in the vicinity of Hawai'i from 1950 to 2024.

Hurricanes Dot, Iwa, Iniki, Nina, and Lane caused some of the most significant damage on Kaua'i. In 1959, the storm center of Hurricane Dot passed directly over Līhu'e and although that station reported gusts to 75 mph as the highest winds, unofficial reports of 104-mph winds were received from other parts of the island. The hurricane blew off roofs, uprooted trees and knocked down utility lines around the island. Many roadways were blocked, huge waves pounded the shoreline, and torrential rains swelled rivers and streams to raise flood threats (Tetra Tech 2021). Hurricane Iwa impacted Kaua'i and Ni'ihau in 1982 with reported gusts exceeding 100 mph per hour and a storm surge of 30 feet. Statewide 2,345 buildings, including 1,927 houses, were damaged or destroyed, leaving 500 people homeless (NWS 2025j). Hurricane Iniki in 1992 was the most destructive hurricane to strike Hawai'i in the twentieth century with estimated peak sustained winds of between 130 and 160 mph over Kaua'i (U.S. Department of Commerce et al. 1993). More than 14,000 homes were affected with 1,421 destroyed and 5,152 suffering major damage. More than half of the utility poles on the island were destroyed. Almost all the green vegetation on the island was stripped and trees were uprooted or broken (U.S. Department of Commerce et al. 1993). Hurricane Lane produced intense rainfall and severe flooding in 2018 to parts of the island already severely affected by record-breaking flooding earlier in the year (NWS 2018).

All of the main Hawaiian Islands are at approximately the same risk of a direct hit by a hurricane. The following other hurricanes or tropical storms have caused serious damage in the state of Hawai'i:

- Hurricane Nina in 1957 produced record winds in Honolulu on the Island of O'ahu.
- Hurricane Iwa also resulted in widespread damage on O'ahu in 1982.
- Hurricane Estelle caused high surf on the islands of Hawai'i and Maui and floods on O'ahu in 1986.
- Hurricane Iniki also produced severe damage on the leeward coast of O'ahu in 1992.

In addition to these destructive hurricanes, numerous tropical storms or hurricanes could have caused serious damage to the islands had they come much closer to the islands than they did. Among these hurricanes that missed the islands are Hurricane Fernanda in 1993, Hurricane Emilia in 1994, Hurricane Ana in 2014, and Hurricane Douglas in 2020.

In the period since the 2021 MHMRP Update, four tropical cyclones have come near the Hawaiian Islands. Of these four storms, only Hurricane Douglas in 2020 and Hurricane Hone in 2024 reached hurricane classifications (Category 1) around the Hawaiian Islands (NOAA 2025b). Hurricane Douglas caused precipitation but no significant damages (State of Hawai'i Emergency Management Agency [HI-EMA] 2023). Hurricane Hone did not have a significant impact on the county, though it did cause damages and power outages elsewhere in the state (NOAA 2025d).

Past tropical cyclone events for the state of Hawai'i were determined by analyzing NOAA's Historical Hurricane Track viewer to identify the number of tropical cyclones that reached hurricane status within 150 miles of the state (NOAA 2025b). Figure I-5 shows tropical cyclone events near the state between 1950 and 2023.

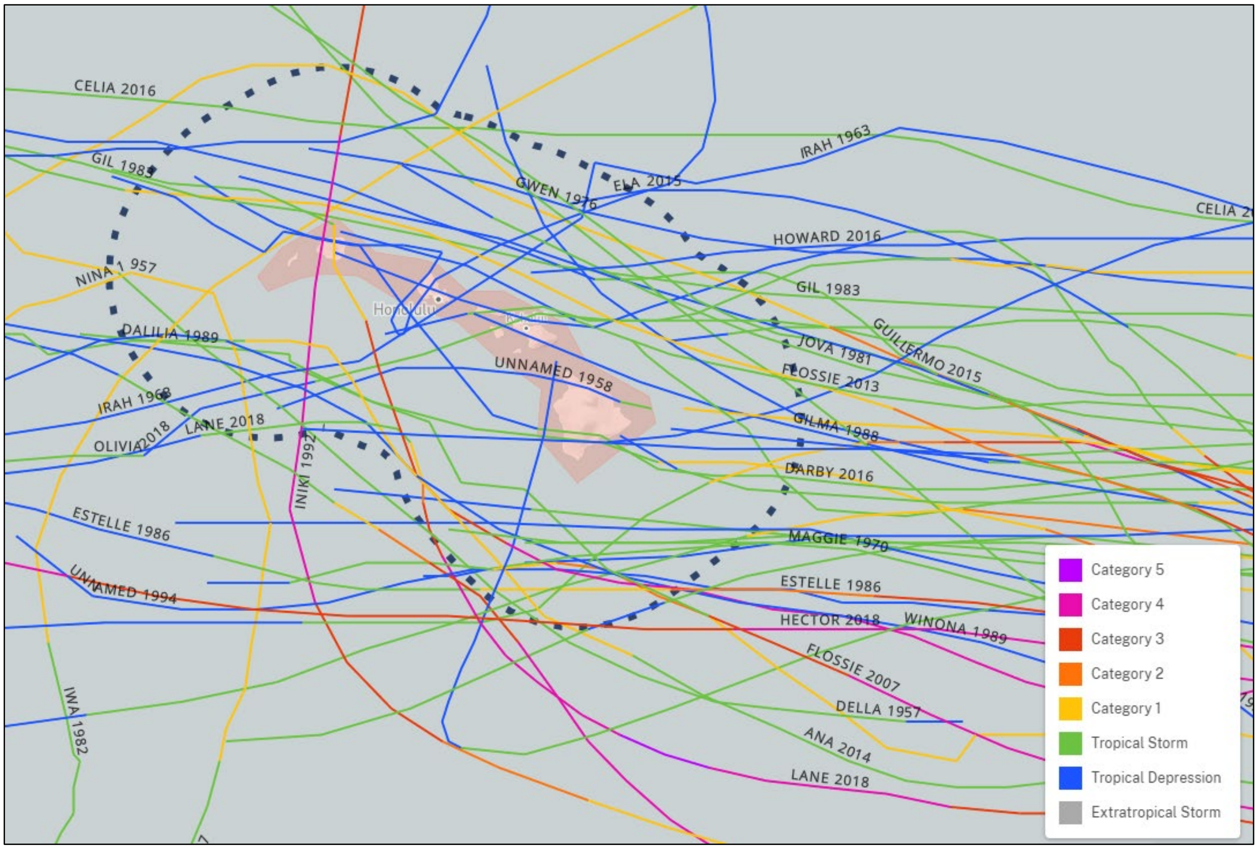


Figure I-5. Historical tropical cyclones within approximately 150 miles of Hawai‘i, 1950 to 2024 (NOAA 2025b).

Other High-Wind Events

Table I-3 summarizes high-wind events in the planning area since January 2005. Some of these events have been added for the 2026 MHMRP Update, and source information for them is included in the table notes. No recorded fatalities and only one injury attributable to high-wind events in Kaua‘i County have occurred in that timeframe. Many of the events caused power outages, downed trees, and some property damage, but most costs of property damage are not available.

Table I-3. Past High-Wind Events Impacting Planning Area

Start Date	End Date	Property Damage	Injuries*	Fatalities*
01/08/2005	01/08/2005	$100,000	0	0
12/04/2007	12/05/2007	–	0	0
12/13/2008	12/13/2008	–	0	0
12/09/2010	12/09/2010	–	0	0
03/09/2012	03/09/2012	–	0	0
11/30/2013	11/30/2013	–	0	0
12/01/2013	12/01/2013	–	0	0
12/15/2013	12/15/2013	–	0	0

Start Date	End Date	Property Damage	Injuries*	Fatalities*
12/30/2014	12/30/2014	–	1	0
12/30/2014	12/30/2014	$10,000	0	0
02/14/2015	02/14/2015	–	0	0
02/09/2019	02/10/2019	–	0	0
12/24/2019	12/24/2019	$2,000	0	0
12/25/2019	12/25/2019	$8,000	0	0
5/18/2022† ‡	5/18/2022	$2,000	0	0
12/19/2022† ‡ §	12/19/2022	–	0	0
4/12/2024,† ‡ § ¶	4/12/2024	$1,000	0	0
12/28/2024† #	12/28/2024	–	0	0
1/30/2025	1/30/2025	$480,583	0	0
Total		**N/A**	**1**	**0**

Source: NOAA (2020b); State of Hawai'i (2018)
– = not available
*.Injuries or fatalities may have occurred that were not recorded in available datasets.
† NOAA (2025b)
‡ Added for the 2026 MHMRP Update;
§ Recorded in the National Centers for Environmental Information (NCEI) database as "thunderstorm winds" as opposed to "strong winds"
¶ Thunderstorm winds associated with the heavy rains that led to a presidential disaster declaration on Kaua'i
# Event was a funnel cloud

The most notable documented high-wind event in Kauaʻi County occurred in January 2025. The event was part of a Kona low that included heavy precipitation, thunderstorms, and high winds. The NWS issued the following forecast in advance of the storm on January 27, 2025, at 10:21 a.m. Hawaii Standard Time:

> An unusually strong low-pressure system will pass north of the state on Thursday bringing a multi-faceted threat... Damaging down sloping winds will be possible east of terrain Wednesday night through Thursday night, especially over Kauai and Oahu. Heavy rain capable of producing flash flooding is also expected... There is an enhanced risk of strong to severe showers and thunderstorms with a primary threat of damaging wind gusts.

According to KEMA, a state emergency proclamation was issued for the event on January 31, 2025, for impacts across the state. On Kauaʻi, the high-wind event resulted in power outages and debris generation. It also caused $480,583 in damage to the Hawaii Department of Transportation-Airports Division ($95,583) and KIUC ($385,000). Extended power outages occurred in the Wainiha and Kīlauea communities. Wilcox Memorial Hospital was also affected by an outage and had to use generator power. Other impacts included debris on Kōkeʻe Road restricting access to recreational areas, debris and minor flooding in intersections in Līhuʻe, and debris that briefly disrupted traffic along the Kapaʻa Bypass in Kapaʻa. Traffic disruptions were generally minor due to rapid response from the County Roads Division and the Hawaii Department of Transportation.

Another notable event occurred in January of 2005 which caused damage estimated at $100,000. Powerful thunderstorms produced strong wind gusts and a small tornado in Waimea and caused significant wind damage at the National Tropical Botanical Garden in Kalāheo (NWS 2025m). Other winter storms have caused less damage but more localized effects, with flooding and power disruption constituting the main problems.

Location

Most tropical cyclones have moved south of the Hawaiian Islands. Because these storms spin counterclockwise in the northern hemisphere, the east-facing shores of Hawai‘i often get hit hardest by strong winds when a storm is coming toward the islands. As the storm passes to the west, the south and west sides feel the onshore winds. The coasts facing the storm usually suffer damage from both strong winds and storm surges. However, the fastest winds can sometimes happen on the side away from where the storm is coming from, as the winds speed up when they move down the mountains.

Strong windstorms can happen anywhere in the planning area, but the topography of the land affects which places are hit the hardest (HI-EMA 2023). For example, kona storms bring wind and rain that can damage the south and west shores (NOAA National Environmental Satellite, Data, and Information Service 2021). In general, wind speeds get stronger the higher you go above the ground, so mountainous areas, such as much of Kaua‘i County, often have the highest winds (HI-EMA 2023; WRCC 2025).

Winds also get faster as they move over hills, ridges, and cliffs. This is called wind speed-up. As stronger winds are connected to greater wind pressure, buildings in these areas can be damaged more easily, especially if building codes do not consider the local topography (Soleimanian et al. 2019). In the past, the amount of wind speed-up caused by hills and mountains in Kaua‘i County was not well understood or included in the state’s building codes (State of Hawai‘i 2018).

Frequency

In evaluating the potential for hazard events of a given magnitude, a mean return period (MRP) is often used. The MRP provides an estimate of the magnitude of an event that may occur within any given year based on past recorded events. MRP is the average period of time, in years, between occurrences of a particular hazard event (equal to the inverse of the annual frequency of exceedance). The following maximum 3-second gust wind speeds have been identified for the Hazus model:

- For the 50-year MRP, 65.0 to 73.5 mph, which approaches the lower limit of a Category 1 hurricane (74–95 mph)
- For the 100-year MRP, 80.3 to 90.7 mph, which is characteristic of a Category 1 hurricane
- For the 500-year MRP, 109.6 to 122.8 mph, which is characteristic of a Category 3 hurricane (111–129 mph)

Severity

It is estimated that Hurricane Iniki delivered winds between 130 and 160 mph over Kaua‘i. These windspeeds would be equivalent of a minimal Category 4 hurricane. By comparison, Hurricane Iwa, the last hurricane to strike the island, was equivalent to a minimal Category 2. The eye of the storm crossed the coast in the Waimea area and departed over Hā‘ena about 40 minutes later (U.S. Department of Commerce et al. 1993).

Although only two hurricanes have made direct landfall on Kaua‘i in recent decades, hurricane-induced storm surge and waves pose a flooding threat to the island. Review of hurricane storm tracks from 1950 to 2024 indicate that 14 storms of Category 1 or higher have come within a 150 nautical mile radius of the Hawaiian Islands.

For this risk assessment, the County determined that a Category 4 event with a storm track south-southwest by northeast, following the path of Iniki, was the scenario likely to have the greatest impact on the planning area. Using Hazus, two types of impacts were modeled for the Category 4 storm scenario event: wind and storm surge. Figures 6-2 and 6-3 show the severity (extent) and location for these two parameters for the scenario event in the planning area. The maximum gusts for the Category 4 scenario modeled for this assessment range from 130 to 147 mph. This would correlate to an MRP of approximately 180 years, using interpolation from the above referenced Hazus MRP values.

High windstorms can be a problem in the planning area and have been known to cause damage to utilities, trees, boats, homes, and other structures and buildings. Kaua'i County is located in FEMA's Wind Zone II, with speeds up to 160 mph (Tetra Tech 2021). Economic impact is largely associated with disrupted services as a result of downed debris blocking transportation infrastructure and potential disruption of energy resources. Outside of a catastrophic high-wind event, the economic disruption caused by this hazard is expected to remain short-term.

Warning Time

Tropical cyclones can be closely monitored and tracked. As a result, accurate warnings up to days in advance of the event are possible, with modeling offering possible storm movement up to a week prior. Track forecasts have improved due in part to the increased numbers of satellites, outfitted with more sophisticated weather-monitoring devices. At the same time, supercomputing power has increased exponentially, and computer models used to forecast a cyclone's direction keep improving (Main 2014). NOAA offers multiple watch, warning, and resource tools through the National Hurricane Center including those described in the sections below.

Tropical Cyclone Public Advisory

The tropical cyclone public advisory contains a list of all current watches and warnings on a tropical or subtropical cyclone. It gives the cyclone position in terms of latitude and longitude and distance from a selected land point, as well as the current motion. The advisory includes the maximum sustained wind speed and the estimated or measured minimum central pressure. The advisory may also include information on potential storm tides, rainfall or tornadoes associated with the cyclone, as well as any pertinent weather observations.

Public advisories are issued for all Atlantic, eastern Pacific and central Pacific tropical or subtropical cyclones. Public advisories for eastern Pacific and central Pacific tropical cyclones are normally issued every 6 hours. Intermediate public advisories may be issued every 3 hours when coastal watches or warnings are in effect, and every 2 hours when coastal watches or warnings are in effect and land-based radars have identified a reliable storm center. Special public advisories may be issued at any time due to significant changes conditions.

Tropical Cyclone Forecast/Advisory

The tropical cyclone forecast/advisory contains a list of all current watches and warnings on a tropical or subtropical cyclone, as well as the current latitude and longitude, intensity, and system motion.
The advisory contains forecasts of the cyclone positions, intensities, and wind fields. It may also include information on any pertinent storm tides associated with the cyclone. Forecast/advisories are issued on all eastern Pacific tropical and subtropical cyclones every 6 hours.

Tropical Cyclone Discussion

The tropical cyclone discussion explains the reasoning for the analysis and forecast of a tropical or subtropical cyclone. It includes a table of the forecast track and intensity. Tropical cyclone discussions for eastern and central Pacific tropical cyclones are normally issued every 6 hours. Special tropical cyclone discussions may be issued at any time due to significant changes in warnings or in the cyclone.

High Wind Watch, Warnings, and Advisories

Meteorologists can often predict the likelihood of a severe storm. This can give several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of the storm. Some storms may come on more quickly and have only a few hours of warning time. The predicted wind speed given in wind warnings issued by the NWS is for a 1-minute average; gusts may be 25% to 30% higher. The NWS Honolulu Forecast Office (HFO) issues the following watches, warnings, and advisories when high wind threatens the state:

- **High Wind Watch:** A high wind watch is issued when sustained winds exceeding 40 mph and/or frequent gusts over 60 mph are likely to develop in the next 24 to 48 hours. For summit areas, high wind watches are issued for predicted sustained winds exceeding 56 mph and/or frequent gusts over 66 mph.
- **High Wind Warning:** A high wind warning is issued when sustained winds exceeding 40 mph and/or frequent gusts over 60 mph are occurring or imminent. For summit areas, warnings are issued for winds exceeding 56 mph and/or frequent gusts over 66 mph. Wind warnings may be issued up to 24 hours ahead of the onset of high winds.
- **Wind Advisory:** A wind advisory is issued when sustained winds of 30 to 39 mph and/or frequent gusts to 50 mph or greater are occurring or imminent. For summit areas the range is 45 to 55 mph for sustained wind and/or 55 to 65 mph for frequent gusts. Wind advisories may be in effect for 6 to 12 hours.
- **Small Craft Advisory:** A small craft advisory is issued for coastal waters when winds of 25 to 33 knots and seas 10 feet or higher are occurring or forecast.
- **Gale Warning:** A gale warning is issued for coastal, offshore, and high seas areas when winds of 34 to 47 knots not associated with a tropical cyclone are occurring or forecast.

The warning time information remains unchanged from the 2021 MHMRP Update.

TSUNAMI

Hazard Description

Tsunami Characteristics

In the open ocean, a tsunami may be only a few inches or feet high, but it can travel with speeds approaching 500 mph. As a tsunami enters the shoaling waters near a coastline, its speed diminishes, its wavelength decreases, and its height increases greatly. The first wave usually is not the largest. Several larger and more destructive waves often follow the first one. As tsunamis reach the shoreline, they may take the form of a fast-rising tide, a cresting wave, or a bore (a large, turbulent wall-like wave). The bore phenomenon resembles a step-like change in the water level that advances rapidly (up to 60 mph).

The tsunami’s size and speed, as well as the coastal area’s form and depth, affect the impact of a tsunami; wave heights of 50 feet are not uncommon. Offshore canyons can focus tsunami wave energy and islands can filter the energy. The orientation of the coastline determines whether the waves strike head-on or are refracted from other parts of the coastline. A wave may be small at one point on a coast and much larger at other points. Bays, sounds, inlets, rivers, streams, offshore canyons, islands, and flood-control channels may cause various effects that alter the level of damage. It has been estimated, for example, that a tsunami wave entering a flood-control channel could reach a mile or more inland, especially if it enters at high tide.

Damage from Tsunami

The first indication of an approaching tsunami may be recession of water (drawdown) caused by the trough preceding the advancing, large inbound wave crest. Rapid drawdown can create strong currents in harbor inlets and channels, undermining roads, buildings, bulkheads, and other structures and severely damaging coastal structures due to erosive scour around piers and pilings. As the water's surface drops, piers can be damaged by boats or ships straining at or breaking their mooring lines. Ships and boats, unless moved away from shore, may be dashed against breakwaters, wharves, and other craft, or be washed ashore and left grounded after the withdrawal of the seawater. The vessels can overturn or sink due to strong currents, collisions with other objects, or impact with the harbor bottom. The outflow action also can carry enormous amounts of highly damaging debris with it, resulting in further destruction.

At some locations, the advancing turbulent front will be the most destructive part of the tsunami. In other situations, the greatest damage will be caused by the outflow of water back to the sea between crests.

Sources of Tsunamis

A tsunami can be generated by any disturbance that displaces a large water mass from its equilibrium position. The most common causes of tsunamis are earthquakes, landslides, and submarine volcanic explosions (Figure I-6). The three tsunami sources are described in the following sections.

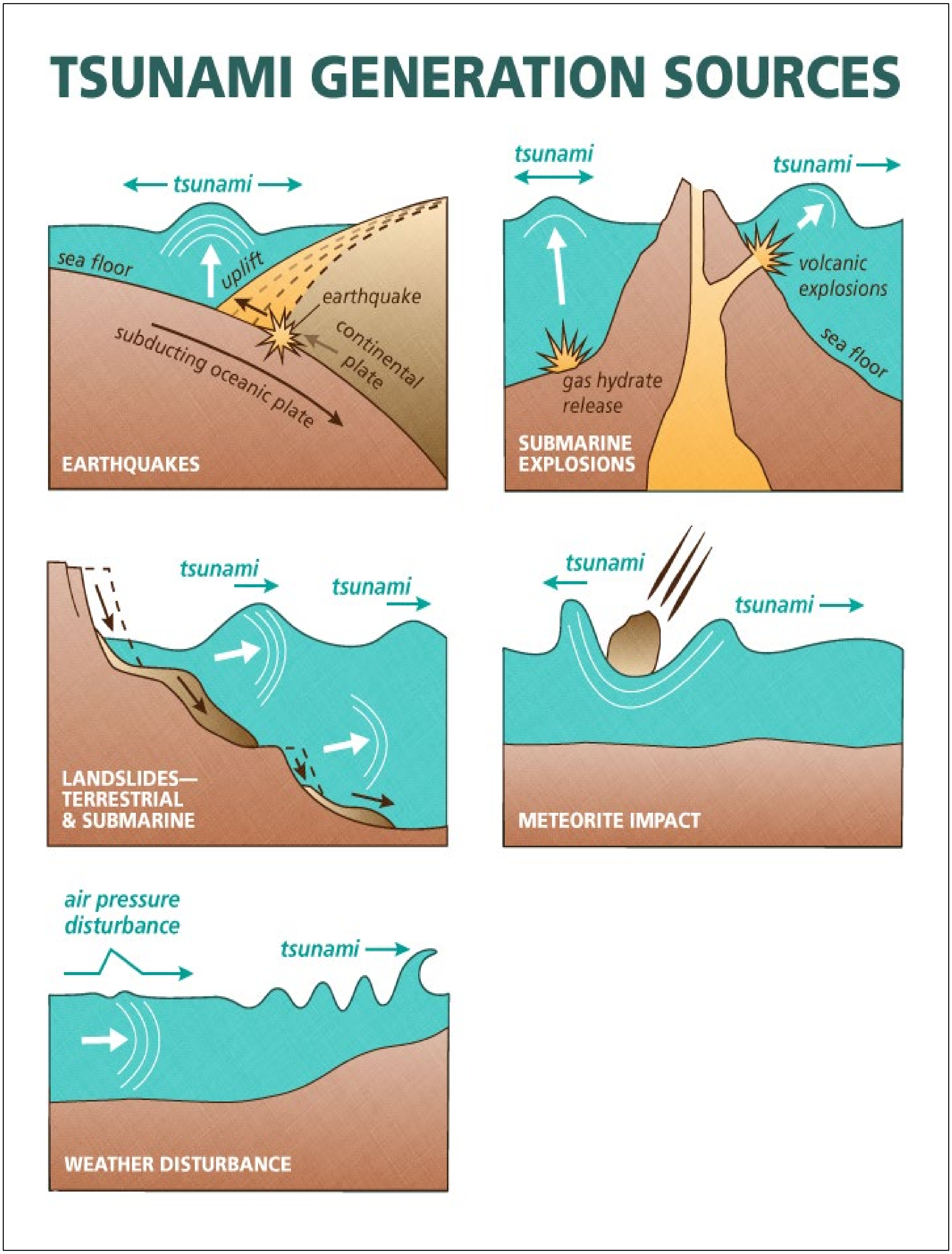


Figure I-6. Common sources of tsunamis (Washington State Department of Natural Resources 2025).

Tsunamis Induced by Earthquakes

Earthquakes that cause tsunamis are referred to as "tsunamigenic earthquakes." Earthquakes generate tsunamis when the sea floor abruptly deforms and displaces the overlying water from its equilibrium position. Waves are formed as the displaced water mass, which acts under the influence of gravity, attempts to regain its equilibrium. In general, scientists believe an earthquake of at least a magnitude 7 is required to produce a tsunami.

The main factor that determines the initial size of a tsunami is the amount of vertical sea floor deformation. The earthquake's magnitude, depth, fault characteristics, and coincident slumping of sediments or secondary faulting control the size of the tsunami. Other features that influence the size of a tsunami along the coast are the shoreline and bathymetric configuration, the velocity of the sea floor deformation, the water depth near the earthquake source, and the efficiency at which energy is transferred from the earth's crust to the water column.

Most tsunamis induced by earthquakes originate in the Pacific Ocean, where resulting tsunami waves can travel at up to 500 mph, striking distant coastal areas in a matter of hours (Figure I-7). Tsunamis affecting Kaua‘i County may be induced by earthquakes at a considerable distance, such as in Alaska or South America.

Tsunamis Induced by Landslides

The second most common cause of tsunamis is landslides. A tsunami may be generated by a landslide originating above sea level but plunging into the sea, by a landslide occurring mainly beneath the sea level, or by a landslide occurring entirely beneath sea level.

Submarine landslides often occur during a large earthquake. During a submarine landslide, the equilibrium sea level is altered by sediment moving along the sea floor. Hydraulic forces then propagate the tsunami, given the initial perturbation of the sea level. The Hawaiian island chain is flanked by at least 20 large submarine landslides. Sedimentary evidence of landslide-induced tsunamis in Hawai‘i is believed to have been found 200 feet above sea level on the flanks of the Kohala volcano in the northern tip of the island of Hawai‘i.

Above-water landslides disturb the water from above the surface. Like submarine landslides, they typically occur during large earthquakes. A tsunami also can be generated by the collapse of the flanks of volcanic islands.

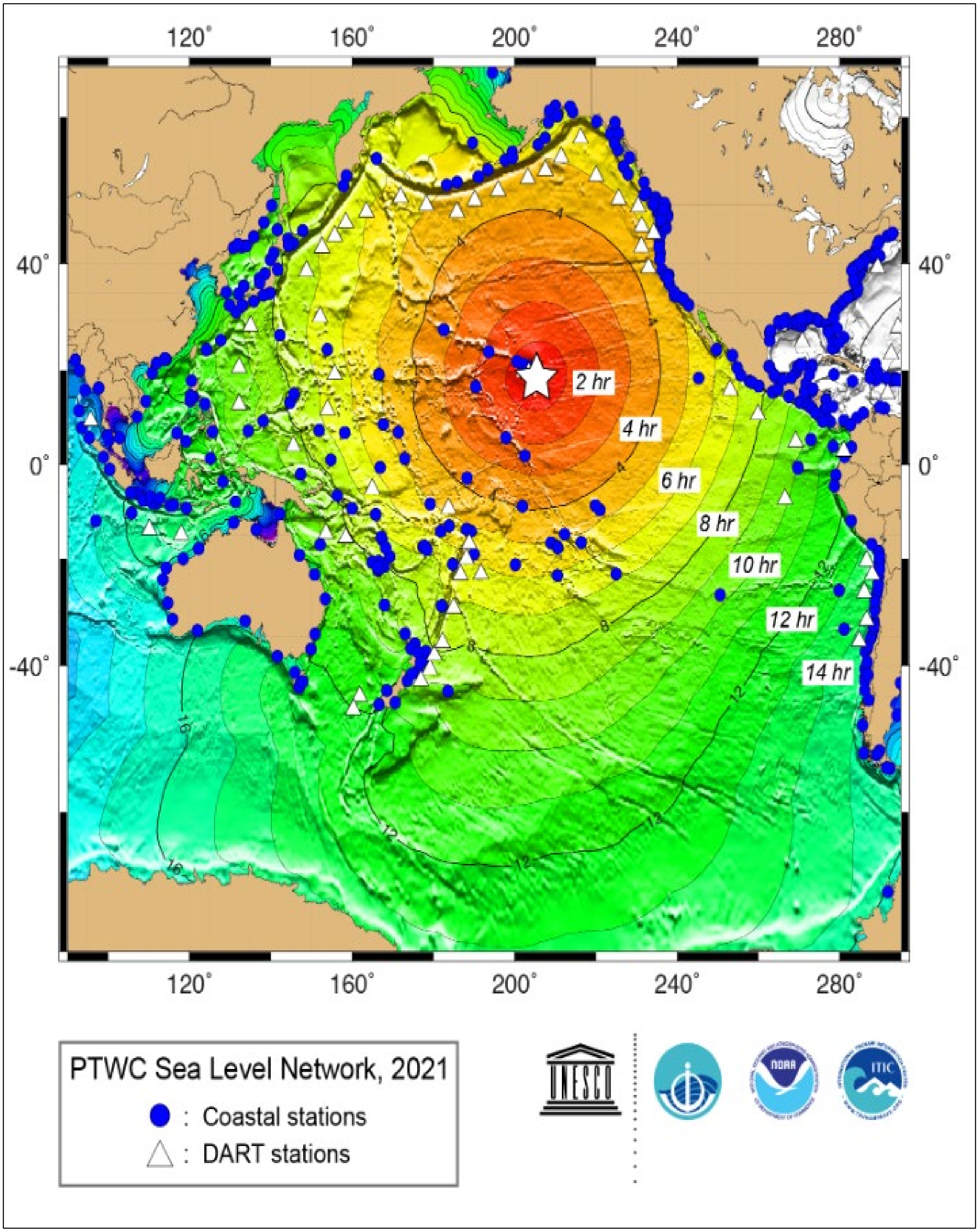


Figure I-7. Potential tsunami travel times in the Pacific Ocean (International Tsunami Information Center 2024).

Tsunamis Induced by Submarine Volcanic Explosions

Three island volcanoes are the subject of studies pertaining to their potential to generate destructive tsunamis: Cumbre Vieja volcano on the Island of La Palma in the Canary Islands, and Mauna Loa and Kīlauea volcanoes on the island of Hawaiʻi. Review of submarine geology around Mauna Loa shows evidence of past landslides along the volcano's southwestern flank.

Hazard Profile

Past Events

The recorded history of tsunamis in Hawaiʻi encompasses several phases according to the availability of recorded data. During the nineteenth century, numerous tsunamis were reported in newspapers, weeklies, and books written by residents at the time. The cause of tsunamis was not generally known, nor was the origin in terms of whether the tsunami was the result of a distant seismic event or a local submarine landslide. Toward the end of the nineteenth century, seismological stations became available to record and locate earthquakes. Through the instruments in these stations, it became easier to associate distant earthquakes with tsunamis in Hawaiʻi. The establishment of the Hawaiian Volcano Observatory in 1912 brought the expertise needed to accurately determine the origin and causes of local earthquakes and tsunamis in the islands. After a 1946 tsunami, the Tsunami Warning System was established and a group of experts was constituted to track and document origin, wave heights, and other data pertinent to tsunamis.

According to the U.S. Geological Survey (USGS), between 1819 and 1975, there were 26 tsunamis greater than 1 meter to reach Kauaʻi with eight of these events causing significant damage (USGS 2002). These events are summarized in Table I-4. There has been one additional large tsunami, considered a tsunami greater than a meter since 1975, to impact Kauaʻi. Table I-4 summarizes select tsunami events experienced in Kauaʻi County between 1819 and 2020 along with all recorded events between 2020 and 2024. Figure I-8 shows tsunamis affecting Kauaʻi from 1819 to 1975.

The most devastating tsunamis to hit the island of Kauaʻi in the past century occurred in 1946 and 1957. The tsunami of 1946 originated in the Aleutian Islands, struck Kauaʻi without warning and killed 17 people, destroyed homes, natural resources and built infrastructure, and damaged boats. Moloaʻa, Kīlauea, and Waimea recorded wave heights of 13.7 meters. The tsunami of 1957 also originated in the Aleutian Islands and destroyed or damaged infrastructure, homes, and boats. The highest measured wave was 16.2 meters at Wainiha Bay on the north shore.

Table I-4. Tsunamis Affecting Kauaʻi County, 1819 to Present

Date	Place of Observation	Source	Meters	Fatalities	Damage
08/14/1868*	Waimea	Chile	1.8	0	Sank ships, carried ships inland
06/15/1896*	Kapaʻa, Kīlauea, Nāwiliwili	Japan	1.5	0	Boats stranded/landed, road and bridge flooded
03/02/1933*	Lāwaʻi, Moloaʻa	Japan	N/A	0	None recorded
04/01/1946*	Hāʻena, Hanalei, Kīlauea, Moloaʻa, Hanapēpē, Waimea	Eastern Aleutian Islands	13.7	17	Destroyed homes, trees, boat launch, shifted buoys, washed tug against breakwater
11/04/1952*	Hanapēpē	Kamchatka	N/A	0	None recorded
03/09/1957*	Nāwiliwili, Kīlauea, Wainiha, Hāʻena	Central Aleutian Islands	16.2	0	Destroyed bridges, flooded highways, homes destroyed or badly damaged, sampans disabled
05/22/1960*	Waimea, Hanapēpē, Poʻipū, Nāwiliwili, Kapaʻa, Kīlauea, Hāʻena	Chile	N/A	0	Minor damage
03/28/1964*	Nāwiliwili, Kapaʻa, Moloaʻa, Hanalei, Hāʻena	Gulf of Alaska	N/A	0	None recorded
06/22/1977	Nāwiliwili	Tonga Trench	<0.1	0	None recorded
12/12/1979†	Nāwiliwili	Ecuador	0.04	0	None recorded
05/07/1986†	Kapaʻa, Hanalei, Nāwiliwili	Aleutian Islands	0.6	0	None recorded
11/30/1987†	Nāwiliwili	Alaska	0.06	0	None recorded
10/04/1994†	Nāwiliwili, Port Allen	Kuril Islands	0.18	0	None recorded
11/15/2006†	Hanalei, Nāwiliwili	Kuril Islands	0.44	0	None recorded
03/11/2011†	Anahola, Hanamāʻulu, Keālia, Kīlauea, Moloaʻa, Nāwiliwili	Japan	5.18	0	Minor damage
10/28/2012†	Hanalei, Nāwiliwili	British Columbia	0.19	0	None recorded
04/01/2014†	Hanalei, Nāwiliwili	Northern Chile	0.15	0	None recorded
09/16/2015†	Hanalei, Nāwiliwili	Central Chile	0.14	0	None recorded
01/23/2018†	Hanalei, Nāwiliwili	Gulf of Alaska	0.13	0	None recorded
05/04/2018‡ §	Nāwiliwili	Hawaii	0.04	0	None recorded
10/19/2020‡ §	Hanalei, Nāwiliwili	Shumagin Islands, Alaska	0.26	0	None recorded
03/04/2021§	Nāwiliwili	New Zealand	0.06	0	None recorded
08/12/2021§	Nāwiliwili	Southern Atlantic Ocean	0.06	0	None recorded
01/15/2022§	Nāwiliwili, Hanalei	Tonga	0.82	0	None recorded

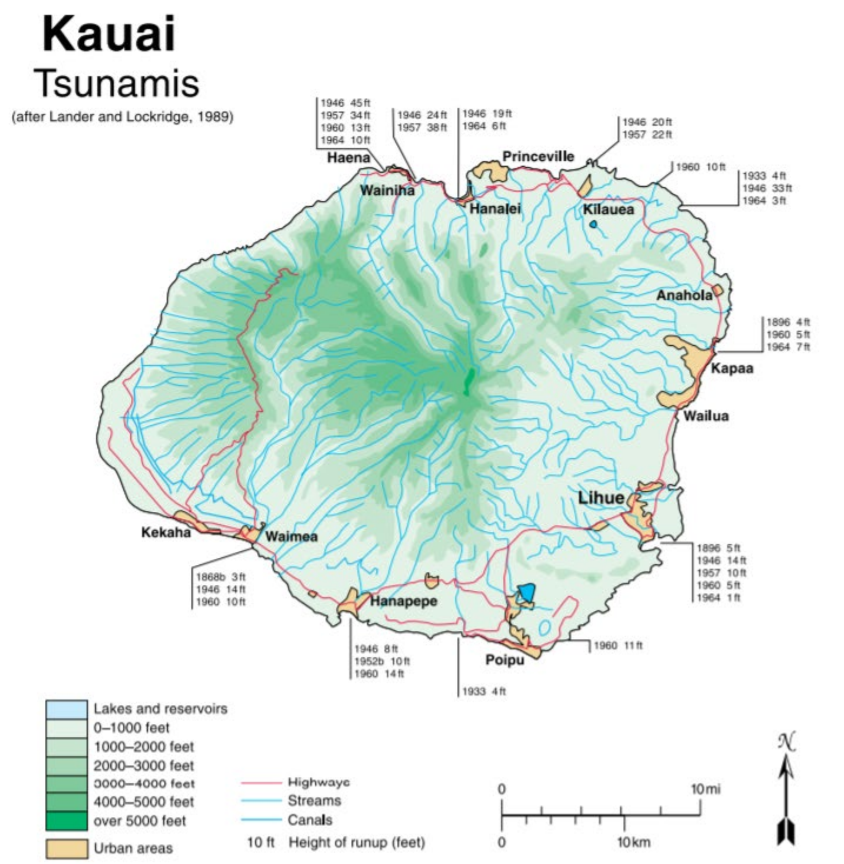
Note: This table represents a selection of data and is not inclusive of all tsunami events. Figure I-8 shows 26 tsunami events that affected Kauaʻi between 1819 and 1975.

* Also listed in Figure I-8

† NOAA (1989, 2020a)

‡ NOAA (2025e)

§ HI-EMA (2023); fatalities and damages reflect only those in Kaua'i County. The events listed may have caused damages or fatalities in other counties.



Large tsunamis* (>1m, 3.3 ft) with reported damage in the Hawaiian Islands

Year	Date	Area of origin	Magnitude**
1819	Apr 12	N Central Chile	M= 2.0
1835	Feb 20	Southern Chile	M = 4.0
1837	Nov 7	Southern Chile	M = 3.0
1841	May 17	Kamchatka	M = 2.0
1868a	Apr 3	SE Hawaii	M = 4.1
1868b	Aug 13	Northern Chile	M = 4.3
1868c	Oct 2	South Pacific	
1869	Jul 24	South Pacific	
1877	May 10	Northern Chile	M = 4.0
1878	Jan 20	Aleutian Is (?)	
1896	Jun 15	Japan	M = 4.0
1901	Aug 9	Tonga	
1906a	Jan 31	Colombia/Ecuador	M = 1.0
1906b	Aug 17	Central Chile	M = 2.0
1918	Sep 7	Kurils	M = 3.6
1919	Oct 2	Hawaii (H = 14 ft)	
1922	Nov 11	N Central Chile	M = 3.0
1923	Feb 3	Kamchatka	M = 3.0
1933	Mar 2	Japan	M = 3.0
1946	Apr 1	Eastern Aleutian Is	M = 5.0
1952a	Mar 17	Hawaii (H = 10 ft)	
1952b	Nov 4	Kamchatka	M = 4.0
1957	Mar 9	Central Aleutian Is	M = 3.5
1960	May 22	Chile	M = 4.5
1964	Mar 28	Gulf of Alaska	M = 4.5
1975	Nov 29	Big Island/Hawaii (H = 47 ft)	

*Reliability of ≥ 3 (of 4)(Lander and Lockridge, 1989), runup > 1m (3.3 ft), and reported damage.

** Tsunami magnitude is defined by $M = \log_2 H$ as revised by Iida and others (1967), where H is the maximum runup height or amplitude on a coastline near the generating area.

Other tsunamis have occurred, such as that of Oct 1994, however, because of their low (< 1 m) runup, insignificant damage, and/or uncertainty surrounding their timing and magnitude as noted in Lander and Lockridge (1989), they were not included here.

Figure I-8. Tsunamis on the Island of Kaua'i, 1819–1975 (USGS 2002).

Warning Time

Typical signs of a tsunami hazard are earthquakes and/or sudden and unexpected rise or fall in coastal water. The large waves are often preceded by coastal flooding and followed by a quick recession of the water. Tsunamis are difficult to detect in the open ocean because waves are often less than 3 feet high.

The Pacific Tsunami Warning System evolved from a program initiated in 1946. It is a cooperative effort involving 26 countries along with numerous seismic stations, water level stations and information distribution centers. The NWS operates two regional information distribution centers: one located in 'Ewa Beach, Hawai'i; and the other in Palmer, Alaska. The 'Ewa Beach center also serves as an administrative hub for the Pacific warning system.

The warning system only begins to function when a Pacific basin earthquake of magnitude 6.5 or greater triggers an earthquake alarm. When this occurs, the following sequence of actions occurs:

- Data are interpolated to determine epicenter and magnitude of the event.
- If the event is magnitude 7.5 or greater and located at sea, a Tsunami Watch is issued.
- Participating tide stations in the earthquake area are requested to monitor their gauges. If unusual tide levels are noted, the tsunami watch is upgraded to a Tsunami Warning.

- Tsunami travel times are calculated, and the warning is transmitted to agencies that relay it to the public.
- The ʻEwa Beach center will cancel the watch or warning if reports from the stations indicate that no tsunami was generated or that the tsunami was inconsequential.

This system is not considered effective for communities near the tsunami-generating source because the first wave would arrive before the data were processed and analyzed. In this case, strong ground shaking would provide the first warning of a potential tsunami.

In addition, as part of the U.S. National Tsunami Hazard Mitigation Program, NOAA implemented the Deep-Ocean Assessment and Reporting of Tsunami (DART) project to ensure detection of tsunamis and to acquire data critical to real-time forecasts. DART systems consist of an anchored seafloor bottom pressure recorder and a moored surface buoy for real-time communications. An acoustic link transmits data from the recorder on the seafloor to the surface buoy. The surface buoy transmits data to the NWS Telecommunications Gateway, which then distributes it in real time to the Tsunami Warning Centers. Figure I-9 depicts the operation of the DART system (County of Maui 2015).

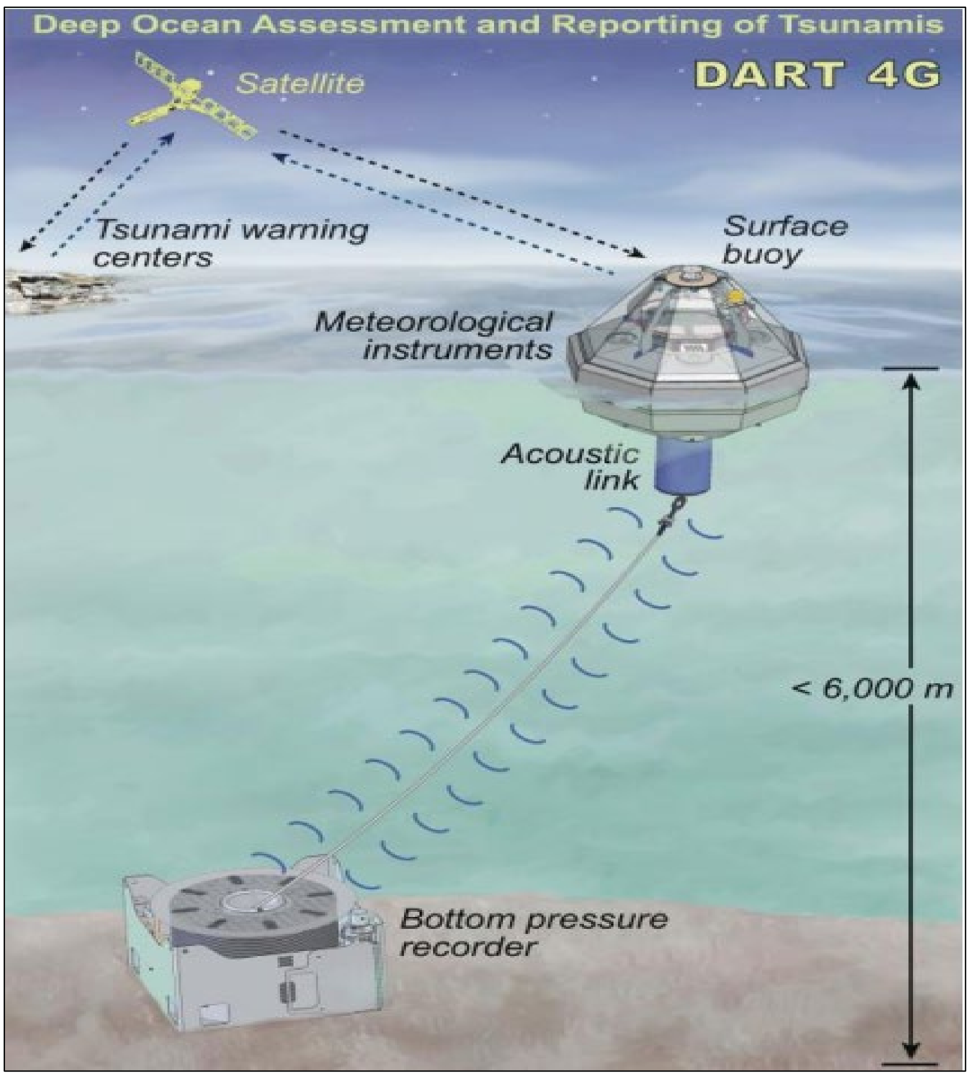


Figure I-9. DART 4G System (NOAA Pacific Marine Environmental Laboratory 2025).

LANDSLIDE

Hazard Description

Landslides may be minor or very large and can move at slow to very high speeds. They are commonly categorized by the form of initial ground failure. Figure I-10 shows different types of slides. Slides can pose serious hazard to property in hillside terrain. When they move—in response to such changes as increased water content, earthquake shaking, addition of load, or removal of downslope support—they deform and tilt the ground surface. The result can be destruction of foundations, offset of roads, breaking of underground pipes, or overriding of downslope property and structures.

Landslides can destroy property and infrastructure and can result in fatalities. Landslides in the United States result in an average of 25 to 50 lives lost per year (USGS 2024b). The annual cost associated with damages from this hazard is expected to be billions of dollars (USGS 2025f). Economic impact is largely associated with the disruption of transportation infrastructure. Communities that are isolated as a result of landslides may suffer from economic issues resulting from a lack of resource movement in and out of the area. This issue could last for a significant amount of time based on the extent of the event.

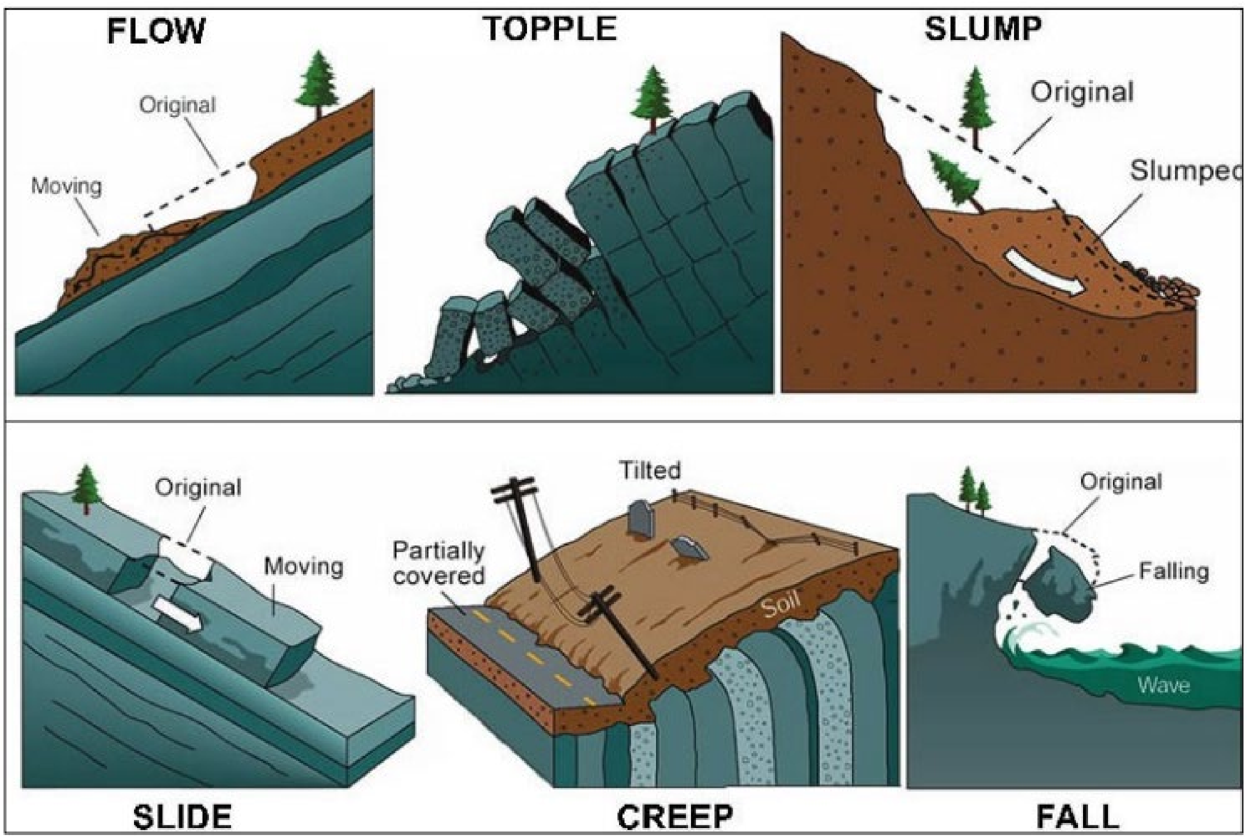


Figure I-10. Types of landslides (British Columbia Ministry of Energy, Mines, and Petroleum Resources 1993; HI-EMA 2023).

Hazard Profile

Past Events

According to NASA’s Global Landslide Catalog (NASA 2020a), NOAA (2025c), and FEMA (2025d) there have been 12 landslide events on Kauaʻi since 2007 (Table I-5). The recorded landslide events on Kauaʻi have been small or medium as indicated in Table I-5. Small landslides impact small areas or a single hillside and yield little damage to infrastructure. They may cause a small number of fatalities or none at all. Medium landslides are one or more landslides that move a substantial amount of material, yield a medium amount of damage to infrastructure, and may cause a small number of fatalities or none at all (NASA n.d.).

Table I-5. Landslides in Kaua‘i County, 2007–2024

Event Date	Event Title/Description	Landslide Setting	Landslide Trigger	Landslide Sizea	Fatalities	Injuries
4/12/2024*	Kaua‘i County Landslides Description: Heavy precipitation led to flooding and landslides in Kaua‘i. Multiple small landslides were reported. The damage associated with the event were primarily due to flooding (NOAA 2025c). A major disaster declaration was issued for severe storms, flooding, and landslides (DR-4793).	Various locations	Precipitation	Small	0	0
3/6/2021†	Kūhiō Highway Description: Heavy precipitation led to flash flooding and at least one landslide. There were $3.9 million in damages associated with this occurrence. Nine homes were destroyed and approximately 100 were damaged. A landslide caused one lane of Kūhiō Highway to close not far from Waikoko.	Above road	Precipitation	Medium	0	0
4/14/2018‡	Kūhiō Highway Landslides cut off Limahuli Garden and Preserve Description: Intense rainfall on April 14 and 15—nearly 50 inches of rain in 24 hours—caused widespread flooding and landslides in Kaua‘i. More than 20 landslides occurred along the Kūhiō Highway between Hā‘ena and Hanalei, blocking the path to Limahuli Garden and Preserve in Hā‘ena.	Above road	Downpour	Medium	0	0
8/6/2016‡	Kūhiō Highway just south of Hanalei Bridge Description: The road was closed in both directions after a landslide just south of Hanalei Bridge.	Above road	Rain	Small	0	0
8/11/2014‡	Mount Wai‘ale‘ale Description: Local resident Dale Rosenfeld took a photo of the slide and submitted it to The Garden Island. She said it was not visible from her home in Wailua Homesteads before Monday morning.	Natural slope	Unknown	Medium	0	0
3/11/2012‡	Hā‘ena Beach Park Description: Hā‘ena State Park closed due to a landslide closing the road to the Park.	Unknown	Downpour	Small	0	
3/9/2012‡	Near Kaua‘i Marriott Description: A landslide was reported near the Kaua‘i Marriott, blocking a lane of traffic.	Unknown	Downpour	Small	0	
3/4/2012‡	Kūhiō Highway in Lumaha‘i Description: The landslide was reported on Kūhiō Highway in Lumaha‘i, near mile marker 5. Both lanes of the highway were closed. A crew from the State Department of Transportation Highways Division removed boulders from the roadway.	Unknown	Downpour	Medium	0	

Event Date	Event Title/Description	Landslide Setting	Landslide Trigger	Landslide Sizea	Fatalities	Injuries
2/26/2012‡	Multiple Roads in Lāwaʻi, Kaua'i, Līhuʻe, and Kalāheo Description: Landslides and boulders were reported on Kalihi Wai Road, Akemama Road in Lāwaʻi, Kahumoku Road in Līhuʻe and Waha Road in Kalāheo.	Unknown	Downpour	Small	0	
11/14/2009‡	Kalihi Wai Bridge on Kūhiō Highway Description: The Kalihi Wai Bridge on Kūhiō Highway was closed, and landslide was reported near a home off Kalihi Wai Road.	Unknown	Downpour	Medium	0	
6/8/2008‡	Kūhiō Highway, Kauaʻi Description: Several boulders, rocks and other debris broke loose from a North Shore hillside along Kūhiō Highway.	Unknown	Rain	Small		

* FEMA (2025d)
† NOAA (2025c)
‡ NASA (2020a)

Location

Soil avalanches may leave bright scars on the hillside for months. A good example is a slide that occurred in Olokele Canyon on Kaua‘i in October 1981. The slide face was 1,000 feet wide and 2,400 feet high. This slide was caused by a combination of high rainfall and underground water seepage.

Valley development often involves work that can trigger landslides:

- **Hillside cuts:** Made when houses are built on the side of a hill. Even very slow movements may cause a house to break, cause telephone poles to bend very slowly, or may cause fences to move.
- **Road cuts:** Landslides have been seen frequently near road cuts. The Hawaii Department of Transportation mitigates landslides near roadways by strapping chicken wire around edges of cliffs. The purpose of this is to prevent rockfalls and other objects from sliding out onto the highway.

Areas generally more prone to landslides are those located at:

- Previous landslides areas
- Base of slopes
- Base of minor drainage hollows
- Base or top of an old, filled slope
- Base or top of a steep, cut slope
- Developed hillsides with leach-field septic systems.

During recent year flooding and storm events, several mudslides occurred impacting transportation. There were also landslide events on the Leeward and North Shore areas of Kaua‘i during the March 2012 and April 2018 flood disaster events, wherein at least three to five major landslides occurred between Kīlauea and Hā‘ena, causing multiple points of isolation and visitors and residents being unable to evacuate or move between these points. Debris flow occurred in Kapa‘a on March 27, 2013, and Waimea on December 2, 2013; both events were caused by heavy rainfall. Based on historic events, there have been occurrences of land movement on conservation lands two or three times per year with heavy rainfall events that coincide with 1 in 50-year flood events (County of Kaua‘i 2015a).

The best available predictor of where landslides might occur is the location of past movements. Past landslides can be recognized by their distinctive topographic shapes, which can remain in place for thousands of years. Landslides recognizable in this fashion range from a few acres to several square miles. Most show no evidence of recent movement and are not currently active. A small portion of them may become active in any given year, with movements concentrated within all or part of the landslide masses or around their edges. The USGS developed the landslide risk mapping used for this assessment. Landslide susceptibility is measured on a scale of 1 to 5 with 5 being the most susceptible. The hazard areas based on these criteria are shown in Section 8, Landslide: Figure 8-1.

Severity

The major Hawaiian Islands experienced catastrophic landslides hundreds of thousands of years ago. The USGS identified a minimum of 15 of these major landslides. The last of which was recorded 100,000 years ago on the island of Hawaii. These catastrophic landslides carried substantial amounts of land off the islands and caused massive waves that carried rock and sediment up to 1,000 feet above sea level. Such a landslide occurring today would result in significant numbers of injuries, fatalities, and loss of properties and critical facilities. However, landslides of this magnitude are exceedingly infrequent and part of an earlier geologic setting in Hawaii. For this reason, the potential for catastrophic landslides is noted here, but they are not considered to pose a significant risk to the county at this time.

Warning Time

The velocity of a landslide may range from a slow creep of inches per year to many feet per second, depending on slope angle, material and water content. Some methods used to monitor mass movements can provide an idea of the type of movement and the amount of time prior to failure. It is also possible to determine what areas are at risk during general time periods.

Assessing the geology, vegetation and amount of predicted precipitation for an area can help in predicting landslides. However, there is no practical warning system for individual landslides. The current standard operating procedure is to monitor situations on a case-by-case basis and respond after the event has occurred. Generally accepted warning signs for landslide activity include:

- Springs, seeps, or saturated ground in areas that have not typically been wet before
- New cracks or unusual bulges in the ground, street pavements or sidewalks
- Soil moving away from foundations
- Ancillary structures such as decks and patios tilting and/or moving relative to the main house
- Tilting or cracking of concrete floors and foundations
- Broken water lines and other underground utilities
- Leaning telephone poles, trees, retaining walls or fences
- Offset fence lines
- Sunken or down-dropped roadbeds
- Rapid increase in creek water levels, possibly accompanied by increased turbidity (soil content)
- Sudden decrease in creek water levels though rain is still falling or just recently stopped
- Sticking doors and windows, and visible open spaces indicating jambs and frames out of plumb
- A faint rumbling sound that increases in volume as the landslide nears
- Unusual sounds, such as trees cracking or boulders knocking together.

DROUGHT

Hazard Description

Droughts originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time (a few weeks or months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months or years, the drought is considered to be long-term. It is possible for a region to experience a long-term circulation pattern that produces drought, and to have short-term changes in this long-term pattern that result in short-term wet spells. Likewise, it is possible for a long-term wet circulation pattern to be interrupted by short-term weather spells that result in short-term drought.

Impacts

Lack of rainfall is not the only factor defining drought. Drought can be characterized based on various impacts or measurements (State of Hawai'i 2018):

- Meteorological measurements such as rainfall deficit compared to normal or expected rainfall
- Agricultural impacts due to reduced rainfall and water supply (e.g., crop loss, herd culling, etc.)
- Hydrological measurements of stream flows, groundwater, and reservoir levels relative to normal conditions
- Direct and indirect socioeconomic impacts on society and the economy (e.g., increased unemployment due to failure of an industry because of drought).

Monitoring Drought

Scientists and academics commonly use drought indices to monitor droughts. Some indices used for the continental United States are not suitable for use in Hawai'i's highly variable climate. The sections below describe indices that are useful for drought monitoring in Hawai'i.

Standardized Precipitation Index

The following descriptions explain applicable Standardized Precipitation Index (SPI) intervals and values for key sectors in Hawai'i (State of Hawai'i 2017):

- **Water Supply Sector:** The water supply sector is typically affected by long sustained periods of drought that affect ground and surface water resources. For this reason, a 12-month SPI is typically the best interval to evaluate drought severity for this sector.
- **Agriculture and Commerce Sector:** The agriculture sector is usually the first sector to feel the effects of drought. Farmers and ranchers who depend on rainfall for irrigation may be severely affected by even short-term moderate drought events. Because the agriculture and commerce sector is affected by short-term drought events, a 3-month SPI drought interval is best suited to evaluate drought severity for this sector.
- **Environment, Public Health, and Safety Sector:** Drought can have a number of effects on the environment, public health and safety sector. However, focus is often given exclusively to the area of wildfire impacts. Prolonged periods of drought can create dry landscapes that are vulnerable to wildfire hazard. Since even short drought periods can increase the risk of wildfire hazards, the 3-month SPI is best suited to evaluate drought severity for this sector.

Table I-6 describes SPI interval values that can be used to evaluate drought severity for the three key sectors.

Table I-6. Drought Stage and SPI Interval and Value per Sector

Drought Stage	SPI Time Interval and Value		
	Water Supply Sector	**Agriculture & Commerce Sector**	**Environmental, Public Health, & Safety Sector**
Normal	12-month SPI 0.99 to -0.99	3-month SPI 0.99 to -0.99	3- and 12-month SPI 0.99 to −0.99
Moderate	12-month SPI -1.00 to -1.49 for 2 consecutive months	3-month SPI -1.00 to -1.49 for 2 consecutive months	3- and 12-month SPI −1.00 to −1.49 for 2 consecutive months

Drought Stage	SPI Time Interval and Value		
	Water Supply Sector	**Agriculture & Commerce Sector**	**Environmental, Public Health, & Safety Sector**
Severe	12-month SPI -1.50 to -1.99 for 2 consecutive months	3-month SPI -1.50 to -1.99 for 2 consecutive months	3- and 12-month SPI −1.50 to −1.99 for 2 consecutive months
Extreme	12-month SPI less than -2.00 for 2 consecutive months	3-month SPI less than -2.00 for 2 consecutive months	3- and 12-month SPI less than −2.00 for 2 consecutive months

Source: State of Hawaiʻi (2017)

The HFO has tailored SPI software for use in Hawaiʻi. Hawaiʻi's SPI monitoring network includes 58 rain gauges, 11 of which are in Kauaʻi County (NWS 2025h):

- 17 quick-look sites use data from real-time reporting stations in the HFO flash flood monitoring network. They provide data immediately after the end of a month so that SPI values can be quickly determined. Table I-7 provides SPI values from the stations in Kauaʻi County through the end of December 2024.
- 41 standard sites are locations from the NWS Cooperative Observer Network. Rainfall readings at these sites are taken manually and submitted via mail after the end of the month.

Table I-7. SPI Early Version for Kauaʻi County as of the End of December 2024

Station	SPI Value						
	1-Month	**2-Month**	**3-Month**	**6-Month**	**12-Month**	**18 Month**	**24-Month**
Līhuʻe AP	−1.02	−1.18	−1.51	−2.08	−0.87	−1.20	−0.36
PH Wainiha	−1.44	−2.04	−1.73	−2.21	−1.71	−1.67	−1.06

Source: NWS (2025h).

U.S. Drought Monitor

The U.S. Drought Monitor (USDM) is a map that is updated weekly to show the location and intensity of drought across the country. The USDM uses a five-category system (National Integrated Drought Information System [NIDIS] 2025b):

- D0—Abnormally Dry
  - Short-term dryness slowing planting, growth of crops
  - Some lingering water deficits
  - Pastures or crops not fully recovered
- D1—Moderate Drought
  - Some damage to crops, pastures
  - Some water shortages developing
  - Voluntary water-use restrictions requested
- D2—Severe Drought
  - Crop or pasture loss likely
  - Water shortages common
  - Water restrictions imposed

- D3—Extreme Drought
    - Major crop/pasture losses
    - Widespread water shortages or restrictions
- D4—Exceptional Drought
    - Exceptional and widespread crop/pasture losses
    - Shortages of water creating water emergencies

The USDM categories show experts' assessments of conditions related to drought. These experts check variables including temperature, soil moisture, water levels in streams and lakes, snow cover, and meltwater runoff. They also check whether areas are showing drought impacts such as water shortages and business interruptions. Associated statistics show what proportion of various geographic areas are in each category of dryness or drought, and how many people are affected. USDM data go back to 2000.

The Drought Severity and Coverage Index (DSCI) is an experimental method for converting drought levels from the USDM map to a single value for an area. DSCI values are part of the USDM data tables. Possible values of the DSCI range from 0 to 500. The utility of the DSCI has not yet been widely tested but it provides a convenient way to convert USDM data from categorical to continuous, and to aggregate from spatially specific to geopolitical boundaries.

El Niño and Drought

El Niño and La Niña are opposite phases of the El Niño-Southern Oscillation (ENSO) cycle, which describes fluctuations in ocean and atmosphere temperature in the east-central Equatorial Pacific. La Niña is sometimes referred to as the cold phase of ENSO and El Niño as the warm phase of ENSO. These temperatures deviations can have large-scale impacts on global weather and climate. El Niño and La Niña episodes occur on average every two to seven years and typically last nine to 12 months, though some prolonged events may last for years.

El Niño is a large-scale ocean-atmosphere climate interaction linked to periodic warming in sea surface temperatures across the central and east-central Equatorial Pacific. The presence of El Niño can significantly influence weather patterns, ocean conditions, and marine fisheries across large portions of the globe for an extended period of time (NOAA 2024).

During El Niño years, droughts in the state of Hawai‘i have occurred during what is normally the winter-spring wet season. For example, one of the most severe periods of drought related to an El Niño event for Kaua‘i occurred between 1998 and 2002 (Frazier et al. 2022). In January 1998, the NWS's network of 73 rain gauges throughout the state did not record a single above-normal rainfall, with 36 gauges recording less than 25% of normal (Pacific ENSO Applications Center 1998). All reporting stations on Kaua‘i had below-average precipitation for the month, with the south and southwest sides of the island reporting only 25% to 35% of average rainfall (Western Regional Climate Center [WRCC] 1998).

Hazard Profile

Past Events

Table I-8 and Table I-9 summarize the history of severe droughts affecting Kaua‘i County. Figure I-11 shows cumulative USDM ratings for Kaua‘i County since the system began in 2000.

Table I-8. Historical Drought in Kauaʻi

Year	Areas	Remarks
1952	Kauaʻi	Long, severe dry spell
1953	Hawaiʻi, Kauaʻi, Maui, Oʻahu	Water rationing on Maui water tanks in Kona almost empty; 867 head of cattle died; pineapple production on Molokaʻi reduced by 30%; rainfall 40% less than normal on Kauaʻi.
1998	Hawaiʻi, Maui, Molokaʻi, Oʻahu, Kauaʻi	Prolonged period of drought persists from 1998 through 2002 (Frazier et al. 2022). State declared drought emergency for Maui County declared emergency for Hawaiʻi due to water shortages.
2000–2002	Hawaiʻi, Maui, Molokaʻi Oʻahu, Kauaʻi	Counties declare drought emergencies; Governor proclaims statewide drought emergency; Secretary of Agriculture designates all counties as primary disaster areas due to drought.
2003	Hawaiʻi, Maui, Molokaʻi, Oʻahu, Kauaʻi	Secretary of Agriculture designates all counties as primary disaster areas due to drought (2003); Governor proclaims statewide drought emergency.
2007–2008	State of Hawaiʻi	D0 (Abnormally dry) to D3 (Extreme drought) covered the entire state; all counties declare drought emergencies; Governor proclaims statewide drought emergency.
2010–2011	Hawaiʻi, Honolulu, Kauaʻi, and Maui	El Niño drought conditions cause all four counties to be designated as Primary Natural Disaster Areas due to losses caused by drought; U.S. Department of Agriculture (USDA) Farm Service Agency provides assistance. Notable drought areas for Kauaʻi County include the windward side from February to December 2010 and in November 2011.
2012–2013	Hawaiʻi, Kauaʻi, Maui	Primary Natural Disaster Area due to drought declared for Maui, Kauaʻi, and Hawaiʻi Counties, windward and leeward sides, from August to December 2012, and January 2013.
2015	Kauaʻi	County listed from Abnormally Dry (D0) to Moderate Drought (D1).
2016	Kauaʻi	From March through June, 35–44% of the county experienced Severe Drought (D2).
2017	Kauaʻi	Entire county experienced periods listed as Abnormally Dry (D0) to Severe Drought (D2).
2019	Kauaʻi	Only 1 month (November) with no drought listing. All other months experienced D0 to D2 conditions.
2020	Kauaʻi	As of July, nearly 60% of the county experienced Abnormally Dry (D0) conditions.

Sources: County of Kauaʻi (2015a); State of Hawaiʻi (2017); USDM (2020)

Table I-9. Drought in Kauaʻi 2020–2024

Year	Remarks
2020	From September through the beginning of November, the entire county was listed from abnormally dry (D0) or under drought conditions. 36% of the county was in moderate drought or worse and 17% was in severe drought. The USDA approved a secretarial drought declaration on November 18, 2020 (designation number: S4870).*
2021	From May to July, 65% of the county was listed abnormally dry (D0) or worse. In November to December, the entire county was listed as abnormally dry (D0) or under drought conditions.
2022	From January through April, the entire county was considered as being abnormally dry (D0) or under drought conditions. In February and March, the whole county had a moderate drought designation (D1) or worse with 13% experiencing severe drought (D2). Conditions briefly improved in May and June before the entire county alternated between abnormally dry (D0), moderate drought (D1), or severe drought conditions (D2) from June through October. 7-8% of the county experienced extreme drought (D3) during this time. A portion of the county retained either an abnormally dry or drought listing through the remainder of the year (D0-D2) with the entire county re-entering abnormally dry to severe drought conditions (D0-D2) in December. The USDA approved a secretarial drought declaration on August 15, 2022 (designation number: S5253).*
2023	The entire county was under abnormally dry (D0) conditions or under drought conditions from August through November with up to 48% of the county experiencing moderate drought (D1) or worse and up to 8% experiencing severe drought (D2).

Year	Remarks
2024	From February to April, 40% to 100% of the county experienced abnormally dry or drought conditions. From June through the end of the year, the county continued to experience dry conditions with 74% and 100% of the county designated abnormally dry (D0) or worse. At varying points in this time frame up to 100% of the county was in moderate drought (D1) or worse conditions, up to 30% was in severe drought (D2) or worse conditions, and up to 6% was in extreme drought (D3). The USDA approved a secretarial drought declaration on September 30, 2024 (designation number: S5793).*

Source: USDM (2025a)

*Data from USDA (2024)

Location

All areas of Kauaʻi County are susceptible to drought, although the extent and severity of the drought will depend on the variance of rainfall throughout the planning area based on location. The climate, and consequently the amount of rainfall, of the Hawaiian Islands is directly influenced by the northeasterly trade winds. Typically, leeward locations (south and west shores) are much drier and sunnier than windward locations (north and east shores). Within leeward and windward locations, rainfall varies considerably according to elevation (WRCC 2025).

Rainfall variability is far greater during winter, when occasional storms contribute to rainfall totals, than during summer, when trade wind showers provide most of the rain. The severe drought years are the ones where the winter rains fail. Although such a deficit of winter storms can affect any portion of the state, it hits hardest in the normally dry areas that depend chiefly on winter rains and receive little rain from the trade wind showers. In these locations, the small amount of rainfall that occurs during the usual dry summer season is insufficient to prevent severe drought (WRCC 2025).

According to Hawaiʻi's *Drought Risk and Vulnerability Assessment and GIS Mapping Project* Kauaʻi has an extensive water supply system to cover nearly the entire population, but most of the developed lands in Kauaʻi County coincide with low rainfall zones and may be susceptible to drought risk. Specific sector risks are as follows (Commission on Water Resource Management [CWRM] 2003):

- For the water supply sector, the greatest risk area from a regional perspective is in the Kōloa region due to low rainfall and sizable population. Other areas where drought frequency is high include Anahola, Kapaʻa, Wailua, Līhuʻe, and Poʻipū.
- For the agriculture and commerce sector, the lands in Waimea, between Poʻipū and Līhuʻe, and in Anahola are at risk.
- For the environment, public health and safety sector, there is concern about the possibility for wildland fires. Most wildland fires on Kaua'i have occurred in the forest reserves of Waimea, away from population concentrations. However, the August 2023 Maui wildfires demonstrate the disastrous situations that can occur when dry conditions combine with other weather factors to allow wildfire ignition near population centers.

Frequency

The frequency with which drought conditions occur is reported by the USDM. Figure I-11 shows the frequency of abnormally dry or drought conditions across the planning area since 2000. Each year is indicated with a January 4 date on the x-axis, but data are shown for the entire year and not only for January. The graphic shows that while abnormally dry conditions have been experienced fairly consistently in the planning area, the frequency of moderate or worse drought conditions has increased, making socioeconomic and environmental losses due to drought more likely.

According to the USDM, instances of the entire county being under abnormally dry conditions is not uncommon in the planning area. On average between 2000 and 2024, 41% of the county was abnormally dry (D0) or worse, 11.5% of the county was under moderate drought conditions (D1) or worse, 2.5% was under severe drought conditions (D2) or worse, and 0.2% was under extreme drought conditions (D3) or worse as measured on a weekly basis (USDM 2025c).

A notable increase in abnormally dry and drought conditions were observed in the planning area between 2020 and 2024. On average, 50% of the county was abnormally dry (D0) or worse, 23% of the county was under moderate drought conditions (D1) or worse, 5% was under severe drought conditions (D2) or worse, and 0.5% was under extreme drought conditions (D3) or worse as measured on a weekly basis (USDM 2025c). The duration of drought has not been as bad historically as in other islands (CWRM 2003).

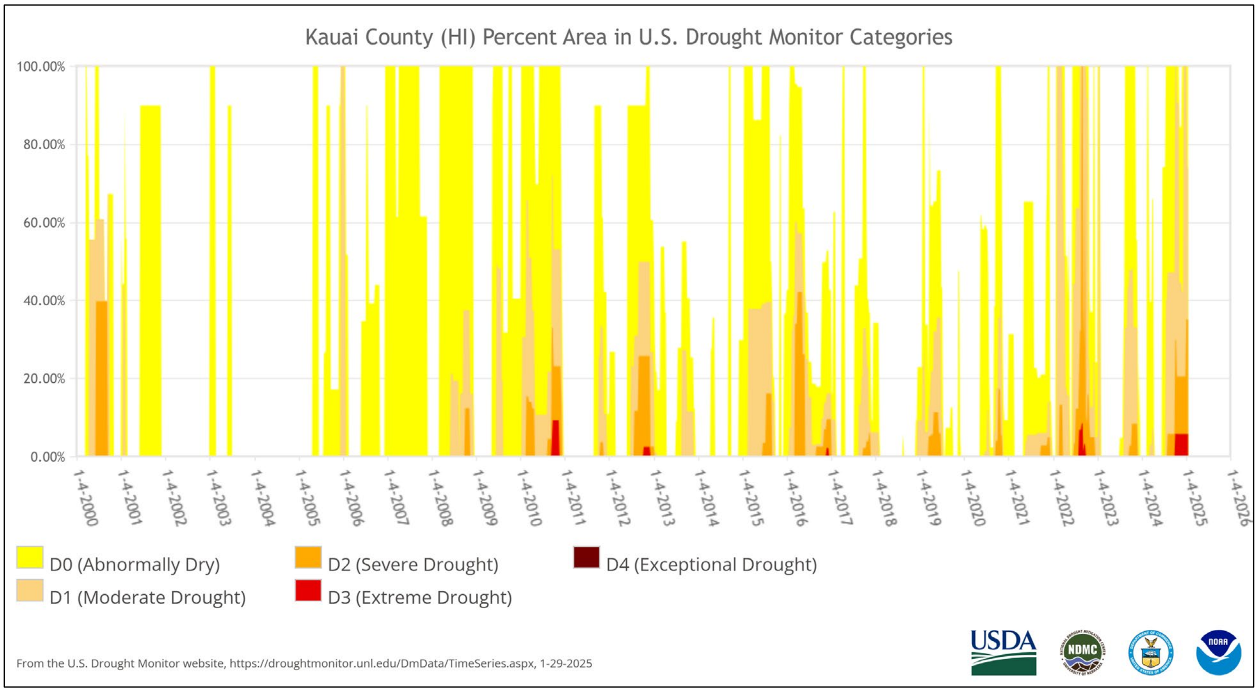


Figure I-11. Percent of Kauaʻi County affected by each USDM rating, 2000–2025 (USDM 2025a).

Warning Time

Drought forecasting is necessary to help prepare the state for potentially devastating drought events and forecasting tools have improved over the past few years. NOAA's Climate Prediction Center (CPC) and NIDIS have developed drought forecasting tools and long-lead rainfall outlooks.

The following are key resources for predicting drought (DLNR 2025):

- **U.S. Drought Information:** The CPC develops operational predictions of climate variability, real-time monitoring of climate and required databases, and assessments of the origins of major climate anomalies. The products cover time scales from a week to seasons, extending into the future as far as technically feasible, and cover the land, the ocean, and the atmosphere, extending into the stratosphere. The CPC's U.S. Monthly Drought Outlook and the U.S. Seasonal Drought Outlook include the Hawaiian Islands.

- **El Niño Diagnostic Discussion:** Many severe Hawaiian drought events are associated with the El Niño phenomenon. The CPC offers a monthly ENSO diagnostic discussion and a weekly ENSO update.
- **Tropical Pacific Islands Rainfall Outlooks:** The CPC produces a suite of short and long-range precipitation forecasts for Hawai'i and the tropical Pacific islands, including maps showing estimates of rainfall anomalies.
- **U.S. Drought Monitor:** The USDM provides current and recent history of areas and populations affected by drought.

Scientists at this time do not know how to predict drought more than a month in advance for most locations. Anomalies of precipitation and temperature may last from several months to several decades, depending on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on the global scale. However, meteorologists have made significant advances in understanding the climate system in the tropics. It is now known that a major portion of the atmospheric variability that occurs on time scales of months to several years is associated with variations in tropical sea surface temperatures.

The Tropical Ocean Global Atmosphere project has produced results that point to the possibility of predicting certain climatic conditions associated with ENSO events more than a year in advance. Since El Niño events are closely linked to drought conditions in Hawai'i, this project's results may help produce more reliable meteorological forecasts that can reduce risks in those economic sectors most sensitive to climate variability and, particularly, extreme events such as drought.

INLAND FLOODING

Hazard Description

Floodplain Background

Measuring Floods and Floodplains

The frequency and severity of flooding are measured using a discharge probability for river systems. The discharge probability is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for different discharge levels and storm surge levels. These measurements reflect statistical averages only; it is possible for multiple floods with a low probability of occurrence (such as a 1% annual chance flood) to occur in a short time period. For riverine flooding, the same flood event can have flows at different points on a river that correspond to different probabilities of occurrence.

The extent of flooding associated with a 1% annual probability of occurrence (also called the base flood) is used as the regulatory boundary by many agencies. Also referred to as the Special Flood Hazard Area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.

Floodplain Ecosystems

A floodplain is defined as the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that becomes inundated with water during a flood. When floodwaters recede after a flood event, they leave behind layers of rock and mud. These gradually build up to create a new floor of the floodplain. Floodplains generally contain unconsolidated sediments (accumulations of sand, gravel, loam, silt, and/or clay), often extending below the bed of the stream. These sediments provide a natural filtering system, with water percolating back into the ground and replenishing groundwater. These are often important aquifers, the water drawn from them being filtered compared to the water in the stream. Fertile, flat reclaimed floodplain lands are commonly used for agriculture, commerce and residential development.

Connections between a water source and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood-control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

Floodplains can support ecosystems that are rich in plant and animal species. A floodplain can contain 100 or even 1,000 times as many species as a river. Wetting of the floodplain soil releases an immediate surge of nutrients: those left over from the last flood, and those that result from the rapid decomposition of organic matter that has accumulated since then. Microscopic organisms thrive and larger species enter a rapid breeding cycle. Opportunistic feeders (particularly birds) move in to take advantage.
The production of nutrients peaks and falls away quickly, but the surge of new growth endures for some time. This makes floodplains valuable for agriculture. Species growing in floodplains are markedly different from those that grow outside floodplains. For instance, riparian trees (trees that grow in floodplains) tend to be very tolerant of root disturbance and very quick growing compared to non-riparian trees.

Human Impacts on Floodplains

Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate in floodplains for a number of reasons: water is readily available; land is fertile and suitable for farming; transportation by water is easily accessible; and land is flatter and easier to develop. But human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels. This increases flood potential in two ways: it reduces the stream's capacity to contain flows, and it increases flow rates or velocities downstream during all stages of a flood event. As a result, Flood Insurance Rate Maps (FIRMs) delineate regulatory floodways where development is restricted or prohibited. Development projects within floodways are highly regulated and proceed on a case-by-case basis.

FEMA Regulatory Flood Zones

According to FEMA, flood hazard areas are defined as areas that are shown on a map to be inundated by a flood of a given magnitude. These areas are determined using statistical analyses of records of river flow, storm tides, and rainfall; information obtained through consultation with the community; floodplain topographic surveys; and hydrologic and hydraulic analyses. Flood hazard areas are delineated on FEMA's FIRM, which are official maps of a community on which the Federal Insurance and Mitigation Administration has delineated both the SFHAs and the risk premium zones applicable to the community.

These maps identify the SFHAs; the location of a specific property in relation to the SFHA; the base flood elevation (1% annual chance) at a specific site; the magnitude of flood a flood hazard in a specific area; the undeveloped coastal barriers where flood insurance is not available and locates regulatory floodways and floodplain boundaries (1% and 0.2% annual chance floodplain boundaries).

The land area covered by the floodwaters of the base flood is the SFHA on a FIRM. It is the area where the National Flood Insurance Program (NFIP) floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies. This regulatory boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities since many communities have maps showing the extent of the base flood and likely depths that will be experienced.

The 1% annual chance flood is referred to as the base flood. As defined by NFIP, the base flood elevation on a FIRM is the elevation of a base flood event, or a flood which has a 1% chance of occurring in any given year. The base flood elevation describes the exact elevation of the water that will result from a given discharge level, which is one of the most important factors used in estimating the potential damage to occur in a given area. A structure located within a 1% annual chance floodplain has a 26% chance of suffering flood damage during the term of a 30-year mortgage. The 1% annual chance flood is a regulatory standard used by federal agencies and most states, to administer floodplain management programs. The 1% annual chance flood is used by the NFIP as the basis for insurance requirements nationwide. FIRMs also depict 0.2% annual chance flood designations.

Digitized Flood Insurance Rate Maps (DFIRMs), FIRMs, and other flood hazard information can be used to identify the expected spatial extent of flooding from a 1% and 0.2% annual chance event. DFIRMs and FIRMs depict SFHAs (areas subject to inundation from the 1% annual chance), defined as follows:

- **Zones A1-30 and AE:** SFHAs that are subject to inundation by the base flood, determined using detailed hydraulic analysis. Base Flood Elevations are shown within these zones.
- **Zone A (also known as unnumbered A-zones**): SFHAs where no Base Flood Elevations or depths are shown because detailed hydraulic analyses have not been performed.
- **Zone AO:** SFHAs subject to inundation by types of shallow flooding where average depths are between 1 and 3 feet. These are normally areas prone to shallow sheet flow flooding on sloping terrain.
- **Zone VE, V1-30:** SFHAs along coasts that are subject to inundation by the base flood with additional hazards due to waves with heights of 3 feet or greater. Base Flood Elevations derived from detailed hydraulic analysis are shown within these zones.
- **Zone B and X (shaded):** Zones where the land elevation as been determined to be above the Base Flood Elevation, but below the 500-year flood elevation. These zones are not SFHAs.
- **Zones C and X (unshaded):** Zones where the land elevation has been determined to be above both the Base Flood Elevation and the 500-year flood elevation. These zones are not SFHAs.

Flooding in Kaua'i

Typical Flood-Causing Events

Prolonged rainfall may result in an accumulation of water creating flooding conditions that last several days, or even weeks. Microbursts or "rain bombs" caused by a sudden concentrated downburst of wind and rain can result in flash flooding. Factors influencing flooding conditions include rainfall intensity and duration, topography, soil type, antecedent soil moisture, and ground cover. In Hawai'i, major floods typically occur during the rainy winter, accounting for approximately 84% of the floods in the islands. Five types of storms produce heavy precipitation, and therefore floods:

- **Kona storms:** These storms occur during the wettest period of the year, from November to April. Trade winds from the northeast slack during this time, allowing storms from the south to more easily approach the islands. Kona winds are generally warmer and carry moisture that is dropped evenly as rain over entire islands. The low-elevation and southern, drier sides of the islands get most of their rainfall (approximately 25 to 30 inches each season) during kona storms. Because of the potential combination of high winds and heavy rains, these events can cause coastal and inland flooding over larger geographic areas.
- **Frontal storms:** Frontal storms usually occur from December through March. They originate over the Pacific Ocean as a result of the intersection of polar and tropical air masses and move eastward over the islands. Heavy continuous rainfall over a period of several hours can create disaster conditions in high sloping areas of the islands. Low-lying areas with poor drainage are prone to landslides and flash floods during these storms.
- **Upper-level lows:** Upper-level lows and troughs can occur any time of the year. In many instances, upper-level lows have little or no effect on the lower levels of the atmosphere. However, these lows are sometimes able to tap into the marine layer and induce heavy showers that sometimes produce flash flooding.
- **Tropical cyclones:** The various categories of tropical cyclones—tropical depressions, tropical storms, and hurricanes—hitting or passing near the Hawaiian Islands cause heavy rains, storm surge, high winds and surf. Impacts from these events include severe coastal and inland flooding. Tropical cyclones also cause severe damage due to high surf.
- **Microbursts:** These are heavy precipitation events associated with thunderstorms. They occur when a column of air moves toward the surface within a thunderstorm bringing strong winds with it. Microbursts can be dry or wet with and only the wet microbursts are associated with substantial rainfall. These events are generally confined to a relatively small area of about 2.5 miles or less (NOAA 2025f; NWS 2025n). Microbursts are sometimes referred to as rain bombs.

General Flooding Types

Heavy precipitation brought about by the storms discussed in the previous section can lead to the following types of floods:

- **Riverine floods:** Small rivers and streams, such as those found in Kauaʻi County, are susceptible to flooding from large-scale and more localized weather systems that cause intense rainfall over small areas. Riverine floods occur along a channel and include overbank and flash flooding. Channels are defined ground features that carry water through and out of a watershed. They may be rivers, creeks, streams, or ditches. Channel overflow occurs when the carrying capacity of the channel is exceeded, which can be exacerbated by development changes within the drainage basin or clogging by debris or overgrown streambed vegetation. When a channel receives too much water, the excess water flows over its banks and inundates low-lying areas.
- **Flash floods:** Intense rainfall may trigger flash floods which provide little warning (less than 6 hours) before the affected area experiences flood conditions. Flash floods are "a rapid and extreme flow of high water into a normally dry area, or a rapid water level rise in a stream or creek above a predetermined flood level, beginning within 6 hours of the causative event (e.g., intense rainfall, dam failure). However, the actual time threshold may vary in different parts of the country. According to the NWS, "ongoing flooding can intensify to flash flooding in cases

where intense rainfall results in a rapid surge of rising flood waters" (NWS 2025o). Flash floods can tear out trees, undermine buildings and bridges, and scour new channels. In urban areas, flash flooding is an increasingly serious problem due to the removal of vegetation and replacement of ground cover with impermeable surfaces such as roads, driveways, and parking lots. The greatest risk from flash floods is that they occur with little to no warning. The major factors in predicting potential damage are the intensity and duration of rainfall and watershed and stream steepness.

- **Overland sheet flow:** Poorly drained low-lying areas are a problem when flooding occurs even when rainfall is not heavy. Overland sheet flow occurs primarily in areas with undefined drainage ways.
- **Dam failure floods:** Dam failures can occur anywhere there is a dam in Kaua'i. Dam failures result in a release of water that can have severe impacts downstream on people, property, and infrastructure along with natural and cultural resources.

Hazard Profile

Past Events

Table I-10 summarizes flood events in Kauaʻi County since 2005, as recorded in the NOAA NCEI Storm Events Database (NOAA 2020b, 2025c). Some of the more severe occurrences of flooding in the county are described following the table.

Table I-10. History of Flood Events

Date	Event	Injuries and Damages	Date	Event	Injuries and Damages
4/11/2024 to 4/12/2024	Flash flood	This flooding event resulted in $13.5 million in damages and led to evacuations and road closures. A major disaster declaration (DR-4793) and multiple state emergency proclamations were issued in response to this event. No injuries or deaths were reported.	11/09/2013	Flash flood	Property damage recorded for this event.
12/20/2023	Flood	None	03/27/2013	Flash flood	Property damage recorded for this event.
12/13/2023	Flood	None	03/26/2013	Flash flood	Property damage recorded for this event.
3/29/2023	Flash flood	None	02/21/2013	Flood	Fatalities resulted from this event
2/21/2023	Flash flood	None	01/27/2013	Flash flood	Property damage recorded for this event.
2/18/2023	Flash flood	None	03/09/2012	Flash flood	Property damage recorded for this event.
2/4/2023	Flash flood	None	03/05/2012	Flash flood	Property damage recorded for this event.
1/30/2023	Flash flood	None	03/04/2012	Flash flood	Property damage recorded for this event.
1/24/2023	Flash flood	None	03/03/2012	Flash flood	Property damage recorded for this event.
3/22/2022	Flash flood	None	02/26/2012	Flash flood	None

Date	Event	Injuries and Damages	Date	Event	Injuries and Damages
1/2/2022	Flash flood	None	01/17/2012	Flash flood	None
12/31/2021	Flash flood	None	11/05/2011	Flash flood	None
3/29/2021	Flash flood	None	05/12/2011	Flash flood	Property damage recorded for this event.
3/12/2021	Flash flood	None	05/08/2011	Flash flood	Property damage recorded for this event.
3/9/2021 to 3/10/2021	Flash flood	This flooding event resulted in $30.1 million in damages across the state. Roads, bridges, and nine homes were destroyed. Nearly 100 additional homes were damaged. No injuries or deaths were reported.	01/16/2011	Flash flood	Property damage recorded for this event.
2/17/2021 to 2/19/2021	Flash flood	None	12/27/2010	Flash flood	Property damage recorded for this event.
1/19/2021	Flash flood	None	12/09/2010	Flash flood	Property damage recorded for this event.
11/25/2020	Flash flood	None	12/03/2010	Flash flood	Property damage recorded for this event.
03/28/2020	Flash flood	Property damage recorded for this event.	04/07/2010	Flash flood	None
03/16/2020	Flash flood	Property damage recorded for this event.	11/26/2009	Flash flood	None
02/06/2020	Flash flood	None	11/14/2009	Flash flood	Property damage recorded for this event.
12/25/2019	Flash flood	Property damage recorded for this event.	11/13/2009	Flash flood	Property damage recorded for this event.
11/16/2019	Flash flood	Injuries were reported from this event	07/23/2009	Flash flood	None
10/11/2019	Flash flood	None	03/09/2009	Flash flood	None
09/16/2019	Flash flood	None	12/31/2008	Flash flood	None
08/04/2019	Flash flood	Property damage recorded for this event.	12/13/2008	Flash flood	Property damage recorded for this event.
12/29/2018	Flash flood	None	10/28/2008	Flash flood	N/A
11/10/2018	Flash flood	None	02/04/2008	Flash flood	Property damage recorded for this event.
08/28/2018	Flash flood	Fatalities resulted from this event	02/03/2008	Flash flood	Property damage recorded for this event.
08/27/2018	Flash flood	Property damage recorded for this event.	12/05/2007	Flash flood	Property damage recorded for this event.
04/14/2018	Flash flood	Property damage recorded for this event.	11/28/2007	Flash flood	Property damage recorded for this event.
03/15/2018	Flash flood	Property damage recorded for this event.	02/23/2007	Flash flood	None
03/14/2018	Flash flood	Property damage recorded for this event.	11/01/2006	Flash flood	None

Date	Event	Injuries and Damages	Date	Event	Injuries and Damages
02/22/2018	Flash flood	Property damage recorded for this event.	08/07/2006	Flash flood	None
02/04/2018	Flash flood	None	04/02/2006	Flash flood	None
11/30/2017	Flash flood	None	03/27/2006	Flash flood	None
11/01/2017	Flash flood	Property damage recorded for this event.	03/26/2006	Flash flood	None
10/31/2017	Flash flood	None	03/17/2006	Flash flood	None
08/21/2017	Flash flood	None	03/16/2006	Flash flood	None
03/01/2017	Flash flood	Property damage recorded for this event.	03/15/2006	Flash flood	None
12/03/2016	Flash flood	Fatalities resulted from this event.	03/13/2006	Flash flood	Fatalities resulted from this event
12/02/2016	Flash flood	Property damage recorded for this event.	03/10/2006	Flash flood	None
03/25/2016	Flash flood	Property damage recorded for this event.	03/09/2006	Flash flood	None
09/04/2015	Flash flood	None	02/21/2006	Flash flood	Property damage recorded for this event.
07/22/2015	Flash flood	None	10/01/2005	Flash flood	None
12/23/2014	Flash flood	None	09/14/2005	Flash flood	None
02/21/2014	Flash flood	Property damage recorded for this event.	02/02/2005	Flash flood	Property damage recorded for this event.
02/16/2014	Flash flood	Property damage recorded for this event.	01/31/2005	Flash flood	Property damage recorded for this event.
12/15/2013	Flash flood	Property damage recorded for this event.	01/01/2005	Flash flood	Property damage recorded for this event.
12/01/2013	Flash flood	Property damage recorded for this event.			

Source: NOAA (2020b, 2025c)

December 1991

Flash floods from a storm on December 14, 1991, dropped over 20 inches of rain in 12 hours over Anahola, causing five deaths, intense flooding, bank failures, erosion, and slides, totaling more than $5 million in property damages.

October/November 2006

Heavy rainfall from October 31 to November 2, 2006, across much of Hawai‘i was the result of two systems, the first being leftover moisture from an old front that pooled along the windward sides of the islands. The light easterly wind flow helped push the moisture over windward sections of the islands, resulting in some showers on October 30. By October 31, the system destabilized further as an upper-level trough of low pressure moved toward Hawai‘i. The more unstable conditions resulted in locally heavy rainfall that persisted into the afternoon hours of November 1. Rainfall amounts during the period were quite large, especially along windward sections of Kauaʻi and Oʻahu, with some locations receiving well over 15 inches of rainfall. Some locations received over 3 inches in a matter of 1 or 2 hours. The excessive rains produced flooding over portions of windward Kauaʻi.

April 2018

A developing upper low northwest of the state, in combination with tropical moisture, induced periods of heavy showers and thunderstorms, generating historic flash flooding conditions over Kauaʻi. An apparent 24-hour rainfall total of 49.69 inches, ending at 12:45 p.m. Hawaii Standard Time on April 15, 2018, was recorded at an automated rain gauge in Waipā, Kauaʻi, about 1 mile west of Hanalei. This total set a new 24-hour rainfall record for the United States, surpassing the previous record of about 43 inches in Alvin, Texas, on July 25 and 26, 1979 (University of Hawaiʻi Mānoa 2022).

The deluge, mainly over northern Kauaʻi but also affecting East Oʻahu, damaged or destroyed farms and various structures, including 532 homes; downed trees and power lines; flooded homes, businesses and vehicles; and closed and damaged numerous roadways with water and debris flows, with highway and road repairs estimated at $35 million. There were apparently no significant injuries, but material losses will be extremely exorbitant, with public property damages alone estimated at $19.7 million. Hawaiʻi's state legislature approved $125 million in relief aid for flood-ravaged communities on Kauaʻi and Oʻahu. A Major Disaster Declaration (DR-4365) was declared on May 8, 2018, with over $11 million in Public Assistance Grants and almost $1.6 million for Individual Assistance.

March 2020

Heavy rainfall led to severe flooding. Almost uninterrupted heavy rain for more than 36 hours on the north shore cut off Hanalei and the rest of the west end of the island. Kūhiō Highway was closed near the Hanalei Bridge as the Hanalei River overflowed along the roadway. Kūhiō Highway was also closed in Wailua as debris piled up against the Wailua River Bridge, creating a makeshift dam. The NWS issued two severe thunderstorm warnings, a flash flood warning, and a tornado warning (no tornado occurred). A major disaster declaration (DR-4549) was issued to assist with recovery. The State of Hawaii issued an emergency proclamation on April 21, 2020, to aid in the recovery (HI-EMA 2020).

April 2024

On April 11 and 12, 2024, heavy rainfall accompanied by thunderstorms led to substantial flooding in parts of the county (Figure I-12). Flash floods were experienced in Kaumakani, Lāwaʻi, Wailua, Līhuʻe, Princeville, and Kapaʻa. Flooding led to evacuations and road closures. Lāwaʻi reported $ 6.5 million in property damages and Wailua reported $7 million. There were no reported injuries or deaths associated with the event (NOAA 2025c). A major disaster declaration (DR-4793) and state emergency proclamations were issued to assist with response and recovery from the disaster. Eight state emergency proclamations have been issued in response to this event as of April 2025.

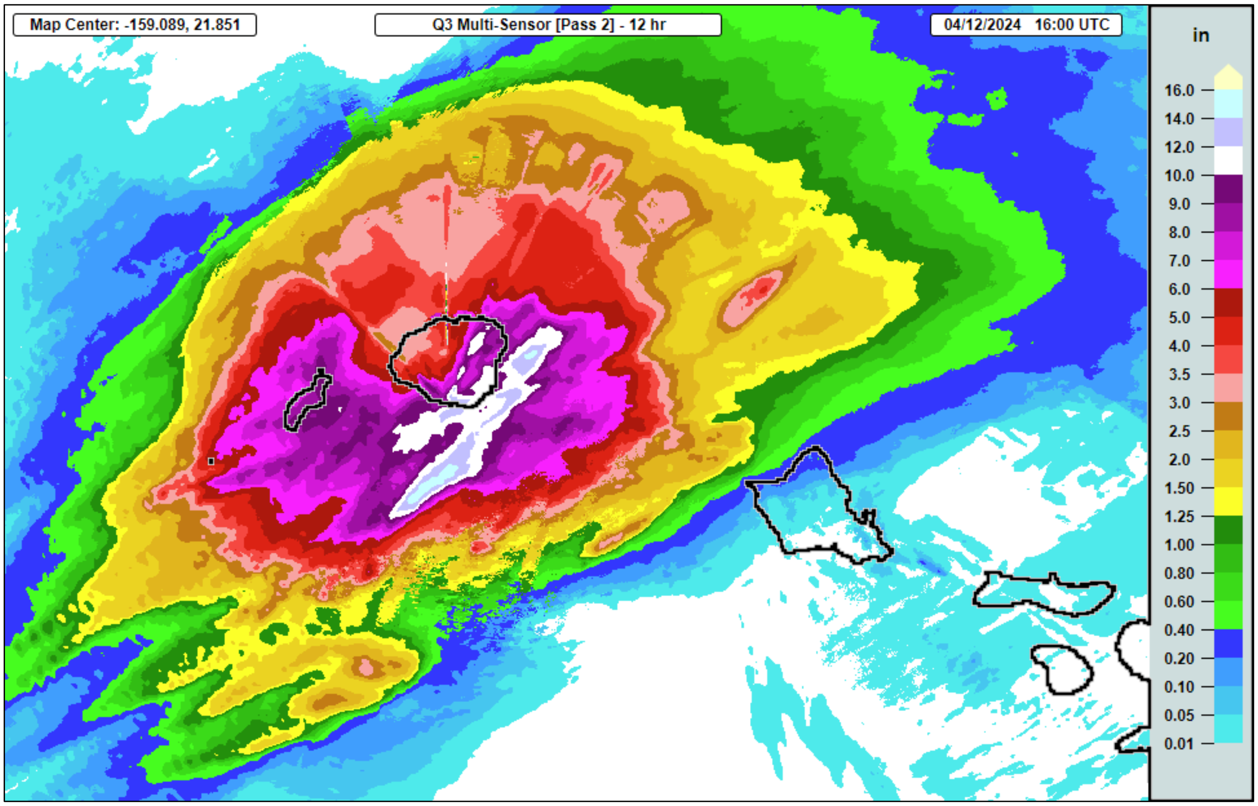


Figure I-12. Estimated rainfall over Kaua’i during the April 2024 flooding event (NWS 2025g).

Location

Annual rainfall on the island of Kaua‘i ranges from more than 400 inches on Mt. Wai‘ale‘ale, to between 20 and 80 inches along the coast. Flooding is common on the wet, windward side of the island where annual rainfall is high. Most of the flooding that has caused damage has been flash flooding during extreme rainfall events that bring about sheet flow between stream channels.

Area Within the Mapped Floodplain

Flooding that has occurred in portions of the county has been documented by gauge records, high water marks, damage surveys, and personal accounts. This documentation was the basis for the floodplains mapped by FEMA on FIRMs for Kaua‘i County (see Section 10: Figure 10-1). All of the principal flooding sources are incorporated in the currently effective FIRMs. The FIRMs are the most detailed and consistent data source available for determining flood extent. The 2010 Flood Insurance Study (FEMA 2010) and associated FIRMs (including some 2019 preliminary DFIRMs) were used in the risk assessment to map the extent and location of the flood hazard, as this version included the certification of all three levees. Table I-11 shows the area of the county in the 1% annual chance floodplain broken down by planning district based on these FIRMs. Only 3% of the entire county (355,024 acres) is within the mapped 1% annual chance floodplain. The 2021 FIS and FIRMs decertified the levees, and this current effective version was determined to not represent a realistic understanding of the current flood risk.

Table I-11. Area in the 1%-Annual Chance (100-Year) Floodplain

Area	Number of Acres	% of Total Floodplain Area
North Shore	2,063	19.2%
East Kauaʻi	1,538	14.3%
Līhuʻe	1,095	10.2%
Kōloa-Poʻipū-Kalāheo	1,170	10.9%
Hanapēpē- ʻEleʻele	506	4.7%
Waimea	4,375	40.7%
Total	10,746	100.0%

Principal Flooding Sources

The following subsections summarize historical flooding issues in specific local areas across the island.

Hanalei Watershed

Hanalei is a small rural community located on the higher ground along the coastline of Hanalei Bay. The major portion of the Hanalei area is in agricultural use; taro fields and pasturelands predominate. Residential and commercial properties are also located in the floodplain, but most are on slightly higher ground. The upper half of the detailed-study section of Hanalei River lies in the Hanalei National Wildlife Refuge.

The plateaus and lowlands extending from Hanalei in the north and clockwise to the Mana-Barking Sands area on the southwest are the island's most fertile lands. The central area, on Kōkeʻe Plateau, consists of steep gulches and valleys, bordered on the west by the cliffs of Na Pali and on the east by Alakaʻi Swamp. The inaccessible sheer cliffs and mountainous terrain of Na Pali, as well as parts of Kōkeʻe, are reserved for conversation and a state park.

The Hanalei River has a history of flooding Kūhiō Highway and adjacent croplands.

Anahola Watershed

Anahola Stream flows easterly from the mountains, bisecting the Town of Anahola before emptying into the Pacific Ocean. The upper slopes of the mountains in the Anahola Watershed are predominantly overgrown with thick vegetation.

Anahola Stream drains an area of approximately 10.3 square miles that is approximately 1.5 miles wide and 7 miles long. The Anahola area is not heavily urbanized. A large portion of the residential area is owned by the Hawaiian Homes Commission. The southeastern bank of the river supports most of the residential homesites, as well as agricultural activities.

The largest flood in the Anahola area occurred on January 25, 1956, when a 24-hour period saw over 13 inches of rain. The discharge rate associated with Anahola Stream during this event was close to that anticipated for the 0.5% annual chance flood event. On December 14, 1991, a 12-hour period saw more than 20 inches of rain, which led to flash floods and severe flooding, five deaths, erosion, slides, and significant property damage (FEMA 2021a).

Kapa‘a Watershed

Kapa‘a Stream is the primary flooding source of Keālia, a small rural community located near the coastline north of Kapa‘a. Upstream of Keālia along Kapa‘a Stream are large tracts of sugarcane fields. Mo‘ikeha Canal drains an area of approximately 2.0 square miles and flows through the northern section of Kapa‘a. Approximately 45% of the drainage area is forested, 50% is in sugarcane and grazing fields, and 5% is occupied by residential and commercial facilities. Mo‘ikeha and Waika‘ea Canals were built to alleviate the flood problems of Kapa‘a (FEMA 2021a). However, neither canal has the capacity to contain a 100-year flood, and each is potentially a primary source of flooding for the Kapa‘a area.

Wailua Watershed

The pear-shaped Wailua River basin extends approximately 11 miles from the ocean on the east to the summit of Mount Wai‘ale‘ale in the central part of the island. Its topography is generally hilly and rugged in the upper sections, with a valley plain in the central portion, which terminates in a small, flat area at the coast.

The Wailua River is the primary source of flooding in the coastal area of Wailua. The land is in agricultural use in the vicinity of the Wailua River and ‘Ōpaeka‘a Stream confluence. Commercial and hotel establishments, along with some residences, occupy the coastal area on relatively low land; the average ground elevation is approximately 6 feet in the residential and business area and approximately 4 feet in the agricultural district. Farmland and pastures predominate in the vicinity of ‘Ōpaeka‘a Stream; there is a residential subdivision downstream of ‘Ōpaeka‘a Road.

The largest flood event recorded in the Wailua watershed happened on January 31, 1975 (FEMA 2021a). This flood rose to a stage that nearly inundated the road leading into the Wailua Homestead area. The largest recorded flood on the Wailua River inundated half of the Wailua residential area on April 15, 1963. At least 20 major floods have been recorded on the river since 1912. In 1955, the Coco Palms Hotel dining room was inundated to a depth of approximately 5 feet. Flood problems on the Wailua River are aggravated by the accumulation of debris at the highway bridge piers.

Līhu‘e Watershed

The Līhu‘e Watershed supports agricultural and commercial activities. Commercial and business centers, a major inter-island airport, a deep-draft commercial harbor, and the island's major hospital are the notable developments. Located in the watershed is Līhu‘e, the county seat and commercial center of Kaua‘i. The watershed extends from the coast to the lower ridges of Mount Wai‘ale‘ale. A significant portion of the developable land is used for agriculture. Several reservoirs built in the watershed serve the agricultural irrigation system.

The Nāwiliwili Stream is the primary source of flooding for the Līhu‘e and Nāwiliwili areas. The upper reach flows through the commercial and industrial are of Līhu‘e. The residential and commercial areas of Nāwiliwili are located near the stream mouth. Puali Stream flows though the residential area of Niumalu, a small community on the outskirts of Nāwiliwili.

The worst flood on Nāwiliwili Stream occurred in April 1963, when the stream overflowed and inundated the low-lying coastal area and damaged sugarcane fields. The Puali and Nāwiliwili Streams’ lowlands are especially vulnerable to flood inundation. Two main factors contribute to this vulnerability. One is backwater that exacerbates flooding due to sand buildup at the mouth of Nāwiliwili Stream. The other is exacerbated flooding due to debris accumulation at the bridge openings. The area upstream of the Rice Street Bridge is particularly problematic. Puali Stream has also inundated lawns, roads, and parking lots with sheet runoff and overflow. Residential areas have experienced 1 to 2 feet of flooding in their low areas (FEMA 2021a).

Kōloa Watershed

The Kōloa-Po'ipū community is located on the southern coast of Kaua'i, approximately 8 miles southwest of Līhu'e. The floodplain contains mostly residential, commercial, and resort development.

The upper reach of Waikomo Stream flows through Kōloa and is that town's primary flooding source. The central and lower reaches flow mostly through agricultural lands. The 'Ōma'o Stream watershed, an area of approximately 4.1 square miles, contains six irrigation reservoirs. The Lāwa'i Stream floodplain is predominantly covered by vegetation with a few houses, several small cultivated areas, and a warehouse complex.

Properties near Waikomo Stream and Waikomo Road within the Kōloa watershed are vulnerable to flooding. The accumulation of debris and vegetation in the stream channel has contributed to worsened flooding in the area (FEMA 2021a). On January 31, 1975, Waikomo Stream flooded the Town of Kōloa. About 30 people had to be evacuated from their homes. However, a more substantial flood problem is present in the coastal areas of Kōloa-Po'ipū, where shallow flooding results from a combination of low-lying areas and a lack of sufficient drainage. Between 1954 and 1965, six storms occurred that flooded these areas of Kōloa-Po'ipū without flooding Waikomo Stream (FEMA 2021a).

Hanapēpē Watershed

The Hanapēpē River is located in the south-central portion of the island. Its steep slopes induce rapid runoff during heavy rainfall, causing an abrupt rise in streamflow and a low rate of infiltration. The floodplain is roughly triangular and is confined by steep bluffs. Except for several small stores, there are no commercial or industrial establishments within the floodplain. It is the primary flooding source of the Hanapēpē area.

The Hanapēpē area experienced its most substantial recorded flood on April 15, 1963. The flood had the highest recorded discharge rate for the river at the time (39,000 cubic feet per second), reaching the anticipated discharge rate for the 0.5 % annual chance flood event. The flood destroyed and damaged many homes and a flood-control levee project in the process of being constructed at the time. The levee has since been built, but low-lying areas behind the levee do not have adequate drainage and have been flooded by Hikiula Gulch (FEMA 2021a).

Moloa'a Stream

Moloa'a Stream and the nearby Anahola area have experienced numerous past flood events. Moloa'a Stream runs to the northeast of the Anahola community. The area along Moloa'a Stream from Ko'ola Road for about a third of a mile downstream experiences flooding due to relatively shallow channel slopes and the additional influx of water from one of the stream's tributaries. Further downstream, flooding of Moloa'a Stream largely occurs on the left bank, if facing downstream, while most homes are located on the right bank. A significant flooding concern associated with the stream is a sandbar at its mouth that must be consistently cleared to prevent flooding from backwater (FEMA 2021a).

There are no gauge stations on Moloa'a Stream, which means there is no recorded flood data for the stream. However, the occurrence of significant flood events in the nearby Anahola community suggests these events also occurred along Moloa'a Stream (FEMA 2021a).

For instance, substantial flooding occurred in northeastern Kauaʻi in December 1991. Two separate floods occurred in the month, one on December 4 and one on December 13 and 14. The latter event resulted in three fatalities and $7 million in damage, and had discharge rates over those anticipated for the 1% annual chance flood event. A flood in January 1965 in the area also had recorded discharge rates above those anticipated for the 1% annual chance flood event. The area additionally experienced significant floods in 1948, 1959, 1965, 1968, and 1975 (FEMA 2021a).

West Kauaʻi Watershed

The West Kauaʻi Watershed extends from the coast to the Waimea Canyon ridgeline. Lying on the leeward side of the island and outside the rain-causing influence of Mount Waiʻaleʻale, the watershed is fairly dry most of the year.

The community of Kekaha lies along the coast in the Kekaha Drainageway and is made up primarily of residences and the Kekaha Sugar Mill and its plantation facilities. Kekaha is located on a broad, flat shelf that forms the greater part of the southwestern coastline of the Island of Kauaʻi. The area is devoid of deep, well-defined streams.

In December 1973, the Kekaha area experienced its largest storm on record. The storm was the result of substantial rainfall throughout the area, which received 7 inches of rain in 2 hours. The Hawaiian Homes area was flooded, and Cox's Ditch, county and state roads, roughly 50 homes, and sugarcane fields were damaged. Local residents stated the flood was worsened by non-natural sand plugs that had been placed in drainageways close to Kekaha (FEMA 2021a).

Wainiha Watershed

The sparsely populated Wainiha Watershed is a rural environment. Small clusters of residential and commercial (primarily tourist-oriented) areas are located along the coast. Most of the watershed lies in steep, mountainous terrain. Having a northern exposure, the watershed receives a large amount of rainfall from the prevailing trade winds.

Few houses are located within the Wainiha Valley. Most of the valley area is either under cultivation or covered by natural vegetation.

The Wainiha River has experienced three substantial flood events. One occurred on February 17, 1956, when the Wainiha Valley received over 20 inches of rain within 24 hours. The flooding destroyed a stream gauge on the Wainiha River located about 7 miles from its mouth (FEMA 2021a). During a 4-day period of November-December 1968, approximately 15.47 inches of rain were recorded at the Wainiha Powerhouse rain gauge and 29 inches estimated at the Wainiha Power Canal Intake rain gauge. Taro patches near the stream were either washed away or covered with mud and debris. The floodplain in the downstream reach (up to the 20-foot contour area) was inundated to depths of 2 to 3 feet. The two wooden bridges at Kūhiō Highway that span the in-stream and the side branch on the in-stream were damaged. Further up the valley, hillside runoff caused road washouts and landslides. The generator units and part of the building of the Wainiha Powerhouse were damaged by a landslide and sustained damages. On April 19, 1974, approximately 11.5 inches of rain fell at the Wainiha Power Canal Intake rain gauge and approximately 9.2 inches at the Wainiha Powerhouse rain gauge during a 24-hour period. One child drowned, and another child survived after being swept 600 feet downstream. Several homes and cars were destroyed. Eleven residents were evacuated by helicopter from the flooded valley area. The floodwater inundated 100 acres of land up to 7 feet deep and heavily damaged the taro crop.

Waimea Watershed

The Waimea Watershed drains the northwestern summit slopes of Mount Wai'ale'ale. The uplands contain a large swamp area that drops steeply into several valleys. A forest reserve that encompasses the Waimea Canyon State Park occupies most of the watershed area.

Near the mouth of the Waimea River is the town of Waimea, where the houses near the river are protected by a flood-control levee. However, this levee system has been decertified by FEMA. The levee is still present and reducing flood risk, but additional efforts are needed for it to be recertified. For a description of the levee, see Section 10.1.3, National Flood Insurance Program. Cultivated fields and natural vegetation occupy the floodplain not protected by the levee.

The Waimea River has flooded the Waimea community numerous times, including particularly damaging floods in 1916, 1921, 1927, and 1942. However, a flood on February 7, 1949, was the most severe recorded. The flood covered all of the Waimea community with a maximum flood depth of over 11 feet and was considered to be a 1.8% annual chance flood event. The flood killed two people, destroyed several homes, and moved some structures off their foundations (FEMA 2021a).

Frequency

There have been nine federal major disaster declarations for non-tsunami, non-tropical cyclone flooding in the Hawaiian Islands since 1955. This equates to a major, non-tsunami, non-tropical-cyclone-related flood event approximately every 7.75 years on average. Based on past major disaster declarations, a large and damaging flood could be expected to occur on Kaua'i with an annual probability of nearly 13% if historic conditions continued into future years.

More localized flood events can be expected to happen annually. The National Centers for Environmental Information (NCEI) Storm Events database (NOAA 2025c) lists of total of 99 flood or flash flood events that have occurred since 2005, including those resulting in major disaster declarations. This comes out to an average of approximately five flood events per year over the past 20 years.

However, the frequency of inland flood events in future years is difficult to quantify as climate change is increasing the likelihood of heavy precipitation events in Kaua'i leading to more flooding. This means historic conditions do not offer a reliable baseline for the frequency of flood events. Additionally, flooding could also increase in smaller streams and basins as a result of increased development, increasing the amount of impervious surface.in smaller streams and basins can be expected to increase somewhat as a result of increased development, increasing the amount of impervious surface.

Severity

The principal factors affecting flood damage are flood depth and velocity. The deeper and faster flood flows become, the more damage they can cause. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. This is especially true when a channel migrates over a broad floodplain, redirecting high-velocity flows and transporting debris and sediment. Flood severity is often evaluated by examining peak discharges. Peak flows used by FEMA to map the floodplains of the planning area are listed in Table I-12.

Warning Time

Due to the sequential pattern of weather conditions needed to cause serious flooding, it is unusual for a flood to occur without warning. Warning times for floods can be between 24 and 48 hours. Flash flooding can be less predictable, but potential hazard areas can be warned in advanced of potential flash flooding danger.

The duration of a flood event means the time between the start and end of the flood or the event that caused it. This can be difficult to define for floods, particularly inland floods, as they recede slowly and do not vanish completely; flood water moves from one area to another. Flash flooding occurs within 6 hours of a rain event, while other types of flooding are longer-term events and may last a week or more.

Flood warnings and watches are issued by the local NWS office. The NWS updates watches and warnings and notifies the public when they are no longer in effect. Flood watches and warnings in Hawai'i are as follows:

- **Coastal Flooding**
    - **Coastal Flood Advisory:** Issued when minor or nuisance coastal flooding is occurring or imminent.
    - **Coastal Flood Watch:** Issued when moderate to major coastal flooding is possible. Such flooding could pose a serious risk to life and property.
    - **Coastal Flood Warning:** Issued when moderate to major coastal flooding is occurring or imminent. This flooding will pose a serious risk to life and property.
- Inland Flooding
    - **Flood Advisory:** Issued when nuisance flooding is occurring or imminent. A flood advisory may be upgraded to a flash flood warning if flooding worsens and poses a threat to life and property.
    - **Flash Flood Watch:** Issued when heavy rain leading to flash flooding is possible. People in the area of a flash flood watch should be prepared for heavy rains and potential flooding. Flash flood watches may be issued up to 12 hours before flash flooding is expected.
    - **Flash Flood Warning:** Issued when flooding is occurring or will develop quickly. The population needs to take shelter and/or move to high ground, as necessary.

The USGS also provides real time information on stream flows in Kaua'i County through its Water Watcher program (USGS 2025g). This program provides real-time stream flow information as well as flood and high flow information for 14 gauges throughout Kaua'i County. An example image from this online tool is shown in Figure I-13.

Table I-12. Summary of Peak Discharges Island of Kaua'i

Source/Location	Discharge (cubic feet/second)			
	10-Year	50-Year	100-Year	500-Year
Anahola Stream – At mouth	15,000	24,000	29,000	42,000
Hanalei River – At mouth	37,000	51,000	58,000	73,000
Hanamā'Ulu Stream – At mouth	N/A	N/A	27,300	N/A
Hanamā'Ulu Stream Tributary – At mouth	N/A	N/A	11,193	N/A
Hanapēpē River – At mouth	21,000	32,000	38,000	52,000
Hanapēpē River – At Gage No. 16049000	17,000	26,000	31,000	42,000
Hulā'la Stream – At mouth	21,270	34,020	40,160	56,190
Hulā'la Stream – At a point approximately 13,800 feet inland	16,800	26,860	31,700	44,330

Source/Location	**Discharge (cubic feet/second)**			
	10-Year	**50-Year**	**100-Year**	**500-Year**
Kalama Stream – At confluence with ‘Ōpaeka‘a Stream	3,800	6,600	8,200	12,200
Kapa‘a Stream – At mouth	21,000	32,000	37,000	51,000
Kekaha Drainageway Waipao-Waika Basin	N/A	N/A	8,605	N/A
Kekaha Drainageway Kapilimao-Waimea Basin	N/A	N/A	10,650	N/A
Kekaha Drainageway – Drainageway between basins	N/A	N/A	5,550	N/A
Lāwa‘i Stream – At Lauoho Road	3,090	5,470	6,650	10,170
Lāwa‘i Stream – At upstream Access Road crossing	2,870	2,070	6,170	9,440
Mo‘Ikeha Canal – At mouth	900	1,300	1,500	1,900
Moloa’a Stream – At mouth	3,630	5,780	6,800	9,480
Moloa’a Stream – Upstream of Tributary “A”	3,410	5,430	6,390	8,900
Moloa’a Stream – Downstream of Tributary “B”	2,950	4,690	5,520	7,690
Moloa’a Stream – Upstream of Tributary “B”	2,530	4,020	4,730	6,590
Nāwiliwili Stream – At mouth	2,400	6,350	10,400	19,000
Nāwiliwili Stream – At Līhu‘e Mill Access Road	2,250	5,800	9,450	17,400
‘Ōma‘o Stream – At confluence with Waikomo Stream	2,700	3,900	4,400	5,700
‘Ōpaeka‘a Tributary – At confluence with Wailua River	9,000	15,200	18,500	27,500
‘Ōpaeka‘a Tributary – Downstream of confluence of Kalama Stream	7,300	12,200	15,500	22,200
‘Ōpaeka‘a Tributary – Upstream of confluence of Kalama Stream	4,300	7,600	9,400	14,000
‘Ōpaeka‘a Tributary – Upstream of confluence of ‘Ōpaeka‘a Tributary	1,560	2,960	3,775	6,200
‘Ōpaeka‘a Tributary – At Access Road crossing	1,810	3,440	4,390	7,230
‘Ōpaeka‘a Tributary – At confluence of ‘Ōpaeka‘a Stream	370	710	900	1,480
‘Ōpaeka‘a Tributary – At Po‘o Road	350	660	840	1,380
Papakōlea Stream – At confluence with Hulā‘ia Stream	3,760	6,000	7,060	9,830
Puali Stream – At mouth	3,000	5,400	6,600	9,700
Waika‘ea Canal – At mouth	3,300	4,700	5,400	6,900
Waikomo Stream – At mouth	4,200	6,000	6,900	8,900
Waikomo Stream – Downstream of confluence of ‘Ōma‘o Stream	5,600	7,900	9,000	11,600
Waikomo Stream – Upstream of confluence of ‘Ōma‘o Stream	N/A	N/A	2,500	N/A
Waikomo Stream Tributary – At confluence with Waikomo Stream	N/A	N/A	670	N/A
Wailua River – At mouth	40,000	64,000	76,000	105,000
Waimea River – At mouth	35,500	54,500	64,000	89,000
Waimea River – Upstream of confluence with Makaweli River	28,900	45,300	53,300	74,600
Wainiha River – At mouth	29,700	46,600	55,590	76,560
Wainiha River – At a point approximately 8,800 feet inland	27,550	43,220	51,540	70,980
Waipā Stream – At mouth	5,000	8,800	10,500	16,000
Wai‘oli Stream – At mouth	7,400	12,500	16,000	23,000

Source: FEMA (2021a)

N/A = not applicable/not available

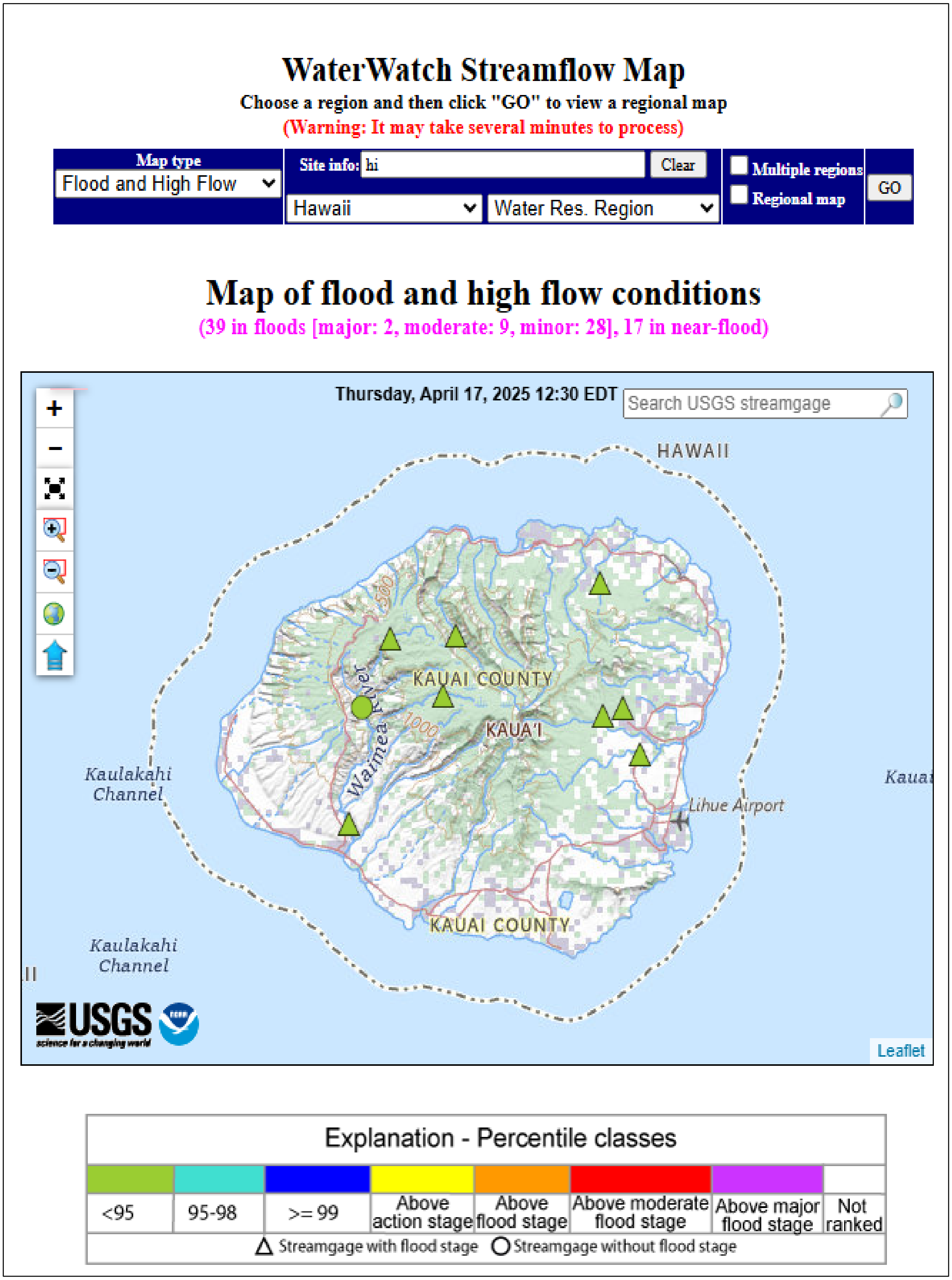


Figure I-13. USGS WaterWatch Streamflow map (USGS 2025g).

HIGH SURF, COASTAL FLOOD, EROSION, AND SEA LEVEL RISE

Hazard Description

High Surf

When deep-water ocean swells encounter the shallow island margins, they rise to great heights because their tops stack up on their slower moving bottoms due to friction along the shallower seafloor. Because the contact between deep water and the shallow margins around the Hawaiian Islands is abrupt, surface waves can grow very tall, very rapidly. Large waves tend to travel in sets, and after breaking they rush up onto the beach temporarily elevating the sea surface near the shoreline. Rip currents form as the water that is pushed up on the shore by successive large waves tries to flow back to the sea.

Waves that reach the shoreline are determined by the energy inherent in the approaching swell (a function of wave height and wave length—the distance between successive wave crests), shoreline aspect, slope, morphology, and geology, and offshore characteristics including seafloor depth, morphology, and barriers (islands, rocks, reefs, sandbars). Large wind-generated waves can also cause storm surge.

High waves from tropical cyclones present a more complex hazard, as they may coincide with high tide or storm surge to produce a combined threat. High waves from tropical cyclones generally occur during hurricane season between June and December. High waves from tropical cyclones most often hit the eastern shores of the Hawaiian Islands as storms approach the islands from the east and the south and west-facing shorelines as the storm passes to the south and west. When combined with storm surge, wave action may have damaging effects over the entire coastline facing a major storm center. In Hawai‘i the wave run-up typically floods areas not reached by the surge itself. The high velocities of hurricane winds often produce wave heights higher than the maximum level of the prevailing high tide or of the surge itself.

Coastal Erosion

Coastal erosion includes beach and dune erosion. Beach erosion is when sand is carried away from a beach and deposited farther from shore. Dune erosion is when sand or sediment not normally affected by wave action is carried away from land and deposited farther from shore.

The following human activities in the past or present may increase coastal erosion:

- Shoreline hardening such as building seawalls, which may protect land directly behind the structure but can accelerate coastal erosion on the makai (waterward) side of the structure due to scouring.
- Dune leveling for development, which removes the natural protection from high waves and sea level rise.
- Canalization to control flash flooding, which may trap sand in the coastal channel mouths. Accumulated sand may be removed off-site, leaving a deficiency in the immediate beach area.
- Coral reef degradation from pollution, turbidity and warmer ocean temperatures, which removes a natural barrier protecting shorelines from high surf events.
- Sand mining

FEMA Regulatory Coastal Flood Zones

Coastal SFHAs are of particular concern within the planning area along coastline areas that are at or slightly above sea level. In 2013, FEMA announced additional information regarding the flood hazard area associated with coastal zones. The NFIP depicts two coastal flood hazard zones on its FIRMS:

- Zone VE, where the flood elevation includes wave heights equal to or greater than 3 feet
- Zone AE, where flood elevation includes wave heights less than 3 feet. It is significant to note that Kaua'i County does not currently have FEMA-mapped coastal AE flood zones (DLNR DOFAW 2025c). However, areas of the county are still subject to coastal flooding with flood heights less than 3 feet despite a lack of data to denote these areas.

Although the coastal flood zones were not developed exclusively to address the impacts of high surf, they do provide an approximate delineation of areas that may be at risk. The coastal zones in Hawai'i also include tsunami inundation risk in some areas, so these zones are likely to greatly overestimate the risk from high surf impacts alone.

Post-storm field visits and laboratory tests throughout coastal areas of the United States have consistently confirmed that wave heights as low as 1.5 feet can cause significant damage to structures that are constructed without considering coastal hazards. FIRMs recently published also include a line showing the Limit of Moderate Wave Action (LiMWA), which is the inland limit of the area expected to receive 1.5-foot or greater breaking waves during the 1% annual chance flood event beyond the coastal VE zones and into the AE zone (Figure I-14).

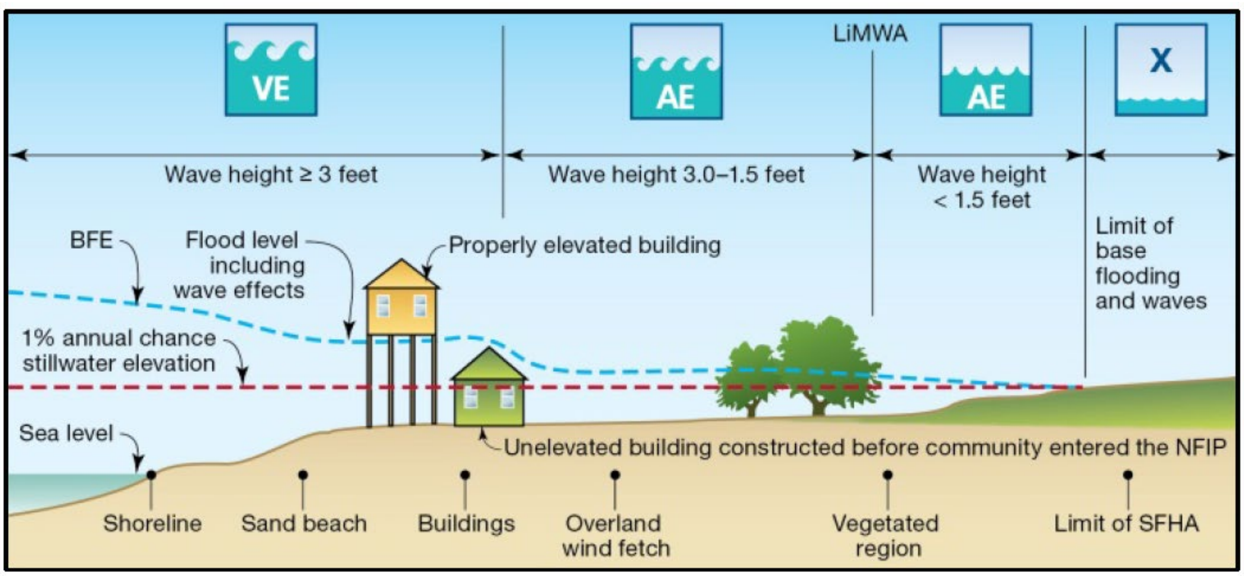


Figure I-14. Limit of moderate wave action (FEMA 2012).

The addition of the LiMWA area to FIRMs allows communities and individuals to better understand the flood risks to their property. The LiMWA area alerts property owners on the coastal side of the line that although their property is in Zone AE, their property may be affected by 1.5-foot or higher breaking waves and may therefore be at significant risk during a 1% annual chance flood event. While not formally defined in the NFIP regulations or mapped as a flood zone, the area between Zone VE and the LiMWA is called the Coastal A Zone. This area is subject to flood hazards associated with floating debris and high-velocity flow that can damage building foundations and, in extreme cases, cause foundation failure (NOAA Office of Response and Restoration 2020).

The current effective FIRMs for Kaua‘i County do not delineate LiMWA areas. If future map updates include such information, they should be used to develop additional coastal flooding mitigation items.

Hazard Profile

Coastal flooding is becoming increasingly exacerbated by sea level rise as a result of climate change or relative sea level rise caused by a local increase in the level of the ocean relative to land as a result of tectonic activity (Tetra Tech 2021).

Past Events

Table I-13 and Table I-14 show the high surf events impacting Kaua‘i County from 2018 through 2020 (since the last recorded date in the 2021 MHMRP Update) and from 2020 through 2024. None of these events resulted in injuries or fatalities; only one resulted in damages, which amounted to $7,000.

Table I-13. Past High Surf Events Impacting Planning Area from 2020–2024

Start Date	End Date	Location*	Start Date	End Date	Location*
5/15/2020	5/16/2020	Leeward and windward	12/21/2021	12/31/2021	East
5/17/2020	5/18/2020	Leeward and windward	1/5/2022	1/7/2022	North and southwest
6/2/2020	6/4/2020	Leeward and windward	1/9/2022	1/12/2022	North and southwest
6/28/2020	6/29/2020	Leeward and windward	1/14/2022	1/16/2022	North and southwest
7/26/2020	7/27/2020	Windward	1/21/2022	1/24/2022	North and southwest
10/25/2020	10/25/2020	Leeward and windward	1/29/2022	1/29/2022	North
11/10/2020	11/12/2020	Windward	2/1/2022	2/2/2022	North and southwest
11/22/2020	11/24/2020	Windward	2/4/2022	2/6/2022	North and southwest
12/1/2020	12/3/2020	Leeward and windward	2/15/2022	2/17/2022	North and southwest
12/5/2020	12/8/2020	Leeward and windward	2/25/2022	2/27/2022	North and southwest
12/17/2020	12/18/2020	Leeward and windward	3/21/2022	3/23/2022	North
12/18/2020	12/19/2020	Windward	4/2/2022	4/3/2022	North
12/23/2020	12/25/2020	Leeward and windward	4/24/2022	4/25/2022	North
12/27/2020	12/28/2020	Windward	5/3/2022	5/5/2022	South and southwest
12/29/2020	12/31/2020	Leeward and windward	5/31/2022	5/31/2022	South and southwest
1/1/2021	1/2/2021	Leeward and windward	6/1/2022	6/2/2022	South and southwest
1/4/2021	1/8/2021	Leeward and windward	6/27/2022	6/29/2022	South and southwest
1/9/2021	1/12/2021	Leeward and windward	7/13/2022†	7/19/2022†	South and southwest
1/14/2021	1/19/2021	Leeward and windward	8/21/2022	8/22/2022	South and southwest
1/23/2021	1/24/2021	Leeward and windward	9/12/2022	9/13/2022	South and southwest
1/24/2021	1/28/2021	Windward	9/22/2022	9/22/2022	South and southwest
2/4/2021	2/6/2021	Leeward and windward	12/1/2022	12/2/2022	North and southwest
2/9/2021	2/9/2021	Leeward and windward	12/16/2022	12/17/2022	North and southwest

Start Date	End Date	Location*	Start Date	End Date	Location*
2/13/2021	2/16/2021	Leeward and windward	12/19/2022	12/21/2022	North and southwest
2/23/2021	2/28/2021	Windward	1/11/2023	1/13/2023	North and southwest
3/1/2021	3/3/2021	Windward	2/9/2023	2/11/2023	East
3/8/2021	3/10/2021	Windward	3/1/2023	3/2/2023	East and south
3/13/2021	3/15/2021	Leeward and windward	3/7/2023	3/10/2023	North and southwest
3/17/2021	3/23/2021	Windward	5/3/2023	5/4/2023	South and southwest
4/6/2021	4/8/2021	East	6/24/2023	6/27/2023	South and southwest
5/1/2021	5/2/2021	North and southwest	10/16/2023	10/18/2023	North
6/20/2021	6/21/2021	South and southwest	11/19/2023	11/21/2023	North
7/5/2021	7/8/2021	South and southwest	11/23/2023	11/25/2023	North
8/16/2021	8/19/2021	South and southwest	12/26/2023	12/29/2023	North
8/21/2021	8/24/2021	East and south	1/17/2024	1/18/2024	North
9/24/2021	9/25/2021	North and southwest	1/20/2024	1/22/2024	North
10/8/2021	10/11/2021	East, south, southwest	2/2/2024	2/4/2024	East and north
11/1/2021	11/4/2021	North and southwest	2/14/2024	2/17/2024	North
11/24/2021	11/26/2021	North and southwest	3/14/2024	3/15/2024	North
12/3/2021	12/6/2021	North and southwest	6/14/2024	6/15/2024	South and southwest

Source: NOAA (2025c)

*The NCEI shifted from referring to sections of Kaua‘i as leeward and windward to north, south, east, and southwest. The NCEI does not have a “west” zone for Kaua’i.

† High surf event resulted in damages totaling $7,000

Table I-14. Past High Surf Events Impacting Planning Area from 2018-2020

Start Date	End Date	Location	Start Date	End Date	Location
01/10/2018	01/17/2018	Leeward and windward	02/12/2019	02/22/2019	Leeward and windward
01/18/2018	01/23/2018	Windward	02/27/2019	02/28/2019	Leeward and windward
02/02/2018	02/05/2018	Leeward and windward	03/09/2019	03/10/2019	Leeward and windward
02/12/2018	02/13/2018	Leeward and windward	03/10/2019	03/11/2019	Leeward and windward
02/19/2018	02/23/2018	Windward	03/17/2019	03/20/2019	Leeward and windward
02/23/2018	02/28/2018	Windward	03/22/2019	03/23/2019	Leeward and windward
03/01/2018	03/03/2018	Windward	03/30/2019	03/31/2019	Leeward and windward
03/06/2018	03/10/2018	Windward	04/11/2019	04/15/2019	Windward
03/12/2018	03/13/2018	Leeward and windward	05/11/2019	05/13/2019	Leeward and windward
03/21/2018	03/22/2018	Windward	05/26/2019	05/28/2019	Leeward and windward
03/25/2018	03/27/2018	Windward	06/14/2019	06/15/2019	Leeward and windward
04/09/2018	04/10/2018	Leeward and windward	06/30/2019	06/30/2019	Leeward and windward
04/13/2018	04/14/2018	Leeward and windward	07/01/2019	07/04/2019	Leeward and windward
04/14/2018	04/17/2018	Windward	07/06/2019	07/09/2019	Leeward and windward
04/28/2018	04/30/2018	Leeward and windward	07/13/2019	07/16/2019	Leeward and windward
05/08/2018	05/09/2018	Leeward and windward	08/04/2019	08/06/2019	Leeward and windward
06/04/2018	06/06/2018	Leeward and windward	08/20/2019	08/21/2019	Leeward and windward

Start Date	End Date	Location	Start Date	End Date	Location
06/08/2018	06/10/2018	Leeward and windward	09/26/2019	09/28/2019	Leeward and windward
07/05/2018	07/08/2018	Leeward and windward	10/27/2019	10/31/2019	Leeward and windward
07/18/2018	07/19/2018	Windward	11/04/2019	11/05/2019	Leeward and windward
08/01/2018	08/03/2018	Windward	11/09/2019	11/10/2019	Leeward and windward
08/07/2018	08/09/2018	Leeward and windward	11/14/2019	11/17/2019	Leeward and windward
08/21/2018	08/27/2018	Leeward and windward	11/20/2019	11/25/2019	Leeward and windward
09/06/2018	09/08/2018	Windward	11/27/2019	11/27/2019	Leeward and windward
09/11/2018	09/12/2018	Windward	12/01/2019	12/02/2019	Leeward and windward
10/04/2018	10/05/2018	Leeward and windward	12/07/2019	12/08/2019	Leeward and windward
10/10/2018	10/12/2018	Leeward and windward	12/10/2019	12/13/2019	Leeward and windward
10/16/2018	10/17/2018	Leeward and windward	12/20/2019	12/26/2019	Windward
10/20/2018	10/27/2018	Leeward and windward	12/29/2019	12/31/2019	Leeward and windward
10/28/2018	10/29/2018	Leeward and windward	01/01/2020	01/02/2020	Leeward and windward
10/30/2018	10/31/2018	Leeward and windward	01/06/2020	01/16/2020	Windward
11/09/2018	11/11/2018	Leeward and windward	01/17/2020	01/20/2020	Leeward and windward
11/15/2018	11/17/2018	Leeward and windward	01/20/2020	01/24/2020	Leeward and windward
11/25/2018	11/28/2018	Leeward and windward	01/25/2020	01/31/2020	Leeward and windward
12/05/2018	12/08/2018	Leeward and windward	02/06/2020	02/09/2020	Leeward and windward
12/09/2018	12/10/2018	Leeward and windward	02/10/2020	02/12/2020	Leeward and windward
12/10/2018	12/14/2018	Windward	02/13/2020	02/14/2020	Windward
12/16/2018	12/19/2018	Leeward and windward	02/19/2020	02/21/2020	Windward
12/27/2018	12/29/2018	Leeward and windward	02/25/2020	02/26/2020	Leeward and windward
01/01/2019	01/05/2019	Leeward and windward	02/28/2020	02/29/2020	Leeward and windward
01/09/2019	01/10/2019	Windward	03/01/2020	03/04/2020	Windward
01/11/2019	01/16/2019	Leeward and windward	03/07/2020	03/08/2020	Windward
01/23/2019	01/25/2019	Leeward and windward	03/12/2020	03/14/2020	Leeward and windward
01/27/2019	01/31/2019	Windward	03/20/2020	03/22/2020	Leeward and windward
02/01/2019	02/02/2019	Windward	03/24/2020	03/25/2020	Leeward and windward
02/06/2019	02/08/2019	Windward	04/15/2020	04/16/2020	Leeward and windward
02/07/2019	02/12/2019	Leeward and windward	04/18/2020	04/20/2020	Leeward and windward
			04/22/2020	04/24/2020	Leeward and windward

Source: NOAA (2025c)

Location

Damaging wind-generated high surf occurs from distant storms in the northern and southern hemispheres, tropical cyclones, and localized kona storms (Figure I-15):

- North- and west-facing shores receive high swells in winter that can be between 20 and 40 feet and result from storms in the North Pacific. Waves from the North Pacific storms tend to be higher than any others experienced on Kaua'i (HI-EMA 2023). These periods of high surf can also last several days (NOAA 2025c).

- Larger northeast trade waves are typically 2 to 4 feet; however, well-developed trade swells produce high waves of 6 to 8 feet that have caused damage. Trade wind swell-induced high waves, typically between 3 and 4 feet high, affect the eastern facing shores of the island.
- South-facing shores are exposed to kona storms and southern swells, which have caused damage at heights of 4 to 6 feet. Kona storms generate high waves that affect the south-facing coast of the island.

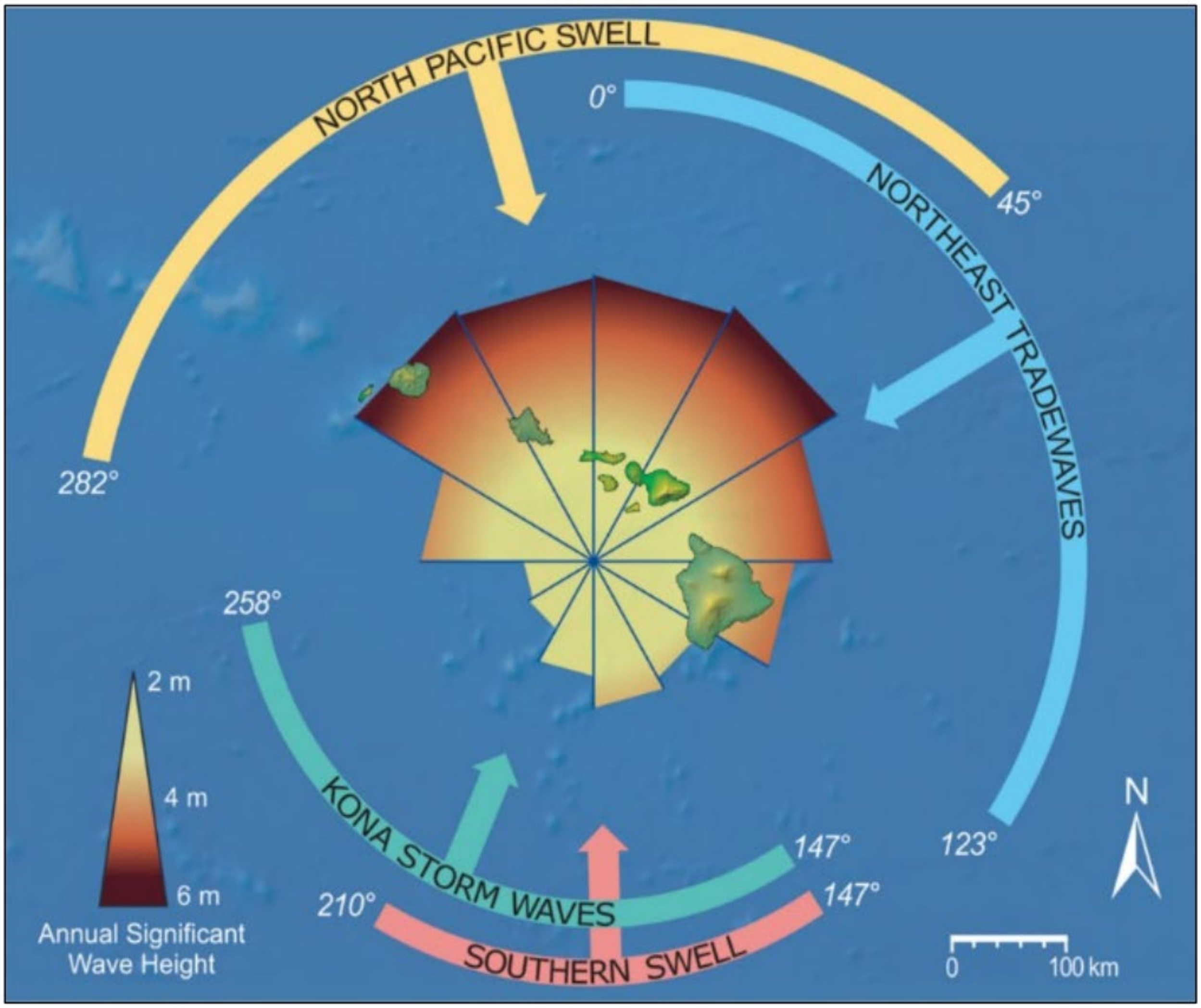


Figure I-15. Dominant swell regimes in Hawaiʻi (HI-EMA 2023).

Even though deep ocean swells typically produce the highest waves affecting the Island, much of the high waves and surf on the island are attributable to passing tropical cyclones. Tropical cyclones can affect all shorelines, especially during summer and fall, with damaging high waves of 10 to 30 feet. Flooding from storm surge is a potential threat in heavily developed coastal areas near Hanalei, Kapaʻa, Līhuʻe and Poʻipū.

Coastal erosion affects all shorelines as well, but potential impacts and erosion rates vary greatly by location. Coastal erosion is worsened by high surf events and sea level rise. Figure I-16 shows coastal erosion locations around the island at the 1.1-foot sea level rise scenario.

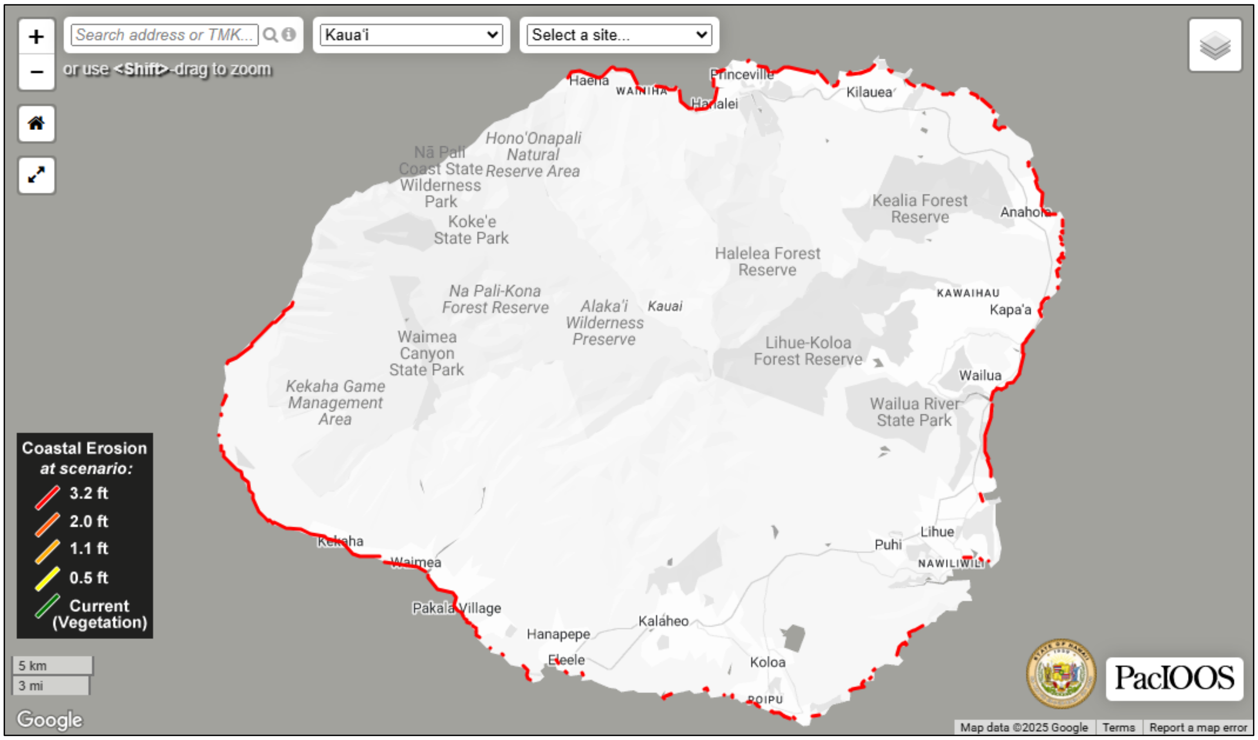


Figure I-16. Coastal erosion locations at 3.2-foot sea level rise scenario (Hawai'i Climate Change Mitigation and Adaptation Commission 2017; University of Hawai'i School of Ocean and Earth Science Climate Research Collaborative 2023).

According to the *National Assessment of Shoreline Change 2012* (Fletcher et al. 2012), Kaua'i lost 8% of its beaches to erosion over the analysis period of 1926 to 2008. The East Shore had the greatest percentage of sandy beaches experiencing long-term coastal erosion at 78%, followed by the North Shore at 76%. The South and West Shores also had significant amounts of beach erosion—63% and 64%, respectively. This 2012 source is the most recent information available.

Frequency

High surf events occur quite frequently on all coasts of Kaua'i County. Table I-13 lists 80 high surf events that occurred in the time period covered by the 2026 MHMRP Update (2020 through 2024). Table I-14 lists high surf events that occurred prior to the planning period going back to 2018.

Severity

Table I-15 summarizes the still-water elevations along Kaua'i's coastline, representing the steady-state water depth not accounting for breaking waves. These are the projected elevations of floodwaters in the absence of waves resulting from wind or seismic effects. In coastal areas, still-water elevations are determined when modeling coastal storm surge; the results of overland wave modeling are used in conjunction with the still-water elevations to develop the coastal base flood elevations.

Table I-15. Summary of Still-Water Elevations

Flooding Source/Location	Still-Water Elevation (feet Local Mean Sea Level)			
	10-Year	50-Year	100-Year	500-Year
Station 253 Anahola Bay	0.7	0.9	1.2	2.3
Station 226 Nāwiliwili Bay	0.7	1.0	1.5	3.1
Station 198 Kukui‘ula Bay	0.7	0.8	1.1	2.2
Station 172 Waimea Bay	0.7	0.8	1.1	2.3

Source: FEMA (2021a)

Flood severity from coastal flooding is determined by wave run-up and setup. Table I-16 shows the water levels used for mapping coastal floodplains in the planning area.

Table I-16. Coastal Flooding Water Elevations

	Coastal Flood Water Elevations (feet, North American Vertical Datum)	
	Nāwiliwili Bay (Transect 15)	Hanapēpē Bay (Transect 33)
10%	0.7	0.7
2%	0.8	0.8
1%	5.4[a]	5.0*
0.2%	2.2	2.4

Source: FEMA (2021a)

* Includes wave setup

Warning Time

The timing of individual waves cannot be predicted, however general forecasting can be made about surf conditions. Wave forecasting involves the prediction and evolution of wind-generated waves using numerical models. These mathematical simulations, often known as ocean surface wave models, consider atmospheric and oceanic conditions, wave interaction, and frictional dissipation. The models’ output typically consists of statistics regarding wave heights and periods that can be used by officials and managers in the shipping industry, emergency response personnel, news media, and the public.

The NWS issues high surf warnings and advisories when general forecasting indicates high surf conditions. The definitions of the warning and advisory are as follows (NWS 2025o):

- **High Surf Warning:** A high surf warning is issued when breaking wave action results in an especially heightened threat to life and property within the surf zone. High surf warnings may be issued up to 24 hours ahead of the arrival of the swell and may remain in effect for several days.
- **High Surf Advisory:** A high surf advisory is issued when breaking wave action poses a threat to life and property within the surf zone. High surf advisories may be issued up to 24 hours ahead of the arrival of the swell and may remain in effect for several days.

DAM FAILURE

Hazard Description

Regulatory Oversight

The U.S. Army Corps of Engineers (USACE) is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. The USACE has inventoried dams; surveyed each state and federal agency's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety.

The Federal Energy Regulatory Commission (FERC) also cooperates with a large number of federal and state agencies to ensure and promote dam safety. More than 3,000 dams are part of regulated hydroelectric projects in the FERC program. However, none of these dams are located in Kauaʻi County (Dam Safety Unit Engineer 2025).

2024 Dam Hazard Collaborative Technical Assistance

The state of Hawaii held a Collaborative Technical Assistance (CTA) program throughout the spring and summer of 2024 to bring together state, regional, county, municipal, and community stakeholders conducting work related to dams. These stakeholders included county officials, FEMA, the state dam safety agency, and some dam owners/managers. The purpose of the CTA was to build relationships between these entities to increase future collaboration and explore a series of topics related to risks and mitigation associated with the hazards of dam failure. The CTA began in March of 2024 with sessions taking place from March through August, culminating in a dam incident tabletop exercise in August. A follow-up session on the tabletop exercise was conducted in September 2024 along with the CTA closeout.

Several key objectives of the CTA are particularly relevant to the 2026 MHMRP Update. One objective was to examine the cascading hazard event potential associated with dam failure events as well as the impacts these events may yield by leveraging existing resources. A second objective was to improve understanding of participating stakeholder roles and build relationships among them. A third objective was to facilitate an assessment of how current emergency action plans could be connected to county emergency operations plans to improve dam failure planning, mitigation, and response. A fourth objective was to determine strategies to increase public awareness of risks and preparedness associated with the dam failure hazard. The state dam safety agency also worked with dam owners/managers to devise safety actions they could implement. All information provided about the CTA was based on correspondence and materials provided by a Dam Safety Unit Engineer with the DLNR Engineering Division (Dam Safety Unit Engineer 2025).

Hazard Profile

Past Events

On March 14, 2006, the Ka Loko Dam broke on the North Shore of Kauaʻi, sending millions of gallons of water downstream. Seven people were killed, and dozens of homes and properties were damaged. The owner faced charges for allegedly filling an emergency spillway, although there were no direct observations of him doing so. The State of Hawaiʻi came under scrutiny for failing to follow its own regulations regarding dam inspections; in addition, water originating on state lands was being diverted to the Ka Loko Reservoir at the time of the break. The County was accountable because it failed to properly manage illegal construction activities by the owner, which likely contributed to the filling of the spillway (American Society of Civil Engineers 2010).

Location

List of High-Hazard Dams

Most dams in Hawaiʻi are old earthen berm reservoirs built during the plantation era, originally for irrigation purposes. Table I-17 lists the 47 regulated dams in the county. All of these are earthen dams; 44 of them are high-hazard dams, and one is undetermined but is almost certainly a high-hazard dam. The DLNR Dam Inventory System (DLNR Engineering Division 2025c) presents more information about each dam.

Inundation and Evacuation Mapping

Following the catastrophic breach of the Ka Loko Dam in March 2006, dam owners in Hawaiʻi were mandated to prepare, maintain, and implement emergency preparedness plans for each dam or reservoir. A key element for each plan is a map defining the potential downstream inundation should the dam fail and an assessment of the critical infrastructure and population at risk under these circumstances. For each dam inundation scenario modeled, it was assumed that:

- The dam failure occurred under sunny day, dry stream conditions
- The dam failure occurred while the dam was at maximum capacity
- Failure occurred by piping halfway up the dam face (or in a location designated by DLNR)
- The spillways or outlet works were inoperable at the time of the breach.

Working groups headed by representatives from county civil defense and emergency management agencies determined evacuation boundaries using the dam inundation maps.

Table I-17. Kaua'i County Regulated Dams

Dam Name	Nearest Downstream City or Town	Distance to Nearest City or Town (miles)	Owner Name	Use*	Built	Crest Length	Dam Height	Storage Capacity	Drainage Area (square miles)	Downstream Hazard Potential†	Date of Emergency Action Plan	Spillway Type‡
Puu Lua Reservoir	Kekaha	8.3	DLNR	F	1925	640	105	888	0.08	H	09/02/2022	U
Puu Opae Reservoir	Mana	2.8	Hawaii Department of Hawaiian Home Lands	I	1930	1,625	41	295	0.046	L	08/30/2022	U
Mana Reservoir	Mana	0.6	Agribusiness Development Corporation	I	1905	1,730	17	135	0.08	H	08/11/2023	C
Waikaia Reservoir	Kapalawai	1.2	Robinson Family Partners	I	1951	720	26	58	0.08	H	09/08/2024	C
Kepani Reservoir	Waimea	4	Robinson Family Partners	I	1954	860	35	85	0.05	H	07/30/2022	U
Waikoloi Reservoir	Kaawanui Village	2.6	Robinson Family Partners	I	1958	505	64	147	0.089	H	07/30/2022	U
Kaawanui Reservoir	Kaawanui Village	0.4	Robinson Family Partners	I	1950	2,560	26	110	0.014	H	07/30/2022	C
Waiakalua Reservoir	Kīlauea	2	Multiple[e]	R	1920	1,200	23	220	0.43	H	09/03/2024	U
Aii Reservoir	Kapaia	1.9	Grove Farm Company	I	1920	350	21	68	0.18	H	02/14/2025	U
Kapaia Reservoir	Kapaia	3	Grove Farm Company	IS	1910	1,050	50	1,114	2.51	H	02/14/2025	U
Okinawa Reservoir	Kapaia	0.6	Grove Farm Company	I	1920	470	25	142	0.78	H	01/29/2025	U
Kaneha Reservoir	Keālia	5	Cornerstone Hawaii Holdings LLC	I	1910	410	46	420	0.8	H	01/03/2025	U
Mimino Reservoir	Keālia	4	Mimino Ranch LLC	I	1920	600	68	70	0.35	H	09/13/2024	U
Kalihiwai Reservoir	Kalihiwai	2	CG Utilities LLC, Kalihiwai Ridge Community Association, Porter Irrigation	IR	1920	950	20	242	0.32	H	02/13/2025	U
Kaloko Reservoir	Kīlauea	2.6	Kaloko LLC, Ko'olau Kula LLC	IO	1890	915	27	147.6	0.12	H	07/20/2022	N
Wailua Reservoir	Wailua Homesteads	5	DLNR	I	1920	1,080	34	842	0.88	H	09/02/2022	U
Lower Kapahi Reservoir	Kawaihau	1	County of Kaua'i, Department of Public Works; DLNR	O	1920	650	20	194	0.36	H	09/02/2022	N
Twin Reservoir	Wailua	2	Multiple[f]	O	1920	1,810	48.5	520	0.49	H	07/18/2022	U
Aahoaka Reservoir	Wailua	4	Agribusiness Development Corporation	I	1910	550	36	210	0.74	H	08/11/2023	U
Alexander	Wahiawa Camp 2	5	BBCP Kauai Operating, LLC	IH	1931	600	119	2777	2.86	H	08/30/2024	U
Waita Reservoir	Kōloa	0.2	Grove Farm Company	IR	1906	3,250	23	9900	3.36	H	01/29/2025	U
Kapa Reservoir	Eleele	0.1	BBCP Kauai Operating, LLC, Kauai Coffee	I	1901	1,780	21	50	0.0064	H	03/13/2024	N
Hukiwai Reservoir	Numila	0.5	BBCP Kauai Operating, LLC, Kauai Coffee	I	1910	1,000	35.5	56	0.0094	H	03/13/2024	U
Ioleau Reservoir	Kalāheo	2.5	BBCP Kauai Operating, LLC, Kauai Coffee	I	1902	980	48	148	0.2	L	02/17/2023	U
Aepo Reservoir	Kukuiula	2	BBCP Kauai Operating, LLC	I	1901	440	70	457	0.17	H	08/30/2024	U
Huinawai Reservoir	Lawai Homesteads	0.1	BBCP Kukui'ula Development, LLC	I	1902	335	45	196	0.27	H	09/08/2023	U
Elima Reservoir	Kalāheo	0.1	BBCP Kauai Operating, LLC	I	1901	700	37	126	0.24	H	08/30/2024	U
Kumano Reservoir	Lawai Homesteads	0.9	BBCP Kauai Operating, LLC	I	1902	400	48	175	0.11	H	08/30/2024	N
Puu O Hewa Reservoir	Kōloa	1.7	Eric A. Knudsen Trust	I	1915	540	23	115	0.24	H	03/05/2025	U
Kaupale Reservoir	Lawai Homesteads	0.6	BBCP Kauai Operating, LLC	I	1910	500	49	240	0.25	H	08/30/2024	U
Ipuolono Reservoir	Kalāheo	0.1	BBCP Kauai Operating, LLC, Kauai Coffee	I	1910	680	45	450	1.96	H	02/17/2023	U
Aepoalua Reservoir	Kukuila	2	BBCP Kauai Operating, LLC	I	1915	435	33	131	0.08	H	08/30/2024	U
Aepoekolu Reservoir	Kukuiula	1.6	BBCP Kauai Operating, LLC	I	1910	420	37	152	0.04	H	08/30/2024	U
Aepoeha Reservoir	Kukuila	0.8	BBCP Kauai Mauka Lands, LLC	I	1913	600	42	670	0.81	H	09/08/2023	U
Omao Reservoir	Kōloa	1.3	Alexander & Baldwin, Inc., Eric A. Knudsen Trust	I	1915	454	32	194	1.17	H	07/01/2024	U
Piwai Reservoir	Omao Homesteads	0.5	Alexander & Baldwin, Inc.	I	1916	535	56	261	0.38	H	07/25/2022	U

Dam Name	Nearest Downstream City or Town	Distance to Nearest City or Town (miles)	Owner Name	Use*	Built	Crest Length	Dam Height	Storage Capacity	Drainage Area (square miles)	Downstream Hazard Potential†	Date of Emergency Action Plan	Spillway Type‡
Pia Mill Reservoir	Kōloa	1	Eric A. Knudsen Trust	I	1910	450	16.5	38.6	0.35	H	03/05/2025	U
Mau Reservoir	Kalāheo	0.1	BBCP Kauai Operating, LLC	I	1901	460	38	78.5	0.04	H	08/30/2024	U
Elua Reservoir	Kalāheo	0.1	BBCP Kauai Operating, LLC	I	1902	600	34	360	1.15	H	08/30/2024	U
Manuhonuhonu Reservoir	Kukuiula	1	BBCP Kukui'ula Development, LLC	I	1954	400	45	49	0.156	H	09/08/2023	N
Mauka Reservoir	Kōloa	2	Eric A. Knudsen Trust	I	1910	550	19	345	0.56	H	03/05/2025	C
Papuaa Reservoir	Halfway Bridge	1.4	Grove Farm Company	I	1914	2,000	43	921	1.75	H	02/05/2025	U
Halenanahu Reservoir	Kipu	1.1	Grove Farm Company	I	1920	650	35	460	1.16	H	01/29/2025	U
Kauaʻi Lagoons			Tower Kauai Lagoons Land LLC	O	1987	0	13.4	470	0.226	H	07/18/2023	U
Halaula Reservoir	Keālia	0.8	Mahi'ai Awawa, LLC	I	0000	410	25.9		0.34	H	01/03/2025	U
Pond No. 1 at Kauai Ranch	Kapaʻa	1.75	Cornerstone Hawaii Holdings LLC	I	2007	500	31.5		0.02344	H	09/13/2024	U
Pinau Reservoir	Kōloa	1	Multiple[g]	O	0000		26	71.4	0.599	U		U

Source: DLNR Engineering Division, Dam Safety (2025c), Dam Safety Unit Engineer (2025)

* Use codes:
F = Fish and Wildlife Pond
I = Irrigation, including dams that are maintained as empty but were previously used for irrigation or with water passing through the dam traveling to its end destination to be used for irrigation, according to a Dam Safety Unit Engineer with the State DLNR Engineering Division
IH = Irrigation and Hydroelectric
IO = Irritation and Other
IR – Irrigation and Recreation
IS = Irrigation and Water Supply
O = Other
R = Recreation

† Hazard Potential: H = High; L = Low, U = Undetermined

‡ Spillway: C = Controlled, U = Uncontrolled, N = None

§ He Makana Ka Wai, Hunt Kīlauea LLC, Malie Wai Properties II, LLC, Matthew C Miller, North, Frederic & Peggy Rev Living Trust, Theresa Drake, Thomas Atkin, Victor Mission Trust LLC, William L. Flaherty, Trust

¶ County of Kauaʻi Department of Public Works, Green Aloha Real Estate, LLC, Kapaa 382, Kulana Home Owners Association, Leonard Kaui, Meghan Ornellas, Outbound LLC, Troy & Renee Johnston, Waipouli Manoa, LLC

County of Kauaʻi Department of Public Works, Department of Water, County of Kauaʻi, Dylan James, Holly Van Every, Joseph Allen, Melvin Willis III

For this risk assessment, digital data suitable for a quantitative assessment of dam failure risk was available for all high-hazard dams listed in Table I-17.

Severity

A dam failure can be catastrophic to all life and property downstream. The State of Hawai‘i classifies dams and reservoirs in a three-tier hazard rating system based on potential consequences to downstream life and property that could result from a failure of the dam (Hawai‘i Administrative Rules 13-190.2-2):

- **High Hazard:** High-hazard dams are those where failure would probably cause loss of human life.
- **Significant Hazard:** Significant hazard dams are those where failure would result in no probable loss of human life but could cause major economic loss, environmental damage, disruption of lifeline facilities, or other concerns. Significant hazard potential classification dams or reservoirs are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
- **Low Hazard:** Low-hazard dams are those where failure would result in no probable loss of human life and low economic loss or environmental loss, or both. Economic losses are principally limited to the owner’s property.

DLNR has rated 44 dams in Kaua‘i County as high hazard (see Table I-17).

Warning Time

Warning time for dam failure depends on the cause of the failure. In the event of extreme precipitation, evacuations can be planned with sufficient time. In the event of a structural failure due to an earthquake, there may be little warning time. A dam’s structural type also affects warning time. Earthen dams do not tend to fail completely or instantaneously. Once a breach is initiated, discharging water erodes the breach until either the reservoir water is depleted or the breach resists further erosion. The time of breach formation ranges from a few minutes to a few hours (U.S. Army Corps of Engineers 1997).

HEAT

Hazard Profile

Past Events

Table I-18 summarizes recent notable heat events recorded in the 2021 MHMRP Update. According to NOAA’s NCEI Storm Event database (NOAA 2025c), no heat events occurred in Kaua’i County between 2020 and 2024.

Table I-18. Notable Heat Events Since 2014

Year	Area Recorded	Remarks
2014	Līhu‘e	High temperatures recorded at the Līhu‘e Airport broke a record 5 out of the 7 days starting October 10. The high of 88 degrees Fahrenheit (ºF) on October 16 broke the previous record set in 1981. The NWS attributed the heat wave to warm ocean temperatures.
2019	Līhu‘e	Every day between August 24 and September 12, high record temperatures were set or surpassed in Līhu‘e. Forty-eight days had record highs or ties and 44 nights had record high lows. Sixteen nights stayed above 80ºF.
2020	Līhu‘e	83 days between July 1 and October 18 exceeded normal high temperatures.

Sources: *Washington Post* (2014); Hawaii News Now (2014); NWS (2020)

Location

All areas of Kaua‘i County are susceptible to extreme heat. Rural communities can be disrupted during periods of unusually hot weather. The effects of heat may be exacerbated in the more urban areas such as Līhu‘e due to the urban heat island effect caused by human activity factors such as:

- Modification of land surfaces (vegetation replaced by pavement or buildings)
- Heat generated by the energy required to operate air conditioning or other cooling systems

Frequency

Official temperature and humidity readings are taken hourly at the NOAA Weather Observation Stations located at the Līhu‘e Airport and at the Pacific Missile Test Facility Barking Sands. News outlets often report on these readings during extreme heat events. Between 2014 and 2020, three multi-day extreme heat events occurred that exceeded previous records. Figure I-17 shows the temperatures at Līhu‘e during October 2024. Nearly every day, normal high temperatures were exceeded, with 3 days meeting record highs. This figure represents a larger trend of warmer temperatures experienced in Kaua‘i, even if temperatures are not often reaching the classification of extreme heat events.

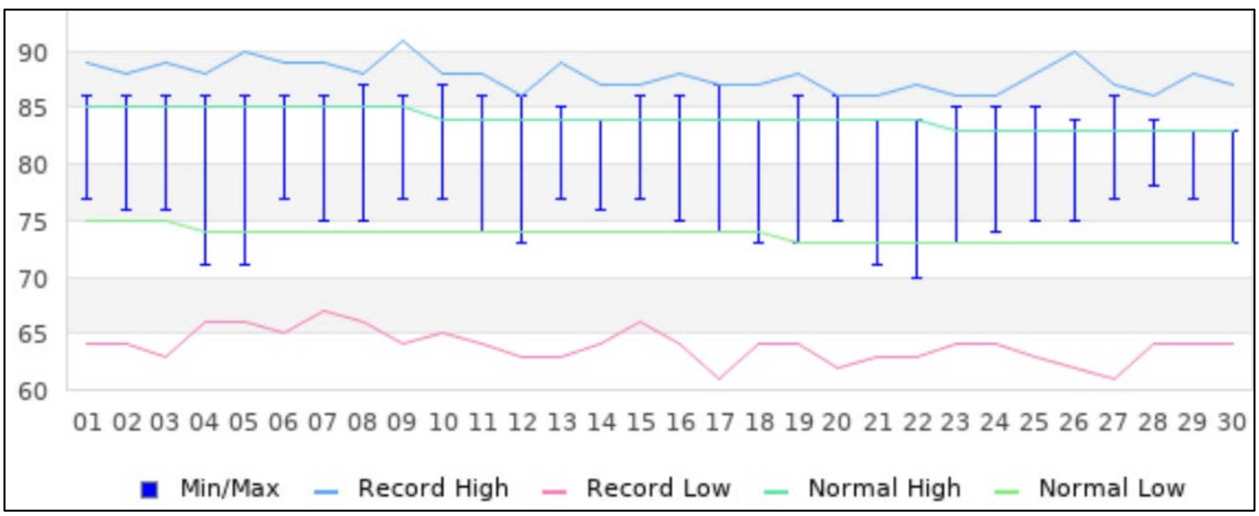


Figure I-17. Līhu‘e temperature plot, October 2024 (NWS 2025k).

Warning Time

NWS criteria for heat advisories measure the severity and intensity of extreme heat. As conditions warrant, the following are issued:

- **Excessive Heat Warning—Take Action:** An excessive heat warning is issued within 12 hours of the onset of extremely dangerous heat conditions. The general rule of thumb for this warning is when the maximum heat index temperature is expected to be 105 degrees Fahrenheit (°F) or higher for at least 2 days and night-time air temperatures will not drop below 75°F; however, these criteria vary across the country, especially for areas not used to extreme heat conditions. Those who do not take precautions immediately when conditions are extreme may become seriously ill or even die.
- **Heat Advisory—Take Action:** A heat advisory is issued within 12 hours of the onset of extremely dangerous heat conditions. The general rule of thumb for this advisory is when the maximum heat index temperature is expected to be 100°F or higher for at least 2 days, and night-time air temperatures will not drop below 75°F; however, these criteria vary across the country, especially for areas that are not used to dangerous heat conditions. Take precautions to avoid heat illness. Those who do not take precautions may become seriously ill or even die.
- **Excessive Heat Watches—Be Prepared:** Heat watches are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. A watch is used when the risk of a heat wave has increased but its occurrence and timing is still uncertain.
- **Excessive Heat Outlooks—Be Aware:** The outlooks are issued when the potential exists for an excessive heat event in the next 3 to 7 days. An outlook provides information to those who need considerable lead time to prepare for the event.

EARTHQUAKE

Hazard Description

The location of an earthquake is commonly described by its focal depth and the geographic position of its epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter of an earthquake is the point on the Earth's surface directly above the hypocenter.

The ratings used in the modified Mercalli scale as well as the perceived shaking and damage potential for structures are shown in Table I-19.

Table I-19. Mercalli Scale and Peak Ground Acceleration Comparison

Modified Mercalli Scale	Perceived Shaking	Potential Structure Damage		Estimated PGA*
		Resistant Buildings	Vulnerable Buildings	(%g)
I	Not Felt	None	None	<0.17%
II-III	Weak	None	None	0.17%–1.4%
IV	Light	None	None	1.4%–3.9%
V	Moderate	Very Light	Light	3.9%–9.2%
VI	Strong	Light	Moderate	9.2%–18%
VII	Very Strong	Moderate	Moderate/Heavy	18%–34%

Modified Mercalli Scale	Perceived Shaking	Potential Structure Damage		Estimated PGA*
		Resistant Buildings	Vulnerable Buildings	(%g)
VIII	Severe	Moderate/Heavy	Heavy	34%–65%
IX	Violent	Heavy	Very Heavy	65%–124%
X–XII	Extreme	Very Heavy	Very Heavy	>124%

Source: HI-EMA (2023)

* PGA = peak ground acceleration (measured as percent of g, where g is the acceleration of gravity)

USGS Earthquake Mapping Programs

ShakeMaps

A ShakeMap is derived from peak ground motion amplitudes recorded on seismic sensors, with interpolation where data are lacking based on estimated amplitudes. Color-coded instrumental intensity maps are derived from empirical relations between peak ground motions and Modified Mercalli intensity. In addition to the maps of recorded events, the USGS creates the following:

- **Scenario ShakeMaps:** Maps of hypothetical earthquakes of an assumed magnitude on known faults
- **Probabilistic ShakeMaps:** Maps based on predicted shaking from all possible earthquakes over a 10,000-year period. In a probabilistic map, information from millions of scenario maps are combined to make a forecast for the future. The maps indicate the ground motion at any given point that has a given probability of being exceeded in a given timeframe, such as a 100-year (1% annual chance) event.

National Seismic Hazard Map

National probabilistic maps of earthquake shaking hazards have been produced since 1948. They provide information essential to creating and updating seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities and land use planning used in the U.S. Scientists frequently revise these maps to reflect new information and knowledge. Buildings, bridges, highways and utilities built to meet modern seismic design requirements are typically able to withstand earthquakes better, with less damage and disruption. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown et al. 2001). The USGS updated its National Seismic Hazard Map for Hawaiʻi in 2023.

Liquefaction and Soil Types

FEMA's National Earthquake Hazards Reduction Program (NEHRP) creates maps based on soil characteristics to help identify locations subject to liquefaction. Table I-20 summarizes NEHRP soil classifications. NEHRP soil types B and C typically can sustain ground shaking without much effect, dependent on the earthquake magnitude. The areas that are commonly most affected by ground shaking have soils classified by the NEHRP as D, E and F. In general, these areas are also most susceptible to liquefaction (HI-EMA 2023).

Soil liquefaction maps are useful tools to assess potential damage from earthquakes. In general, areas with NEHRP soil types D, E and F are also susceptible to liquefaction. If there is a dry soil crust, excess water will sometimes come to the surface through cracks in the confining layer, bringing liquefied sand with it, creating sand boils. This is a vital need for assessing seismic risk within the planning area; however, NEHRP mapping has not been done for Kaua'i County.

Table I-20. NEHRP Soil Classification System

NEHRP Soil Type	Description	Mean Shear Velocity to 30 meters (m/s)
A	Hard Rock	1,500
B	Firm to Hard Rock	760–1,500
C	Dense Soil/Soft Rock	360–760
D	Stiff Soil	180–360
E	Soft Clays	<180
F	Special Study Soils (liquefiable soils, sensitive clays, organic soils, soft clays >36 meters thick)	

Hazard Profile

Past Events

Although no earthquakes have been recorded in Kaua'i, the USGS lists 27 earthquakes with magnitudes of 5.0 or greater that have occurred in Hawai'i since 1990, as listed in Table I-21 and shown on Figure I-18. The following sections describe significant earthquakes in the state's history.

1868 Ka'ū District Earthquake

An earthquake occurred in 1868 in the Ka'ū district on the southeast flank of Mauna Loa with an estimated magnitude of 7.5 to 8.0. Although the 1868 earthquake caused damage island-wide, the devastation was greatest in Ka'ū where the earthquake triggered a mudflow killing 31 people and coastal subsidence generated a tsunami that destroyed several villages. Approximately 79 people were killed, mostly due to the mudslide and the tsunami (Tetra Tech 2021).

1973 South Hilo Earthquake

A large earthquake, unrelated to volcanic activity, was located 25 miles beneath Honomū in the South Hilo district in 1973. This earthquake had a magnitude of 6.2. It caused $5.6 million worth of damage and injured 11 people (Tetra Tech 2021).

1975 Kīlauea Earthquake

The largest earthquake on the island during the twentieth century occurred on the south flank of Kīlauea in 1975. This earthquake had a magnitude of 7.2. It caused coastal subsidence at Kalapana, generated a tsunami that killed two people in the Hawai'i Volcanoes National Park, destroyed houses in the Ka'ū district, sank fishing boats in Keauhou Bay within the North Kona district, and damaged boats and piers in Hilo, within the South Hilo district (Tetra Tech 2021).

2006 Kīholo Bay Earthquake

The most recent major earthquakes in the state of Hawai'i were the magnitude 6.7 Kīholo Bay and magnitude 6.0 Māhukona earthquakes that occurred on October 15, 2006, at 7:07 a.m. and 7:14 a.m., respectively. Both earthquakes were centered near the Kona coastline of Hawai'i. The largest ground shaking for this earthquake was at the north end of the island at the towns of Waimea and Hāwī. These areas had amplified ground motion due to their softer soil conditions. The most heavily damaged buildings were concentrated in the Waimea and Hāwī areas, with some damage also in the Honoka'a and Kona areas. There was very little damage at the south end of the island (Tetra Tech 2021).

Table I-21. Earthquakes of Magnitude 5.0 or Larger in the State of Hawai'i (1990–2024)

Date	Magnitude	Epicenter Location (see Figure I-18)		
		Latitude (degrees)	Longitude (degrees)	Depth (miles)
2/9/2024	5.88	19.19	−155.49	22.97
12/5/2023	5.06	19.33	−155.21	1.29
10/14/2022	5.02	19.14	−155.49	5.59
10/10/2021	6.21	18.82	−155.53	21.79
7/5/2021	5.17	20.22	−155.63	16.73
4/14/2019	5.34	19.74	−155.79	8.3
3/13/2019	5.54	19.33	−155.20	4.3
5/4/2018	6.9	19.32	−155.00	3.6
5/4/2018	5.73	19.33	−155.02	4.0
5/3/2018	5.06	19.34	−155.07	4.0
6/8/2017	5.28	19.33	−155.12	4.4
6/28/2015	5.2	19.34	−155.21	5.3
6/5/2013	5.3	18.91	−155.06	25.0
4/14/2009	5.2	19.33	−155.21	6.2
8/14/2007	5.4	19.35	−155.07	6.0
11/23/2006	5.2	19.89	−155.97	23.4
10/15/2006	6.1	20.13	−155.98	11.7
10/15/2006	6.7	19.88	−155.94	24.2
7/17/2005	5.1	18.78	−155.45	20.3
7/15/2005	5.3	20.44	−155.13	11.1
9/13/2001	5.2	18.86	−155.24	7.8
4/17/1999	5.8	19.25	−155.49	6.8
6/30/1997	5.7	19.36	−155.07	4.7
2/1/1994	5.6	19.24	−155.29	20.4
6/8/1993	5.2	19.33	−155.22	2.3
5/8/1991	5.5	19.37	−156.27	22.6
8/2/1990	5	19.84	−155.62	12.9

Source: USGS (2020, 2025c).

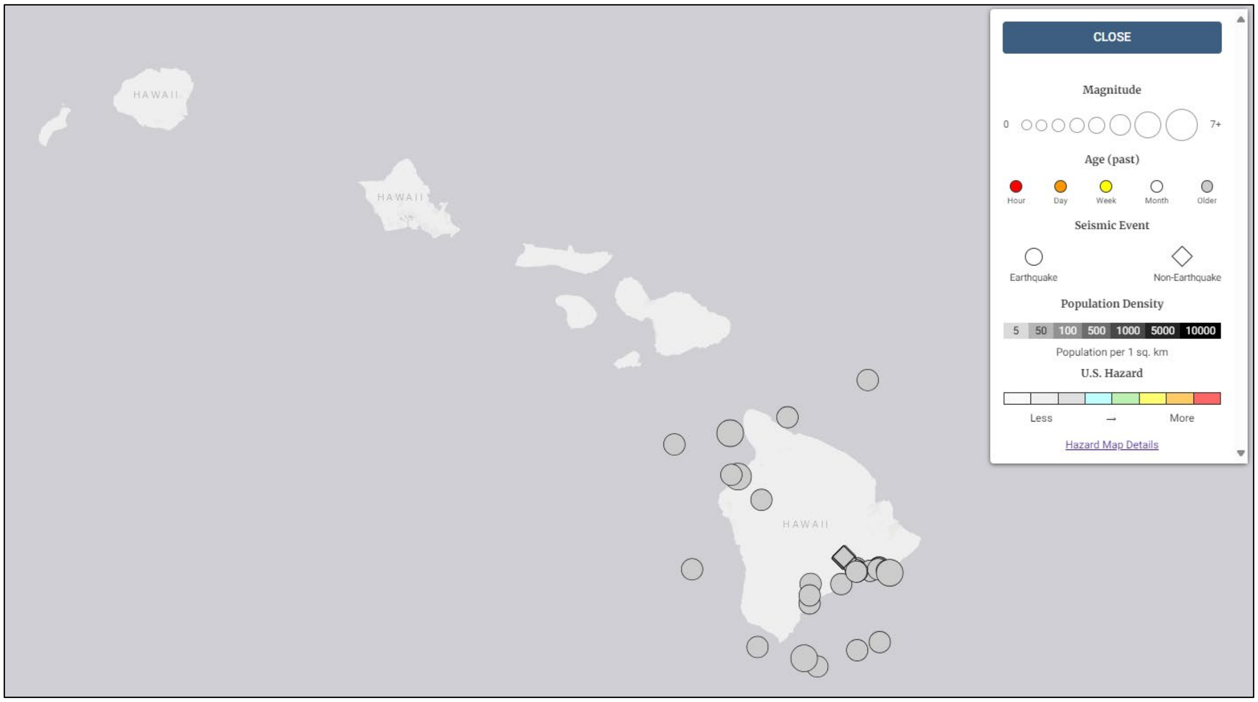


Figure I-18. Earthquakes of magnitude 5.0 or greater in Hawaiʻi, 1990–2024 (USGS 2025c).

Location

NEHRP Soil Maps

NEHRP soil type maps define the locations that will be significantly impacted by an earthquake. NEHRP soils types B and C typically can sustain low-magnitude ground shaking without much effect. The areas that are most commonly affected by ground shaking have NEHRP soil types D, E and F. As stated previously, NEHRP soil classifications are available only for Maui and Hawaiʻi Counties but are not available for Kauaʻi County.

Fault Locations

The USGS maintains a map and database on faults that show evidence of seismic activity with the past 1.6 million years (the Quaternary period). Fault complexes are present on the island of Hawaiʻi. USGS mapping shows no faults on any of the other Hawaiian Islands, including Kauaʻi (USGS 2025d).

Potential Damage

Any seismic activity of 6.0 or greater felt within the planning area would have significant impacts throughout the county. While this level of seismicity is unlikely, substantial shaking may occur as a result of a large earthquake on the islands of Maui or Hawaiʻi. Potential warning systems could give approximately 40 seconds notice that a major earthquake is about to occur, which would not provide adequate time for preparation.

An event of this magnitude is highly unlikely due to Kauaʻi's low potential of earthquake damage. However, the risks to property from earthquakes in the state of Hawaiʻi are among the highest in the nation, with only San Francisco and San José, California having a greater annual loss per million dollars of building value. Earthquake occurrence rates in Hawaiʻi County are responsible for the losses and are as high as those near the most hazardous fault areas in the mainland United States (Tetra Tech 2021). Notably, the likelihood of a damaging earthquake on Kaua’i is far less likely than on the other islands, particularly the islands of Hawai‘i and O‘ahu.

Strong earthquakes, while infrequent, may endanger people and property by shaking structures, causing ground cracks, ground settling and landslides. Strong earthquakes in Hawai‘i’s past have destroyed buildings, water tanks and bridges and damaged roadways, water, sewer and utility lines. Soil and topographic conditions may exacerbate potential earthquake hazards where steep slopes and water saturated soils may be susceptible to mudflows or landslides. Large earthquakes may also generate tsunamis.

Warning Time

There is currently no reliable way to predict when an earthquake will occur at any given location. Research is being done with warning systems that use the low energy waves that precede major earthquakes. These potential warning systems give approximately 40 seconds notice that a major earthquake is about to occur. The warning time is very short, but it could allow for someone to get under a desk, step away from a hazardous material they are working with, or shut down a computer system.

County of Kaua‘i Multi-Hazard Mitigation and Resilience Plan

Appendix J. Dam Risk Summaries

J. DAM RISK SUMMARIES

The Pacific Disaster Center (PDC), in partnership with the University of Hawaii and under contract with the State of Hawaii Department of Land and Natural Resources (DLNR), conducted the Phase I Dam Failure Inundation Mapping Project to assess the risks and impacts associated with dam failures across Hawaii, including Kaua‘i County. This initiative was launched in response to a catastrophic dam failure on Kaua‘i in March 2006, which prompted new requirements for dam owners to develop emergency preparedness plans supported by detailed inundation maps and consequence assessments. The main goal of Phase I was to produce flood-inundation maps and consequence-assessment reports for all 135 registered dams statewide, providing DLNR and local emergency managers with critical baseline data for further study and planning (Pacific Disaster Center & University of Hawaii 2008).

The methodology for this project involved modeling dam failure scenarios under conservative assumptions: each dam was presumed to fail by piping halfway up the dam face while at maximum reservoir capacity, under sunny day and dry downstream conditions, with spillways and outlet works inoperable. The Danish Hydrological Institute’s MIKE 21 two-dimensional hydrodynamic model was used to generate inundation maps depicting maximum water depths, timing, and velocities of potential floodwaters. This approach was selected for its accuracy in simulating complex flow paths across floodplains. While bridges and downstream structures were not included in the digital elevation models due to data limitations, their impact was preliminarily assessed through overlay analyses (Pacific Disaster Center & University of Hawaii 2008).

Phase I deliverables included detailed inundation maps, model output statistics at key downstream locations, assessments of impacts on critical infrastructure such as bridges, and hydrologist-reviewed scenario comments. Consequence assessments were performed at the parcel level using Tax-Map Key (TMK) data and county geographic information system (GIS) resources to estimate building and land values and to identify critical facilities at risk. Population exposure was estimated using dasymetric mapping techniques based on 2000 U.S. Census data and land use/land cover information, providing a refined understanding of vulnerable populations in potential inundation zones. These analyses are intended to support emergency managers in Kaua‘i County and statewide in improving risk awareness and mitigation planning. This data aims to strengthen Hawaii’s dam safety and emergency preparedness, providing Kaua‘i County with the detailed hazard identification and consequence assessments needed for effective mitigation planning (Pacific Disaster Center & University of Hawaii 2008).

Table J-1 summarizes the individual assessment reports prepared by the PDC (Pacific Disaster Center & University of Hawaii 2008). Evacuation maps, along with additional information regarding the dams in Kaua‘i County, can be found at the DLNR Dam Inventory System website (DLNR Engineering Division 2025c): https://dams.hawaii.gov.

Table J-1. Dam Assessment Report Summary

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00002- PUU LUA RESERVOIR **Inundation Area (acres):** **Population at Risk:** 0 **Total Parcels Affected:** 8 **Total Land Value:** $4,661,800 **Total Building Value:** $365,900 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges: 0 Length of Roads (miles): 2 **Hydrologist Summary** This is a medium-sized reservoir that empties very rapidly; the model predicts an extremely deep, extremely swift flood. The flood does not spread out much, so a relatively small area will be affected. The affected area is mostly undeveloped except for a State Park. The majority of the water flows down the main stream but some goes down a different stream valley to the south. In the main stream valley the model predicts very deep and VERY fast water. When this flood reaches the coast (at the northernmost end of the State Park) the water will still be deep, quite swift, and quite hazardous. Some of the water from the reservoir will flow down a valley that is immediately south of the main valley. Water in the southern valley will be much less deep and swift, but when the water reaches the coast it will spread out over a topographic depression landward of the beach.			KA-0002	HI00002

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00003 PUU OPAE RESERVOIR **Inundation Area (acres):** 949 **Population at Risk:** 0 **Total Parcels Affected:** 3 **Total Land Value:** $1,720,300 **Total Building Value: $345,100** **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 7 **Hydrologist Summary** Puu Opae is a small reservoir that empties in 30 minutes. The flood travels 2.25 miles down the Nui Stream Valley before disgorging onto the coastal plain south of Mana. The flood within Nui Valley is swift and deep, but the water slows down and spreads out (until it is 3 miles wide) after it reaches the coastal plain. The flood does not reach the ocean because it is trapped in a topographic depression behind the beach berm. According to the model the coastal highway is not flooded.		Low Hazard	KA-0003	HI00003

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00005 MANA RESERVOIR **Inundation Area (acres):** 749 **Population at Risk:** 0 **Total Parcels Affected:** 2 **Total Land Value:** $196,000 **Total Building Value:** $255,800 **Number of Critical Facilities affected**: Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 5 **Hydrologist Summary** This is a relatively small reservoir, and the flood spreads out (eventually reaching 0.62 to 1.24 miles in width) rather than being confined to a valley. Consequently, the water velocities are relatively low and the flood depths are shallow (mostly less than 3 feet), except for immediately below the dam where the water is a bit higher and swifter. The flood waters pond (are trapped) in a shallow depression on the coastal plain and do not reach the ocean.			KA-0005	HI00005

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00006 WAIKAIA RESERVOIR **Inundation Area (acres):** 99 **Population at Risk:** 1 **Total Parcels Affected:** 57 **Total Land Value:** $3,058,200 **Total Building Value:** $2,331,200 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 2 **Hydrologist Summary** Waikaia is a very small reservoir that empties in 30 minutes. It is an offstream dam (not in a stream valley), so at first the flood spreads out over the slope below the dam. The floodwaters soon enter the Makaweli River, flows down it to where the Makaweli River joins the Waimea River, and flows down the Waimea River to the sea. Also, the floodwaters backflood (travels up) the Makaweli river valley and the Waimea River valley. Owing to the relatively small amount of water and flat topography in the river valleys, the flood takes 4.5 hours to reach Highway 50. Maximum flood velocities are about 0.5 feet per second at Highway 50.			KA-0006	HI00006

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00007 KEPANI RESERVOIR **Inundation Area (acres):** 139 **Population at Risk:** 2 **Total Parcels Affected:** 52 **Total Land Value:** $2,652,400 **Total Building Value:** $96,100 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) **Hydrologist Summary** Kepani is a very small reservoir that empties rapidly. The dam is located on the hillslope above Makaweli river. For the first 100 yards the flood flows overland until it enters the Makaweli river. It then flows down the Makaweli stream valley for three miles until it joins the Waimea river. At this juncture the flood slows to a crawl as it spreads across the relatively flat topography. The best available topographic data show shallow depressions that trap the floodwaters and prevent the flood from reaching the ocean. The actual topography may vary from the best available data, however, so it is possible that the flood WILL reach the ocean. Emergency response plans should proceed on the assumption that a small flood will travel down the Waimea River to the ocean.			KA-0007	HI00007

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00008 WAIKOLOI RESERVOIR **Inundation Area (acres):** 216 **Population at Risk:** 99 **Total Parcels Affected:** 8 **Total Land Value:** $2,698,400 **Total Building Value:** $3,354,400 **Total Number of Critical Facilities Affected:** Number of Critical Facilities affected: Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 3 **Hydrologist Summary** This is a small dam that takes 20 minutes to drain. The flood takes 55 minutes (from the time the dam begins to fail) to travel the 3.5 miles from the dam to Highway 50. At first, the flood is contained within gulches (first a tributary to Mahinauli Gulch and then Mahinauli Gulch), but for the last mile before the ocean, the floodwaters spread out Draft: June 30, 2008 University of Hawaii-PDC: DLNR–Phase I 50 (about 800 ft wide at the highway). Maximum water velocities are about 2 feet per second at Highway 50.			KA-0008	HI00008

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00008 KAAWANUI RESERVOIR **Inundation Area (acres):** 127 **Population at Risk:** 209 **Total Parcels Affected:** 5 **Total Land Value:** $2,163,800 **Total Building Value:** $3,273,300 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 3 **Hydrologist Summary** Kaawanui is a very small reservoir that empties in 30 minutes. The flood is more or less confined to Kaawanui Gulch for the first mile. Kaawanui Village is flooded. When the gulch exits into the Mahinauli valley, the floodwaters have an opportunity to spread out, resulting in shallower depths and slower water velocities. Maximum water velocities Draft: June 30, 2008 University of Hawaii-PDC: DLNR–Phase I 56 are1-1.5 feet per second at Highway 50 and very hazardous (11 feet per second) near Kaawanui Village.			KA-0009	HI00009

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00010 WAIAKALUA RESERVOIR **Inundation Area (acres):** 63 **Population at Risk:** 13 **Total Parcels Affected:** 21 **Total Land Value:** $30,174,500 **Total Building Value:** $3,929,900 **Total Number of Critical Facilities Affected:** Number of Critical Facilities affected: Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 0 **Hydrologist Summary** Waiakalua is a small reservoir about a mile from the ocean. It takes about an hour to empty. Immediately below the dam, the floodwaters spread out to about 400 feet wide. Further downstream (just below the highway), the flood flows into a deep, narrow gulch, and the floodwaters remain within this gulch (which contains Waiakalua Stream) the remaining distance to the ocean. Maximum water velocities are about 10-12 feet per second where the flood crosses Highway 56.			KA-0010	HI00010

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00011 All RESERVOIR **Inundation Area (acres):** 171 **Population at Risk:** 15 **Total Parcels Affected:** 46 **Total Land Value:** $209,637,400 **Total Building Value:** $61,695,300 **Total Number of Critical Facilities Affected:** Total number affected 2 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 1 Airports and Seaports total 1 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 1 **Hydrologist Summary** This is a relatively small reservoir, so the flood depths are not particularly deep. For its entire length, the flood is confined by topography by a valley/gulch, and thus does not spread very far from the channel. The model predicts that the flood will stop short of the ocean, but it would still be advisable to evacuate the beach. In the vicinity of Kapaia, the water depths will be on the order of 1.5 - 7 feet, and water velocities will be quite hazardous (up to 10 feet per second) in some spots.			KA-0011	HI00011

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00012 KAPAIA RESERVOIR **Inundation Area (acres):** 459 **Population at Risk:** 36 **Total Parcels Affected:** 49 **Total Land Value:** $188,481,500 **Total Building Value:** $6,426,400 **Total Number of Critical Facilities Affected:** Total number affected 2 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 1 Airports and Seaports total 1 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 5 **Hydrologist Summary** This is a medium-sized reservoir. The model predicts that the flood will be confined by topography so that the flooded area is narrow in width. As a result, the flood will be deep and velocities will be very high. Water velocities will be as high as 10 feet per second in the inhabited areas near Kapaia, Hanamaulu, and the beach park.			KA-0012	HI00012

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00014 OKINAWA RESERVOIR **Inundation Area (acres):** 116 **Population at Risk:** 24 **Total Parcels Affected:** 42 **Total Land Value:** $187,562,600 **Total Building Value:** $6,039,500 **Total Number of Critical Facilities Affected:** Total number affected 2 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 1 Airports and Seaports total 1 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 1 **Hydrologist Summary** This is a relatively small reservoir. In the upper reaches of the stream the flood is confined to a narrow valley, so the flow is moderately deep and moderately swift. In the last mile before the ocean the valley widens and the flood widens and slows down.			KA-0014	HI00014

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00015 KANEHA RESERVOIR **Inundation Area (acres):** 236 **Population at Risk:** 17 **Total Parcels Affected:** 60 **Total Land Value:** $22,066,000 **Total Building Value:** $8,576,700 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 2 **Hydrologist Summary** Kaneha is a small reservoir that takes 30-40 minutes to empty. The flood travels down a narrow stream valley (gulch) for about six miles prior to flowing into the ocean via Kapaa Stream. Because the water is confined to a narrow valley, the waters are deep and extremely swift, especially in the first three miles below the dam. Maximum water velocities are hazardous (7-8 feet per second) at the location where the flood crosses Highway 56.			KA-0015	HI00015

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00016 MIMINO RESERVOIR **Inundation Area (acres):** 132 **Population at Risk:** 10 **Total Parcels Affected:** 43 **Total Land Value:** $14,170,200 **Total Building Value:** $7,824,500 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 2 **Hydrologist Summary** Mimino is a very small reservoir that empties in 15 minutes. The flood is confined within a gulch (first the Mimino Str. Gulch and then the Kapaa Str. Gulch) the entire way from the dam to the ocean, a distance of about five miles. At first the flood travels relatively rapidly, but it slows down at after two hours and reaches the coastal highway / ocean 6.5 hours after the dam breaks. Maximum water velocities are about 1.5 feet per second at the coastal highway.			KA-0016	HI00016

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00024 KALIHIWAI RESERVOIR **Inundation Area (acres):** 111 **Population at Risk:** 1 **Total Parcels Affected:** 23 **Total Land Value:** $18,784,900 **Total Building Value:** $2,041,700 **Total Number of Critical Facilities Affected:** Total number affected 1 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 1 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) **Hydrologist Summary** This is a moderately sized reservoir that takes over an hour and a half to empty. Initially, the flood spreads out to about 1000 feet wide, but soon enters Kalihiwai River valley. At this point the flood is confined by topography to a narrow valley. It takes just under an hour for the flood to reach the highway and the estuary. The flood spreads out to about 1000 feet wide just above the highway. Finally, the flood flows through the estuary and into Kalihiwai Bay. Water velocities at the highway will be hazardous (4-5 feet per second).			KA-0024	HI00024

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00030 KA LOKO RESERVOIR **Inundation Area (acres):** 304 **Population at Risk:** 18 **Total Parcels Affected:** 46 **Total Land Value:** $108,966,200 **Total Building Value:** $16,481,000 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) **Hydrologist Summary** Ka Loko is a medium-sized reservoir that empties in one hour. For the first 2.2 miles below the dam the flood is confined within a valley. Thereafter it spreads out over a broad area (1/3 mil e wide) before flowing into two drainages (plus an additional drainage for a short distance). The majority of the flow goes down the east drainage. This branch of the flood flows through the Morita reservoir and continues downstream until it flows into the Kalihiwai Estuary. The west branch of the flow also flows into the Kalihiwai Estuary. Extreme water velocities (about 20 feet per second or greater) occur where the flood crosses the Kuhio highway, at the mouth of the Klihiwai Estuary, and the most channelized sections of flow (the two miles immediately below the dam and the west branch of the flow for the last 1/2 mile above the estuary.)			KA-0030	HI00030

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00060 WAILUA RESERVOIR **Inundation Area (acres):** 252 **Population at Risk:** 17 **Total Parcels Affected:** 71 **Total Land Value:** $87,122,400 **Total Building Value:** $85,754,200 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 1 **Hydrologist Summary** In most locations the flood does not spread very far from the river. It does, however, flow back up a tributary for a considerable distance. (This tributary is about 2/3 of the way from the dam to the ocean.)			KA-0060	HI00060

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00061 LOWER KAPAHI RESERVOIR **Inundation Area (acres):** 122 **Population at Risk:** 34 **Total Parcels Affected:** 77 **Total Land Value:** $47,812,900 **Total Building Value:** $54,852,200 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 1 **Hydrologist Summary** This is a small reservoir that empties in 45 minutes. The flood remains within a narrow gulch the entire journey from the dam to the ocean (a distance of about 3 miles as the crow flies.) Maximum water velocities are mostly in the range of 3-8 feet per second, but there are a few locations where the water is much faster.			KA-0061	HI00061

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00062 TWIN RESERVOIR **Inundation Area (acres):** 341 **Population at Risk:** 5 **Total Parcels Affected:** 26 **Total Land Value:** $28,667,000 **Total Building Value:** $48,601,800 **Total Number of Critical Facilities Affected:** Total number affected 1 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 1 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 2 **Hydrologist Summary** The flood is confined to a narrow valley (about 75-100 ft wide) for the first kilometer below the dam, producing deep and extremely swift flows. The flood then spreads out somewhat and crests a divide, so that it is flowing in two different gulches. Three km below the dam the flood reaches a flat coastal plain, slows down, and spreads out to about 1/3 mile wide. The majority of the water enters Waikea Canal and flows through the Canal to the ocean.	Smaller TWIN Reservoir		KA-0062	HI00062

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00063 AAHOAKA RESERVOIR **Inundation Area (acres): 226** **Population at Risk:** 1 **Total Parcels Affected:** 22 **Total Land Value:** $19,998,200 **Total Building Value:** $416,000 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected*: Number of Bridges 0 Length of Roads (miles) 1 **Hydrologist Summary** In some locations the flood is confined to a narrow canyon. The flood spreads away from the river in only a few locations. This is a relatively moving flood compared to many of the other Hawaiian dams.			KA-0063	HI00063

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00098 ALEXANDER **Inundation Area (acres):** 319 **Population at Risk:** 5 **Total Parcels Affected:** 25 **Total Land Value:** $11,378,600 **Total Building Value:** $4,792,200 **Total Number of Critical Facilities Affected:** Total number affected 2 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 1 Airports and Seaports total 1 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 2 Length of Roads (miles) 2 **Hydrologist Summary** This is a large reservoir producing a large flood. The flood flows are confined to a deep narrow gully/valley all the way to the ocean. Consequently, the flood is very deep and incredibly swift (commonly about 30 feet per second).	Alexander Reservoir		KA-0098	HI00098

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00099 WAITA RESERVOIR **Inundation Area (acres):** 1,680 **Population at Risk:** 1,639 **Total Parcels Affected:** 827 **Total Land Value:** $866,629,900 **Total Building Value:** $646,739,400 **Total Number of Critical Facilities Affected** Total number affected 4 School total 1 Hospital total 0 Fire Station total 1 Police total 0 Government total 2 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 1 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 22 **Hydrologist Summary** Waita is a large reservoir that sits above the town of Koloa and the southern part of the town of Poipu. The reservoir is not located in a stream valley, so the flood spreads out over a large area, with the width of flood being about 1-2 miles. There are several main flow paths and several dry islands in the middle of the flooded area. Once the flood reaches the coast part of it spreads south along the beach. The model predicts that the reservoir will take about 8 hours to drain, and that the peak discharge will occur about 2.5 hours after the dam begins to fail.			KA-0099	HI00099

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00100 KAPA RESERVOIR **Inundation Area (acres):** 232 **Population at Risk:** 309 **Total Parcels Affected:** 193 **Total Land Value:** $54,167,500 **Total Building Value:** $189,798,400 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 3 **Hydrologist Summary** Kapa is a very small reservoir located on a hill (not a stream valley) above Hanapēpē Bay. Initially, the flood spreads out, but within 1/4 to 1/2 mile it flows into several different small gulches. Part of the upper (spread out) flood crosses Mehana Road and floods the Draft: June 30, 2008 University of Hawaii-PDC: DLNR–Phase I 203 upper part of Eleele. Water velocities across Mehana Road are up to 10 feet per second. Water velocities are up to 5 feet per second where the flood crosses Halewili Road.			KA-0100	HI00100

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00101 HUKIWAI RESERVOIR **Inundation Area (acres):** 55 **Population at Risk:** 0 **Total Parcels Affected:** 8 **Total Land Value:** $3,836,200 **Total Building Value:** $1,648,000 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 1 **Hydrologist Summary** Hukiwai is a very small reservoir that empties in less than 30 minutes. It is an offstream reservoir (not in a stream valley) so at first the floodwaters spread over the ground (to a width of about 600 feet). The flood then flows into Wahiawa Stream, and down Wahiawa Stream to Wahiawa Bay. There is a little backflooding (upstream flow) where the flood first enters the stream. The flood is narrow, deep, and extremely swift once it enters the stream valley. Maximum water velocities of 8 to 15 feet per second are expected where the flood crosses Halewili Road.	KCOF Reservoir #12		KA-0101	HI00101

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00102 IOLEAU RESERVOIR **Inundation Area (acres):** 40 **Population at Risk:** 0 **Total Parcels Affected:** 4 **Total Land Value:** $3,890,900 **Total Building Value:** $1,644,400 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 0 **Hydrologist Summary** This is a small reservoir, and a relatively small area is flooded. The water velocities in the flooded area are hazardous. From the dam the flood travels down a narrow stream valley for slightly over a mile before reaching the ocean. The flood is confined to the narrow valley the entire time and there is little development in the flooded area.	KCOF Reservoir #6	Low hazard	KA-0102	HI00102

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00103 AEPO RESERVOIR **Inundation Area (acres):** 252 **Population at Risk:** 55 **Total Parcels Affected:** 63 **Total Land Value:** $207,867,100 **Total Building Value:** $55,753,000 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 2 **Hydrologist Summary** Aepo is the uppermost of a series of four dams in series in Kukuiula Gulch and its tributaries. (The lower dams are Aepoalua, Aepoekolu, and Aepoeha.) They are all small reservoirs that empty rapidly. In this scenario, it is assumed that Aepo dam fails by piping and that the resulting floodwaters damage the next reservoir, which then fails by overtopping. Like dominoes, all three of the lower dams fail through overtopping. The flood is more or less confined within the gulch the entire way to the coastal plain, a distance of about two miles. There is one location where water overtops a divide, creating a new branch of the flood that later rejoins the main flow. When the flood Draft: June 30, 2008 University of Hawaii-PDC: DLNR–Phase I 221 reaches the coastal plain it slows down and spreads to the east until it is almost one mile wide. Maximum water velocities are about 7 feet per second where the Kukuiula Gulch crosses the coastal road. Water velocities are much higher--and extremely hazardous-- in the mauka part of the gulch and generally slower in the coastal plain.			KA-0103	HI00103

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00104 HUINAWAI RESERVOIR **Inundation Area (acres):** 350 **Population at Risk:** 491 **Total Parcels Affected:** 298 **Total Land Value:** $241,299,500 **Total Building Value:** $53,409,400 **Total Number of Critical Facilities Affected:** Total number affected 3 School total 1 Hospital total 0 Fire Station total 1 Police total 0 Government total 1 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 1 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 4 **Hydrologist Summary** Huinawai is a small reservoir that empties in 20 minutes. The flood flows down Poeleele Stream Valley for about 2.75 miles before inundating Koloa Town. The flood then Draft: June 30, 2008 University of Hawaii-PDC: DLNR–Phase I 227 continues another ~2.5 miles down Waikomo Stream before flowing into the ocean at the Koloa Boat Ramp. The flood reaches the ocean one hour and 20 minutes after the dam begins to fail. Maximum water velocities in Koloa are about 3-4 feet per second.			KA-0104	HI00104

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00105 ELIMA RESERVOIR **Inundation Area (acres):** 101 **Population at Risk:** 55 **Total Parcels Affected:** 35 **Total Land Value:** $10,676,900 **Total Building Value:** $ 4,159,400 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 0 **Hydrologist Summary** This is a very small reservoir that takes 20 minutes to drain. After the dam breaches the resulting flood will flow across Highway 50 and into Ipuolono Reservoir. The capacity of Ipuolono is 6.7 times that of Mau so it is possible that Ipuolono Reservoir can contain all the floodwaters from Mau without resulting in failure of Ipuolono dam. The modeling scenario, however, assumes that the Mau flood passes through Ipuolono (without it failing) and continues on to the ocean. The floodwaters remain within Kahaleo Gulch the entire three miles to the ocean. Maximum water velocities at Highway 50 near Kalāheo are about 8 feet per second, which is very hazardous. Less than ten minutes elapse Draft: June 30, 2008 University of Hawaii-PDC: DLNR–Phase I 233 between the time between when the dam begins to break and the floodwaters reach Highway 50	No. 5 Reservoir		KA-0105	HI00105

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00106 KUMANO RESERVOIR **Inundation Area (acres):** 37 **Population at Risk:** 0 **Total Parcels Affected:** 11 **Total Land Value:** $77,757,400 **Total Building Value:** $1,604,400 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 0 **Hydrologist Summary** The flood flows are confined by topography and the flooded area is rarely wider than 100 yards. About halfway to the ocean the water plunges over a waterfall into Lawai valley. Once in the valley the water backfloods about 1/3 mile up the valley. In certain locations within Lawai Valley the water velocities will be high enough to be hazardous. Extremely high velocities are expected near the waterfall and between the dam and the waterfall.	Komano Reservoir		KA-0106	HI00106

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00107 PUU O HEWA RESERVOIR **Inundation Area (acres):** 302 **Population at Risk:** 612 **Total Parcels Affected:** 300 **Total Land Value:** $223,629,900 **Total Building Value:** $55,994,800 **Total Number of Critical Facilities Affected:** Total number affected 3 School total 0 Hospital total 0 Fire Station total 1 Police total 0 Government total 2 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 5 **Hydrologist Summary** This is a very small reservoir that empties in 30-40 minutes. It first flows down a tributary of Waihohonu Stream and thence into Waihohonu Stream, passing through the middle of Koloa Town prior to entering the ocean at Koloa Ramp. The flood is confined to a narrow valley (gulch) for nearly the entire distance, although it does spread out slightly to a width of 1/4 mile in Koloa Town. Maximum water velocities are about 3 feet per second at the upper end of Koloa (where it crosses the Cane Haul Road) and 4-1.5 feet per second where it crosses Poipu Road just above Koloa Ramp.			KA-0107	HI00107

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00108 KAUPALE RESERVOIR **Inundation Area (acres):** 67 **Population at Risk:** 3 **Total Parcels Affected:** 8 **Total Land Value:** $76,947,000 **Total Building Value:** $1,604,400 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 0 **Hydrologist Summary** This is a small dam located one mile from the ocean. After the dam breaches, the resulting flood will flow into Kumano Reservoir, which is about ¼ mile downstream and cause it to fail through overtopping. About 1/3 mile below Kumano, the flood pours into the Lawai Stream valley. Due to the flat topography, there is backflooding* of Lawai Stream Valley for about ¼ mile. (*This means that the flood goes up the valley.)			KA-0108	HI00108

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00109 IPUOLONO RESERVOIR **Inundation Area (acres):** 96 **Population at Risk:** 1 **Total Parcels Affected:** 7 **Total Land Value:** $4,052,800 **Total Building Value:** $1,873,700 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 1 **Hydrologist Summary** The flood takes a straightforward path from the dam, traveling down the valley, and to the ocean. In most locations the flood does not spread very far from the river.	No. 8 Reservoir		KA-0109	HI00109

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00110 AEPOALUA RESERVOIR **Inundation Area (acres):** 187 **Population at Risk:** 18 **Total Parcels Affected:** 50 **Total Land Value:** $173,694,000 **Total Building Value:** $50,665,300 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 1 **Hydrologist Summary** Aepoalua is the second highest in a series of four dams in Kukuiula Gulch and its tributaries. In this scenario it is assumed that Aepoalua dam fails by piping. This creates a domino effect as the resulting flood damages the two lower reservoirs (Aepoekolu and Aepoeha), which then fail by overtopping. All the reservoirs are small and empty rapidly. The flood is more or less confined within the gulch the entire way from Aepoalua to the coastal plain, a distance, of about 1.75 miles. There is one location where water overtops a divide, creating a new branch of the flood that later rejoins the main flow. When the flood reaches the coastal plain it slows down and spreads to the east until it is Draft: June 30, 2008 University of Hawaii-PDC: DLNR–Phase I 263 almost one mile wide. Maximum water velocities are about 4 feet per second where the Kukuiula Gulch crosses the coastal road. Water velocities are much higher--and extremely hazardous--in the mauka part of the gulch and generally slower in the coastal plain.			KA-0110	HI00110

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00111 AEPOEKOLU RESERVOIR **Inundation Area (acres):** 162 **Population at Risk:** 14 **Total Parcels Affected:** 46 **Total Land Value:** $170,639,200 **Total Building Value:** $50,621,400 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 1 **Hydrologist Summary** Aepoekolu Dam is about 0.8 miles upstream of Aepoeha Dam (HI00112). Both reservoirs are small, but the lower one holds four times more water than the upper one. In this scenario it is assumed that the upstream reservoir (Aepoekolu) fails by piping and that the resulting floodwaters damage the lower reservoir, which then fails by overtopping. The flood is confined within Kukuiula Gulch for the entire distance between the upper dam and the coastal plain. In the gulch the flooded area is only 300-500 feet wide. When the flood approaches the coastal plain it slows down and spreads to the east until it is almost one mile wide. Maximum water velocities are about 4 feet per second where the Kukuiula Gulch crosses the coastal road. Water velocities are much Draft: June 30, 2008 University of Hawaii-PDC: DLNR–Phase I 269 higher (up to 20 feet per second, which is extremely hazardous) in the mauka part of the gulch and slower in the coastal areas where the flood has spread out.			KA-0111	HI00111

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00112 AEPOEHA RESERVOIR **Inundation Area (acres):** 170 **Population at Risk:** 52 **Total Parcels Affected:** 63 **Total Land Value:** $210,835,500 **Total Building Value:** $55,753,000 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 1 **Hydrologist Summary** Aepoeha is a small reservoir located ¾ mile from the ocean. For the first half mile below the dam, the flood is confined within Kukuiula Gulch. When the flood enters the coastal plain, it slows down and spreads eastward until it is about one mile wide. The facilities and park at the Kukuiula Boat Harbor are engulfed. Maximum water velocities are about 6 feet per second where the Kukuiula Gulch crosses the coastal road. Water velocities are much higher (more than 20 feet per second, which is extremely hazardous) in the mauka part of the gulch and slower (1-3 fps) in the coastal areas where the flood has spread out.			KA-0112	HI00112

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00113 OMAO RESERVOIR **Inundation Area (acres):** 314 **Population at Risk:** 475 **Total Parcels Affected:** 299 **Total Land Value:** $245,995,700 **Total Building Value:** $53,657,000 **Total Number of Critical Facilities Affected:** Total number affected 3 School total 1 Hospital total 0 Fire Station total 1 Police total 0 Government total 1 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 1 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 4 **Hydrologist Summary** This is a small reservoir that empties in 40 minutes; the flood reaches the ocean in 75 minutes. The flood flows down a defined valley, and the width of the flooded area ranges from about 300 to 1300 feet. In the town of Koloa the model predicts flood depths of up to about four feet and velocities up to about 5-6 feet per second.		Not in inventory	KA-0113	HI00113

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00114 PIWAI RESERVOIR **Inundation Area (acres):** 421 **Population at Risk:** 666 **Total Parcels Affected:** 374 **Total Land Value:** $319,197,100 **Total Building Value:** $146,655,100 **Total Number of Critical Facilities Affected:** Total number affected 3 School total 1 Hospital total 0 Fire Station total 1 Police total 0 Government total 1 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 1 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 6 **Hydrologist Summary** The first 2.5 miles (approximately) below the dam the flood is confined to a very narrow valley. It is here that the velocities are extremely high and very hazardous; the deepest flood depths are also found in the narrow valley. After the first 2.5 miles (approximately), the flood spreads out and the velocities decrease (but are still high enough to be hazardous).			KA-0114	HI00114

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00115 PIA MILL RESERVOIR **Inundation Area (acres):** 201 **Population at Risk:** 258 **Total Parcels Affected:** 176 **Total Land Value:** $152,456,400 **Total Building Value:** $39,769,300 **Total Number of Critical Facilities Affected:** Total number affected 2 School total 0 Hospital total 0 Fire Station total 1 Police total 0 Government total 1 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 2 **Hydrologist Summary** Pia Mill is a small reservoir that takes a relatively long time (1.5 hours) to empty. For the most part the flood stays in a single channel all the way from the dam to the ocean. Maximum water velocities are about 3-3.5 feet per second where the flood crosses Koloa Rd. (right above Koloa Village) and about 5-6 feet per second along Poipu Road.			KA-0115	HI00115

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00116 MAU RESERVOIR **Inundation Area (acres):** 85 **Population at Risk:** 48 **Total Parcels Affected:** 35 **Total Land Value:** $10,825,700 **Total Building Value:** $4,395,700 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 0 **Hydrologist Summary** Mau Reservoir is a very small reservoir that takes 20 minutes to drain. After the dam breaches the resulting flood will flow into first Maui and then Ipuolono Reservoirs. The modeling scenario assumes that the flood passes through these reservoirs without causing them to break. The floodwater remains within Kahaleo Gulch the entire three miles from the dam to the ocean. Maximum water velocities at Highway 50 near Kalāheo are about 7 feet per second, which is very hazardous. Five minutes elapse between the time between when the dam begins to break and when the floodwaters reach Highway 50.	No. 4 Reservoir		KA-0116	HI00116

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00117 ELUA RESERVOIR **Inundation Area (acres):** 115 **Population at Risk:** 95 **Total Parcels Affected:** 72 **Total Land Value:** $21,175,500 **Total Building Value:** $7,023,100 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 1 **Hydrologist Summary** This small reservoir that takes 40 minutes to drain. After the dam breaches the resulting flood will flow across Highway 50 and into Ipuolono Reservoir, which is assumed to fail through overtopping. The floodwaters remain within Kahaleo Gulch the entire three miles to the ocean. Maximum water velocities at Highway 50 near Kalāheo are about 15 feet per second, which is extremely hazardous. Five minutes elapse between the time between when the dam begins to break and when the floodwaters reach Highway 50.	No. 2 Reservoir		KA-0117	HI00117

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00118 MANUHONUHONU RESERVOIR **Inundation Area (acres):** 124 **Population at Risk:** 21 **Total Parcels Affected:** 24 **Total Land Value:** $131,367,200 **Total Building Value:** $45,949,200 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 1 **Hydrologist Summary** This is a very small reservoir that empties in about 30 minutes. Initially the flood flows down a small narrow valley, but as it approaches the coastline it spreads out to about 1/2 mile wide. Near the coast the flood is very shallow (less than a foot) with velocities less than about 1.5 feet per second. About halfway from the dam to the ocean is a private road (as shown on some maps, anyway). At this road the flood is narrow (about 500 feet), about 3 feet deep, and has hazardous velocities (up to six feet per second).			KA-0118	HI00118

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00119 MAUKA RESERVOIR **Inundation Area (acres):** 466 **Population at Risk:** 855 **Total Parcels Affected:** 413 **Total Land Value:** $304,572,900 **Total Building Value:** $121,244,600 **Total Number of Critical Facilities Affected:** Total number affected 4 School total 1 Hospital total 0 Fire Station total 1 Police total 0 Government total 2 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 1 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 8 **Hydrologist Summary** Mauka is a small to medium sized reservoir that empties slowly (three hours) because the reservoir is very shallow. The flood flows down the Waihohonu Stream valley, Draft: June 30, 2008 University of Hawaii-PDC: DLNR–Phase I 320 passing through the middle of Koloa Town prior to entering the ocean at Koloa Ramp. The flood is confined to a narrow valley (gulch) for nearly the entire distance. It does, however, spread out slightly to a width of 1/4 mile in Koloa Town, and floods the coast for 1/4-mile northwest of Koloa Ramp. Maximum water velocities are about 3.5 feet per second at the upper end of Koloa (where it crosses the Cane Haul Road) and 7 feet per second where it crosses Poipu Road just above Koloa Ramp. Even higher velocities are encountered at Koloa Ramp.			KA-0119	HI00119

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HI00120 PAPUAA RESERVOIR **Inundation Area (acres):** 388 **Population at Risk:** 10 **Total Parcels Affected:** 33 **Total Land Value:** $8,146,900 **Total Building Value:** $1,695,600 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 2 **Hydrologist Summary** This is a medium-sized reservoir that empties in about one hour. The flood flow is confined to the narrow Huleia valley all the way from the dam to the estuary than empties into Nawiliwili Bay (a distance of about six miles). This results in deep, swift flood waters. The inundated area is about 200-600 feet wide. In the last mile before the estuary, predicted water velocities are typically 8 feet per second, but can be up to 20 feet per second.			KA-0120	HI00120

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HALENANAHU RESERVOIR **Inundation Area (acres):** 263 **Population at Risk:** 2 **Total Parcels Affected:** 28 **Total Land Value:** $6,048,200 **Total Building Value:** $1,554,700 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 2 Hydrologist's Significant Observations and Comments This is a medium-sized reservoir that empties in under an hour. Intitially, the flood spreads out until it is almost 1/3 mile wide. The Kaumualii Highway is immediately below the dam; maximum water velocities over the highway will be about 12 feet per second. Below the highway, the flood enters the Huleia Stream channel. Once in the Huleia Stream channel, the flood travels through a narrow valley all the way to the ocean (or more precisely, to the Huleia Stream estuary). The flood enters the estuary above Alakoko Fishpond. While in the narrow valley, the flood is very deep and swift.			KA-0121	HI00121

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
KAUAI LAGOONS **Inundation Area (acres):** 7.07 **Population at Risk:** 1 **Total Parcels Affected:** 6 **Total Land Value:** $74,834,400 **Total Building Value:** $23,332,183 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 0 Length of Roads (miles) 0 **Hydrologist Summary** This is a medium-sized reservoir that, when breached, takes over two hours to empty. The dam is only 0.3 miles from the ocean; however, floodwaters reach the ocean within 5 minutes of when the dam begins to break. The area south-east of the dam is flooded to a depth of 2-3 feet and experiences very high water velocities (up to 20 feet per second). South-west of the dam there is an area that is flooded to a depth of 6 inches with water velocities up to 5 feet per second. According to a Dam Safety Unit Engineer with the State DLNR Engineering Division, the hazard report used to assess the impacts of the dam failing was run for a break on one side of the lake and did not cover much area. There is concern that if another part of the embankment were to break, there would be greater impacts.	Kauai Lagoons Resorts		KA-0145	HI00145

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
HALAULA RESERVOIR **Inundation Area (acres):** 126.5 **Population at Risk:** 7 **Total Parcels Affected:** 23 **Total Land Value:** $6,587,800 **Total Building Value:** $1,479,800 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 0.7 **Hydrologist Summary** Halaula is a small reservoir that empties within 24 minutes of the time that the dam begins to fail. At first, the flood flows at a very high rate of speed (more than 10 feet per second) down a stream valley. About half a mile below the dam the stream valley opens onto a flat coastal plain. As the water travels across this plain it slows to about 1 foot per second and spreads out until it is about 1 foot deep. According to the model, floodwaters reach the town of Kealia and Highway 56 (Kuhio Highway), but do not cross the highway. Instead, the floodwaters drain southwest into the estuary of Kapaa Stream. Upstream portions of the Kapaa Estuary are backflooded. About 45 minutes elapse between the beginning of the dam break and the time that the flood reaches either Kealia or the estuary. According to the DEM, the slope within the Kapaa Stream Estuary is inland (from the point where the flood enters the estuary). The flood, therefore, back floods the estuary in the mauka direction before eventually reversing direction and flowing towards the ocean. The DEM may or may not be accurate about the slope of the bottom of the estuary. If the slope is downhill in a makai direction, then the flood will arrive at the ocean sooner than is depicted in the simulation.			KA-0146	HI00146

Dam No./Name/Details	Additional Notes	Hazard Potential	State ID	National ID
POND NO. 1 AT KAUAI RANCH **Inundation Area (acres):** 145 **Population at Risk:** 3 **Total Parcels Affected:** 46 **Total Land Value:** $17,751,500.00 **Total Building Value:** $8,533,000.00 **Total Number of Critical Facilities Affected:** Total number affected 0 School total 0 Hospital total 0 Fire Station total 0 Police total 0 Government total 0 Airports and Seaports total 0 Emergency Operation Centers affected (total number): 0 Shelters affected (total number): 0 *Infrastructure Affected:* Number of Bridges 1 Length of Roads (miles) 0.80 **Hydrologist Summary** The model scenario is based on scenario parameters defined for Phase 1 of the DLNR Dam Inundation Mapping Project. This model run was not reviewed by a hydrologist.	CORNERSTONE MAUKA		KA-0155	HI00155
PINAU RESERVOIR According to a Dam Safety Unit Engineer with the State DLNR Engineering Division, there is not currently an assessment report for Pinau Dam. The hazard area for this dam is completely within the Piwai area	LITTLE SMITH BIG SMITH RESERVOIR	No. 22- No inundation	KA-0158	HI00158

County of Kaua‘i Multi-Hazard Mitigation and Resilience Plan

Appendix K. Detailed Vulnerability Assessment Results

K. DETAILED VULNERABILITY ASSESSMENT RESULTS

BACKGROUND

The results in this appendix were produced using the Federal Emergency Management Agency's (FEMA's) Hazus software or through a non-Hazus geographic information system (GIS) analysis. Hazus was used for the vulnerability assessment for the following hazards: Tropical Cyclones and Other High Winds, Inland Flooding, Coastal Flood, Dam Failure, Tsunami, Landslide, Earthquake, and the Coastal Flood component of the High Surf, Coastal Flood, Erosion, and Sea Level Rise hazard. GIS analysis was used for the vulnerability assessment for Wildfire and Landslide hazard as well as for High Surf, Erosion, and Sea Level Rise (the remaining components of the High Surf, Coastal Flood, Erosion, and Sea Level Rise hazard). The Heat and Drought hazards were not assessed qualitatively. Due to the different methods of assessing vulnerability between hazards, the hazards analyzed using GIS used different building and population datasets than those used for the hazards analyzed using Hazus.

It is important to note that all data presented in this section are estimates. Additionally, the models used to predict population and buildings exposed to a hazard; population displaced or needing shelter; and structure and content loss estimates all assume that the hazard occurred across the entire exposed area. However, this would be unlikely to occur for most hazards. For instance, many areas throughout the planning area experience medium or high risk from wildfires. The estimates in this appendix were calculated as though every area with medium or high risk experienced wildfires at the same time, which would be unlikely to occur in actuality and overestimates the damage of a single wildfire event. This represents a limitation in current modeling capabilities for hazard events.

Data Sources for Hazards Analyzed Using GIS

Data for the vulnerability assessments for the Wildfire, Landslide, High Surf, Erosion, and Sea Level Rise hazards (those analyzed using GIS) came from the following sources:

- **Total number of buildings, residential buildings, and building and content values:** Kauaʻi building stock data provided by the County of Kauaʻi (County). For the 2021 Multi-Hazard Mitigation Resilience Plan (MHMRP) Update, replacement cost values derived from tax assessor parcel and residential and commercial building data for Kauaʻi County were input into Hazus. The resulting layer was provided by the County for this 2026 MHMRP Update and was used to calculate the count of buildings and their replacement and content costs exposed to each hazard by occupancy class. These values differed from those used in the Hazus analyses and had lower estimated total values of structures and contents. This is a limitation in the analyses between the Hazus and non-Hazus analyzed hazards.
- **Estimated average population per household:** 2023 American Community Survey (ACS) 1-year estimates (U.S. Census Bureau 2025b)
- **Estimated population exposed:** Number of exposed residential buildings multiplied by the average household size and a correction factor. The correction factor adjusts all district population amounts so that the sum will be equivalent to the 2023 ACS 1-year estimate for the entire county.

Table K-1 shows a county-wide summary of the data by planning district. These data were used as inputs to assess the population and buildings exposed to hazards. The data were also used to calculate the percentage of the exposed population and the percentage of the total value damaged relative to county totals. These hazards could not be analyzed in Hazus, which meant only the exposed population and exposed structure and content values could be calculated for them. All hazard-specific data used to determine hazard exposure zones are included in Appendix H, Risk Assessment Methodology.

Table K-1. Kauaʻi County Population, Buildings, and Building Values by Planning District

District	Total Number of Buildings	Total Building Value (structure and contents in $)	Total Number of Residential Buildings	Estimated Average Population per Household	Correction Factor	Estimated Population
East Kauaʻi	9,381	$3,687,342,673	9,080	3.46	0.6465	20,311
Hanapēpē - Eleʻele	1,899	$890,307,898	1,760	3.46	0.6465	3,937
Kōloa -Poʻipū- Kalāheo	8,123	$4,383,192,487	7,800	3.46	0.6465	17,447
Līhuʻe	7,320	$6,484,552,718	6,396	3.46	0.6465	14,307
North Shore	5,795	$4,103,681,163	5,587	3.46	0.6465	12,497
Waimea	2,187	$853,099,377	2,068	3.46	0.6465	4,626
Total	34,705	$20,402,176,316	32,691	3.46	0.6465	73,125

Data Sources for Hazards Analyzed Using Hazus

Data for the vulnerability assessments for the Tropical Cyclones and Other High Winds, Inland Flooding, Coastal Flood, Tsunami, Dam Failure, and Earthquake hazards (those analyzed using Hazus) came from the following sources:

- Total number of buildings, residential buildings, and building and content values: Hazus general building stock
- Estimated population exposed: Hazus demographic data drawn from the 2020 U.S. Census (FEMA 2025a)
- Estimated population displaced and requiring shelter: Based on Hazus calculation using demographic data from the 2020 U.S. Census and hazard exposure areas
- Debris: Based on Hazus analysis

WILDFIRE

Table K-2 through Table K-5 present results by planning district for communities at risk of wildfire as well as the number of structures at risk.

Table K-2. Estimated Exposure for Communities at Risk of Wildfire – High Risk Level Rating

District	Estimated Buildings Exposed	Estimated Average Population per Household	Correction Factor	Estimated Population Exposed	% of Population Exposed	Value of Exposed Structures ($)	Value of Exposed Contents ($)	Total Value (structures + contents) Exposed ($)	% of Total Value
East Kaua‘i	6,903	3.46	0.6465	15,441	21.1%	1,776,252,900.53	1,069,968,057.28	2,846,220,957.81	77.2%
Hanapēpē - Ele‘ele	1,795	3.46	0.6465	4,015	5.5%	404,009,600.52	266,790,668.16	670,800,268.68	75.3%
Kōloa -Po‘ipū- Kalāheo	5,501	3.46	0.6465	12,305	16.8%	1,840,766,390.20	1,066,325,869.19	2,907,092,259.39	66.3%
Līhu‘e	4,089	3.46	0.6465	9,146	12.5%	2,643,627,218.25	2,105,612,796.55	4,749,240,014.79	73.2%
North Shore	75	3.46	0.6465	168	0.2%	20,717,809.80	10,979,318.72	31,697,128.52	0.8%
Waimea	1,982	3.46	0.6465	4,433	6.1%	445,915,963.02	282,795,382.45	728,711,345.47	85.4%
Total	**20,345**	**3.46**	**0.6465**	**45,509**	**62.2%**	**7,131,289,882**	**4,802,472,092**	**11,933,761,974.66**	**58.5%**

Table K-3. Estimated Exposure for Communities at Risk of Wildfire – Medium Risk Level Rating

District	Estimated Buildings Exposed	Estimated Average Population per Household	Correction Factor	Estimated Population Exposed	% of Population Exposed	Value of Exposed Structure in $	Value of Exposed Contents in $	Total Value (Structures + Contents) Exposed in $	% of Total Value
East Kaua‘i	2,284	3.46	0.6465	5,109	7.0%	510,451,557.06	256,145,276.31	766,596,833.38	20.8%
Hanapēpē - Ele‘ele	0	3.46	0.6465	-	0.0%	0	0	0	N/A
Kōloa -Po‘ipū- Kalāheo	705	3.46	0.6465	1,577	2.2%	151,000,984.95	86,595,393.94	237,596,378.89	5.4%
Līhu‘e	987	3.46	0.6465	2,208	3.0%	261,825,309.99	137,608,821.52	399,434,131.51	6.2%
North Shore	0	3.46	0.6465	-	0.0%	0	0	0	N/A
Waimea	0	3.46	0.6465	-	0.0%	0	0	0	N/A
Total	**3,976**	**3.46**	**0.6465**	**8,894**	**12.2%**	**923,277,852**	**480,349,492**	**1,403,627,343.77**	**6.9%**

Table K-4. Number of Structures in Risk Rating Level High

District	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
East Kauaʻi	6,615	236	40	0	9	0	3	6,903
Hanapēpē - Eleʻele	1,689	88	14	0	4	0	0	1,795
Kōloa -Poʻipū- Kalāheo	5,313	161	15	2	10	0	0	5,501
Līhuʻe	3,496	446	132	0	14	0	1	4,089
North Shore	73	0	0	0	0	0	2	75
Waimea	1,885	69	22	0	5	0	1	1,982
Total	**19,071**	**1,000**	**223**	**2**	**42**	**0**	**7**	**20,345**

Table K-5. Number of Structures in Risk Rating Level Medium

District	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
East Kauaʻi	2,279	5	0	0	0	0	0	2,284
Hanapēpē - Eleʻele	0	0	0	0	0	0	0	N/A
Kōloa -Poʻipū- Kalāheo	682	12	11	0	0	0	0	N/A
Līhuʻe	961	19	6	0	1	0	0	705
North Shore	0	0	0	0	0	0	0	987
Waimea	0	0	0	0	0	0	0	N/A
Total	**3,922**	**36**	**17**	**0**	**0**	**0**	**0**	**3,976**

TROPICAL CYCLONES AND OTHER HIGH WINDS

Hurricane Wind

Table K-6 and Table K-7 present results by planning district for a Category 4 hurricane.

Table K-6. Estimated Building Exposure, Economic Loss, and Debris Generation, Category 4 Hurricane Wind

District	Debris (Tons) Estimate	Estimated Buildings Exposed	Estimated Value of Buildings Exposed in $1,000	Estimated Building Loss to Structures in $1,000	Estimated Content Loss to Structures in $1,000	Estimated Total Value (Structures + Contents) Damaged in $1,000	% of Total Value
East Kauaʻi	238,966	7,630	5,379,897	1,298,171	626,738	1,924,909	35.8%
Hanapēpē - Eleʻele	57,016	983	511,507	130,289	60,827	191,116	37.4%
Kōloa -Poʻipū- Kalāheo	167,951	5,216	4,836,386	1,290,154	619,998	1,910,152	39.5%
Līhuʻe	241,950	4,991	7,408,818	1,488,066	815,320	2,303,386	31.1%
North Shore	246,926	4,052	3,455,784	735,568	350,363	1,085,931	31.4%
Waimea	321,865	3,630	3,010,291	580,669	353,460	934,128	31.0%
Total	**1,274,674**	**26,502**	**24,602,683**	**5,522,917**	**2,826,705**	**8,349,623**	**33.9%**

Table K-7. Estimated Effects to Population, Category 4 Hurricane Wind

District	Estimated Population Exposed	% of Population Exposed	Estimated Displaced Population	Estimated Population Requiring Short-Term Shelter
East Kauaʻi	22,935	100%	3,457	6,804
Hanapēpē - Eleʻele	5,952	100%	386	745
Kōloa -Poʻipū- Kalāheo	12,962	100%	2,421	3,955
Līhuʻe	16,858	100%	2,695	5,087
North Shore	8,073	100%	1,176	1,337
Waimea	6,272	100%	1,243	2,805
Total	**73,052**	**100%**	**11,378**	**20,733**

Hurricane Storm Surge

Table K-8 through Table K-10 present results by planning district for storm surge resulting from a Category 4 hurricane.

Table K-8. Estimated Building Exposure, Economic Loss, and Debris Generation, Category 4 Hurricane Storm Surge

District	Debris Estimated (Tons)	Estimated Buildings Exposed	Estimated Value of Buildings Exposed in $1,000	Estimated Building Loss to Structures in $1,000	Estimated Content Loss to Structures in $1,000	Estimated Total Value (Structures + Contents) Damaged in $1,000	% of Total Value
East Kaua‘i	11,621.3	2,473	$2,425,072	127,843	206,755	334,598	6.2%
Hanapēpē - Ele‘ele	1,479.1	730	$673,728	19,368	29,423	48,791	9.5%
Kōloa -Po‘ipū- Kalāheo	766.3	482	$1,585,321	7,524	10,265	17,789	0.4%
Līhu‘e	3,918.8	1,121	$1,794,608	28,872	40,213	69,085	0.9%
North Shore	1,494.8	2,197	$2,116,633	18,387	14,248	32,635	0.9%
Waimea	4,267.5	1,796	$1,733,213	59,398	60,954	120,352	4.0%
Total	**23,547.8**	**8,799**	**$10,328,575**	**261,392**	**361,858**	**623,250**	**2.5%**

Table K-9. Estimated Effects to Population Resulting from a Category 4 Hurricane Storm Surge

District	Estimated Population Exposed	% of Population Exposed	Estimated Displaced Population	Estimated Population Requiring Short-Term Shelter
East Kaua‘i	5,992	26.1%	1,822	304
Hanapēpē - Ele‘ele	1,679	28.2%	512	37
Kōloa -Po‘ipū- Kalāheo	429	3.3%	25	4
Līhu‘e	3,372	20.0%	296	82
North Shore	3,689	45.7%	344	66
Waimea	4,741	75.6%	3,049	251
Total	**19,902**	**27.2%**	**6,048**	**744**

Table K-10. Number of Structures in Storm Surge Inundation Area

District	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
East Kaua‘i	2,088	311	33	4	15	18	4	2,473
Hanapēpē - Ele‘ele	585	96	13	3	9	23	1	730
Kōloa -Po‘ipū- Kalāheo	400	72	4	2	2	-	2	482
Līhu‘e	933	146	16	2	7	15	2	1,121
North Shore	2,032	131	11	2	3	14	4	2,197
Waimea	1,564	91	11	1	26	96	7	1,796
Total	**7,602**	**847**	**88**	**14**	**62**	**166**	**20**	**8,799**

TSUNAMI

Table K-11 and Table K-12 present results by planning district for the Tsunami hazard.

Table K-11. Estimated Population Exposed, Building Impacts, and Economic Loss, Tsunami Inundation Area

Jurisdiction	Estimated Population Exposed	% of Population Exposed	Estimated Buildings Impacted	Total Value of Structures Impacted in $1,000	Estimated Building Loss to Structures in $1,000	Estimated Content Loss to Structures in $1,000	Estimated Total Value (Structures + Contents) Damaged in $1,000	% of Total Value
East Kaua‘i	6,174	26.9%	2,488	2,599,979	864,018	649,622	1,513,641	28.1%
Hanapēpē - Ele‘ele	1,245	20.9%	578	583,851	101,306	88,426	189,732	37.1%
Kōloa -Po‘ipū-Kalāheo	471	3.6%	588	1,800,500	165,518	98,545	264,063	5.5%
Līhu‘e	4,039	24.0%	1,279	1,888,095	227,044	154,000	381,043	5.1%
North Shore	3,842	47.6%	2,264	2,158,425	467,555	282,806	750,361	21.7%
Waimea	4,969	79.2%	2,111	2,079,291	577,978	422,776	1,000,754	33.2%
Total	**20,740**	**28.4%**	**9,308**	**11,110,142**	**2,403,418**	**1,696,175**	**4,099,593**	**16.7%**

Note: Hazus does not estimate debris or shelter requirements for tsunamis; therefore, the population and building results are reported together in the table. Hazus also assumes all buildings exposed to the Tsunami hazard will be at least partially damaged due to the force associated with the hazard, which is why “buildings impacted” is reported instead of "buildings exposed”.

Table K-12. Number of Structures in Hazard Area

District	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
East Kaua‘i	2,095	314	33	4	16	20	6	2,488
Hanapēpē - Ele‘ele	440	91	12	3	9	22	1	578
Kōloa -Po‘ipū-Kalāheo	501	77	4	2	2	-	2	588
Līhu‘e	1,089	142	14	2	7	23	2	1,279
North Shore	2,095	135	11	2	3	14	4	2,264
Waimea	1,733	95	11	1	26	238	7	2,111
Total	**7,953**	**854**	**85**	**14**	**63**	**317**	**22**	**9,308**

LANDSLIDE

Table K-13 through Table K-16 present results by planning district for the Landslide hazard for the Moderate to Highest susceptibility zones.

Table K-13. Estimated Landslide Exposure to Landslide Hazard – High to Highest Susceptibility Zones

District	Estimated Buildings Exposed	Estimated average population per household	Correction Factor	Estimated Population Exposed	% of Population Exposed	Value of Exposed Structures in $	Value of Exposed Contents in $	Total Value (Structures + Contents) Exposed in $	% of Total Value
East Kaua'i	1,271	3.46	0.6465	2,843	3.9%	278,516,576.30	139,402,042.80	417,918,619.10	11.3%
Hanapēpē -Ele'ele	166	3.46	0.6465	371	0.5%	39,221,722.74	21,510,881.43	60,732,604.17	6.8%
Kōloa - Po'ipū-Kalāheo	1,165	3.46	0.6465	2,606	3.6%	292,156,808.10	151,716,160.00	443,872,968.10	10.1%
Līhu'e	306	3.46	0.6465	684	0.9%	162,678,541.30	152,738,506.80	315,417,048.10	4.9%
North Shore	937	3.46	0.6465	2,096	2.9%	1,109,157,078.00	613,511,770.80	1,722,668,848.80	42.0%
Waimea	98	3.46	0.6465	219	0.3%	14,706,507.41	8,078,670.14	22,785,177.55	2.7%
Total	**3,943**	**3.46**	**0.6465**	**8,820**	**12.1%**	**1,896,437,234**	**1,086,958,032**	**2,983,395,265.82**	**14.6%**

Table K-14. Estimated Exposure to Landslide Hazard – Moderate Susceptibility Zone (20%–40% slope)

District	Estimated Buildings Exposed	Estimated average population per household	Correction Factor	Estimated Population Exposed	% of Population Exposed	Value of Structure in $ Exposed	Value of Exposed Contents in $	Total Value (Structures + Contents) Exposed in $	% of Total Value
East Kaua'i	1004	3.46	0.6465	2,246	3.1%	234,202,010.60	138,200,155.70	372,402,166.30	10.1%
Hanapēpē -Ele'ele	226	3.46	0.6465	506	0.7%	40162968.84	22722804.82	62,885,773.66	7.1%
Kōloa-Po'ipū-Kalāheo	770	3.46	0.6465	1,722	2.4%	182,403,828.40	97,474,665.68	279,878,494.08	6.4%
Līhu'e	828	3.46	0.6465	1,852	2.5%	794,631,423.60	431,414,905.50	1,226,046,329.10	18.9%
North Shore	625	3.46	0.6465	1,398	1.9%	409765054.5	216048553.6	625,813,608.10	15.3%

District	Estimated Buildings Exposed	Estimated average population per household	Correction Factor	Estimated Population Exposed	% of Population Exposed	Value of Structure in $ Exposed	Value of Exposed Contents in $	Total Value (Structures + Contents) Exposed in $	% of Total Value
Waimea	75	3.46	0.6465	168	0.2%	14354289.27	8045493.027	22,399,782.30	2.6%
Total	**3,528**	**3.46**	**0.6465**	**7,892**	**10.8%**	**1,675,519,575**	**913,906,578**	**2,589,426,153.54**	**12.7%**

Table K-15. Number of Structures – High Susceptibility Zone

District	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
East Kaua'i	1,270	0	0	0	1	0	0	1,271
Hanapēpē - Ele'ele	158	7	1	0	0	0	0	166
Kōloa-Po'ipū-Kalāheo	1,152	4	9	0	0	0	0	1,165
Līhu'e	236	46	24	0	0	0	0	306
North Shore	67	10	8	0	8	0	1	94
Waimea	96	1	1	0	0	0	0	98
Total	**2,979**	**68**	**43**	**-**	**9**	**-**	**1**	**3,100**

Table K-16. Number of Structures – Moderate Susceptibility Zone

District	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
East Kaua'i	986	14	3	0	1	0	0	1,004
Hanapēpē - Ele'ele	212	13	0	0	1	0	0	226
Kōloa-Po'ipū-Kalāheo	759	8	3	0	0	0	0	770
Līhu'e	759	49	20	0	0	0	0	828
North Shore	606	16	1	0	0	0	2	625
Waimea	72	2	1	0	0	0	0	75
Total	**3,394**	**102**	**28**	**-**	**2**	**-**	**2**	**3,528**

DROUGHT

Drought impacts were not calculated quantitatively. No modeling is currently available to anticipate the losses experienced by various drought events. A qualitative vulnerability assessment for the Drought hazard can be found in Section 9.2.

INLAND FLOODING

Table K-17 through Table K-22 present results by planning district for the 1% and 0.2% annual chance flood event.

Table K-17. Estimated Building Exposure, Economic Loss, and Debris Generation, 1% Annual Chance Inland (Riverine) Flood Zone

District	Debris Estimated (Tons)	Estimated Buildings Exposed	Estimated Value of Buildings Exposed in $1,000	Estimated Building Loss to Structures in $1,000	Estimated Content Loss to Structures in $1,000	Estimated Total Value (Structures + Contents) Damaged in $1,000	% of Total Value
East Kauaʻi	592.1	3,808	2,987,062	9,373	8,902	18,275	0.3%
Hanapēpē - Eleʻele	608.6	762	710,655	4,117	5,391	9,508	1.9%
Kōloa -Poʻipū-Kalāheo	634.0	2,474	3,130,022	9,414	12,674	22,088	0.5%
Līhuʻe	395.8	1,404	1,790,906	6,019	8,389	14,408	0.2%
North Shore	1,028.9	1,638	1,421,767	6,358	5,046	11,404	0.3%
Waimea	1,382.1	2,124	2,043,199	12,163	12,139	24,302	0.8%
Total	**4,641.5**	**12,210**	**12,083,611**	**47,444**	**52,541**	**99,985**	**0.4%**

Table K-18. Estimated Population Exposure, Population Displaced, and Population Requiring Shelter, 1% Annual Chance Inland (Riverine) Flood Zone

District	Estimated Population Exposed	% of Population Exposed	Estimated Displaced Population	Estimated Population Requiring Short-Term Shelter
East Kauaʻi	10,216	44.5%	1,077	374
Hanapēpē - Eleʻele	1,719	28.9%	621	55
Kōloa -Poʻipū- Kalāheo	5,302	40.9%	612	111
Līhuʻe	4,396	26.1%	476	128
North Shore	2,668	33.0%	605	63
Waimea	5,235	83.5%	3,233	279
Total	**10,216**	**40.4%**	**6,624**	**1,010**

Table K-19. Estimated Building Exposure, Economic Loss, and Debris Generation, 0.2% Annual Chance Inland (Riverine) Flood

District	Debris Estimated (Tons)	Estimated Buildings Exposed	Estimated Value of Buildings Exposed in $1,000	Estimated Building Loss to Structures in $1,000	Estimated Content Loss to Structures in $1,000	Estimated Total Value (Structures + Contents) Damaged in $1,000	% of Total Value
East Kaua'i	1,428.1	3,906	$3,061,832	16,851	16,800	33,651	0.6%
Hanapēpē - Ele'ele	884.1	766	$738,739	6,020	8,291	14,311	2.8%
Kōloa -Po'ipū- Kalāheo	727.9	2,626	$3,270,606	8,889	11,274	20,163	0.4%
Līhu'e	655.8	1,404	$1,790,906	7,005	9,549	16,554	0.2%
North Shore	1,336.1	1,638	$1,421,767	8,689	8,202	16,891	0.5%
Waimea	1,976.5	2,257	$2,146,964	15,683	17,185	32,868	1.1%
Total	**7,008.5**	**12,597**	**$12,430,814**	**63,137**	**71,301**	**134,438**	**0.5%**

Table K-20. Estimated Population Exposure, Population Displaced, and Population Requiring Shelter, 0.2% Chance Inland (Riverine) Flood Zone

District	Estimated Population Exposed	% of Population Exposed	Estimated Displaced Population	Estimated Population Requiring Short-Term Shelter
East Kaua'i	10,713	46.7%	1,546	425
Hanapēpē - Ele'ele	1,723	28.9%	660	63
Kōloa -Po'ipū- Kalāheo	5,633	43.5%	802	124
Līhu'e	4,434	26.3%	490	129
North Shore	4,366	54.1%	755	63
Waimea	5,675	90.5%	3,860	249
Total	**32,544**	**44.5%**	**8,113**	**1,053**

Table K-21. Number of Structures in 1% Annual Chance Inland (Riverine) Flood Zone

District	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
East Kaua'i	3,404	313	49	7	11	17	7	3,808
Hanapēpē - Ele'ele	613	100	13	3	9	23	1	762
Kōloa -Po'ipū- Kalāheo	2,248	185	20	2	9	6	4	2,474
Līhu'e	1,198	156	15	2	11	20	2	1,404
North Shore	1,474	121	16	4	4	15	4	1,638
Waimea	1,762	87	11	1	18	238	7	2,124
Total	**10,699**	**962**	**124**	**19**	**62**	**319**	**25**	**12,210**

Table K-22. Number of Structures in 0.2% Annual Chance Inland (Riverine) Flood Zone

District	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
East Kauaʻi	3,490	323	50	7	12	17	7	3,906
Hanapēpē - Eleʻele	613	103	14	3	9	23	1	766
Kōloa -Poʻipū- Kalāheo	2,375	206	22	2	10	6	5	2,626
Līhuʻe	1,198	156	15	2	11	20	2	1,404
North Shore	1,474	121	16	4	4	15	4	1,638
Waimea	1,875	98	12	1	26	238	7	2,257
Total	**11,025**	**1,007**	**129**	**19**	**72**	**319**	**26**	**12,597**

HIGH SURF, COASTAL FLOOD, EROSION, AND SEA LEVEL RISE

Coastal Flood

Table K-23 through Table K-26 present results by planning district for the 1% and 0.02% annual chance coastal flood.

Table K-23. Estimated Building Exposure, Economic Loss, and Debris Generation, 1% Annual Chance Coastal Flood

Jurisdiction	Debris Generated	Buildings Exposed	Value of Buildings Exposed in $1,000	Building Loss to Structures in $1,000	Content Loss to Structures in $1,000	Total Value (Structures + Contents) Damaged in $1,000	% of Total Value
East Kauaʻi	278.2	487	838,940	3,414	2,865	6,279	0.1%
Hanapēpē - Eleʻele	19.2	205	234,093	309	639	948	0.2%
Kōloa -Poʻipū- Kalāheo	372.6	518	1,621,821	6,577	7,787	14,364	0.3%
Līhuʻe	55.2	106	565,929	300	463	763	0.0%
North Shore	2,834.7	1,933	1,763,655	41,668	26,134	67,802	2.0%
Waimea	40.1	524	678,594	1,496	6,870	8,366	0.3%
Total	**3,600.0**	**3,773**	**5,703,032**	**53,764**	**44,758**	**98,522**	**0.4%**

Table K-24. Estimated Population Exposure, Population Displaced, and Population Requiring Shelter, 1% Annual Chance Coastal Flood

Jurisdiction	Estimated Population Exposed	% of Population Exposed	Estimated Displaced Population	Estimated Population Requiring Short-Term Shelter
East Kauaʻi	835	3.6%	103	24
Hanapēpē - Eleʻele	375	6.3%	23	9
Kōloa -Poʻipū- Kalāheo	388	3.0%	31	4

Jurisdiction	Estimated Population Exposed	% of Population Exposed	Estimated Displaced Population	Estimated Population Requiring Short-Term Shelter
Līhuʻe	88	0.5%	5	1
North Shore	3,350	41.5%	661	54
Waimea	514	8.2%	47	6
Total	**5,550**	**7.6%**	**870**	**98**

Table K-25. Estimated Building Exposure, Economic Loss, and Debris Generation, 0.2% Annual Chance Coastal Flood

Jurisdiction	Debris Generated	Buildings Exposed	Value of Buildings Exposed in $1,000	Building Loss to Structures in $1,000	Content Loss to Structures in $1,000	Total Value (Structures + Contents) Damaged in $1,000	% of Total Value
East Kauaʻi	278.2	487	838,940	3,414	2,865	6,279	0.1%
Hanapēpē - Eleʻele	19.2	205	234,093	309	639	948	0.2%
Kōloa -Poʻipū- Kalāheo	372.6	518	1,621,821	6,577	7,787	14,364	0.3%
Līhuʻe	55.2	106	565,929	300	463	763	0.0%
North Shore	2,834.7	1,933	1,763,655	41,668	26,134	67,802	2.0%
Waimea	40.1	524	678,594	1,496	6,870	8,366	0.3%
Total	**3,600.0**	**3,773**	**5,703,032**	**53,764**	**44,758**	**98,522**	**0.4%**

Table K-26. Estimated Population Exposure, Population Displaced, and Population Requiring Shelter, 0.2% Annual Chance Coastal Flood

Jurisdiction	Population Exposed	% of Population Exposed	Displaced Population	Population Requiring Short-Term Shelter
East Kauaʻi	835	3.6%	103	24
Hanapēpē - Eleʻele	375	6.3%	23	9
Kōloa -Poʻipū- Kalāheo	388	3.0%	31	4
Līhuʻe	88	0.5%	5	1
North Shore	3,350	41.5%	661	54
Waimea	514	8.2%	47	6
Total	**5,550**	**7.6%**	**870**	**98**

Sea Level Rise Exposure

Table K-27 and Table K-28 present results by planning district for structures exposed to sea level rise and future chronic coastal flood.

Table K-27. Estimated Exposure to SLR, Future Chronic Coastal Flood

Jurisdiction	Estimated Buildings Exposed	Estimated Average Population Per Household	Correction Factor	Estimated Population Exposed	% of Population Exposed	Value of Exposed Structures in $	Value of Exposed Contents in $	Total Value (Structures + Contents) Exposed in $	% of Total Value
East Kaua'i	444	3.46	0.6465	993	1.4%	118,830,740.00	85,457,777.72	204,288,517.72	5.5%
Hanapēpē - Ele'ele	103	3.46	0.6465	230	0.3%	16,906,891.81	9,080,977.37	25,987,869.18	2.9%
Kōloa -Po'ipū-Kalāheo	22	3.46	0.6465	49	0.1%	27,220,977.54	13,610,488.77	40,831,466.31	0.9%
Līhu'e	167	3.46	0.6465	374	0.5%	28,110,291.50	19,503,349.68	47,613,641.18	0.7%
North Shore	260	3.46	0.6465	582	0.8%	63,226,740.83	33,073,802.27	96,300,543.10	2.3%
Waimea	258	3.46	0.6465	577	0.8%	74,491,753.66	48,581,738.80	123,073,492.46	14.4%
Total	**1,254**	**3.46**	**0.6465**	**2,805**	**3.8%**	**328,787,395**	**209,308,135**	**538,095,529.95**	**2.6%**

Table K-28. Number of Structures in Hazard Area

District	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
East Kaua'i	410	26	8	0	0	0	0	444
Hanapēpē - Ele'ele	100	3	0	0	0	0	0	103
Kōloa -Po'ipū-Kalāheo	22	0	0	0	0	0	0	22
Līhu'e	152	14	0	0	1	0	0	167
North Shore	257	3	0	0	0	0	0	260
Waimea	234	23	1	0	0	0	0	258
Total	**1,175**	**69**	**9**	**–**	**1**	**–**	**–**	**1,254**

Sea Level Rise Exposure Combined with 1% Annual Chance Coastal Flood

The modeling used to assess the combined sea level rise and 1% annual chance coastal flood hazard has not been updated since the 2021 MHMRP Update. Additionally, the County's building data have not been updated with replacement and content cost. As such, an analysis was not rerun for the sea level rise exposure and 1% annual chance coastal flood zone were not reanalyzed; the results presented below are the same as those in the 2021 MHMRP Update. The data used in 2021 to update these sources came from values based on 2020 parcel and real property data provided by the County, the 1% annual chance coastal flood zone + 3.2-foot SLR from the 2017 *Hawaii Sea Level Rise Vulnerability and Adaptation Report* (Hawai'i Climate Change Mitigation and Adaptation Commission 2017), and the percent of residential buildings exposed multiplied by the estimated population from the 2015 Census Block groups with population figures from the ACS 5-year estimates (U.S. Census Bureau 2025b).

While the buildings exposed to this hazard were not updated, the population exposed to sea level rise combined with the 1% annual chance coastal flood was updated to reflect changes in population in the county over the past 5 years. Population estimates from the 2023 ACS were used for the update.

Table K-29 and Table K-30 present results by planning district for the populations and structures exposed to sea level rise combined with the 1% annual chance coastal flood.

Table K-29. Estimated Exposure to SLR, SLR Exposure Plus Event-Based Coastal Flood

Jurisdiction	Estimated Population Exposed	% of Population Exposed	Estimated Buildings Exposed	Value of Exposed Structures in $	Value of Exposed Contents in $	Total Value (Structures + Contents) Exposed in $	% of Total Value
East Kaua‘i	5,304	7.3%	2,371	903,151,793	602,005,428	1,505,157,220	40.85%
Hanapēpē - Ele‘ele	772	1.1%	345	103,463,253	90,140,841	193,604,093	21.75%
Kōloa -Po‘ipū-Kalāheo	2,957	4.0%	1,322	505,270,336	279,678,491	784,948,826	17.91%
Līhu‘e	3,700	5.1%	1,654	1,026,183,190	614,864,149	1,641,047,339	25.31%
North Shore	2,315	3.2%	1,035	303,205,956	174,294,114	477,500,071	11.64%
Waimea	3,923	5.4%	1,754	417,371,785	284,323,979	701,695,764	82.25%
Total	**18,971**	**25.9%**	**8,481**	**3,258,646,313**	**2,045,307,001**	**5,303,953,314**	**26.00%**

Table K-30. Number of Structures in Hazard Area

District	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
East Kaua‘i	2,068	226	32	0	7	0	3	2,336
Hanapēpē - Ele‘ele	262	73	8	0	2	0	0	345
Kōloa -Po‘ipū-Kalāheo	1,292	26	1	0	3	0	0	1,322
Līhu‘e	1,521	105	25	0	3	0	0	1,654
North Shore	990	33	13	0	1	0	0	1,037
Waimea	1,648	71	30	0	4	0	1	1,754
Total	**7,781**	**534**	**109**	**0**	**20**	**0**	**4**	**8,448**

DAM FAILURE

The data presented throughout this section includes the predicted exposure and vulnerabilities associated with all regulated high-hazard dams in the county in addition to two regulated low-hazard dams and one regulated undetermined dam that is almost certainly high hazard. More information about the specific vulnerabilities, impacts, and risk associated with each regulated dam in Kaua'i County can be found in Appendix J, Dam Risk Summaries. Table K-31 and Table K-32 present the effects to structures and populations exposed to the Dam Failure hazard.

Table K-31. Estimated Building Exposure, Economic Loss, and Debris Generation, Dam Failure

District	Debris Generated	Buildings Exposed	Value of Buildings Exposed in $1,000	Building Loss to Structures in $1,000	Content Loss to Structures in $1,000	Total Value (Structures + Contents) Damaged in $1,000	% of Total Value
East Kaua'i	104.6	1,442	1,242,539	2,558	2,249	4,807	0.1%
Hanapēpē - Ele'ele	166.4	642	486,288	3,794	3,530	7,324	1.4%
Kōloa -Po'ipū-Kalāheo	4,932.9	2,405	3,066,806	57,985	74,934	132,919	2.7%
Līhu'e	462.3	334	305,036	7,880	13,529	21,409	0.3%
North Shore	136.9	424	299,898	1,228	1,033	2,261	0.1%
Waimea	286.0	435	358,708	1,574	1,708	3,282	0.1%
Total	**6,089.1**	**5,682**	**5,759,275**	**75,019**	**96,983**	**172,002**	**0.7%**

Table K-32. Estimated Population Exposure, Population Displaced, and Population Requiring Shelter, Dam Failure

District	Estimated Population Exposed	% of Population Exposed	Estimated Displaced Population	Estimated Population Requiring Short-Term Shelter
East Kaua'i	3,689	16.1%	89	49
Hanapēpē - Ele'ele	1,671	28.1%	365	70
Kōloa -Po'ipū- Kalāheo	5,356	41.3%	2,150	209
Līhu'e	1,358	8.1%	114	43
North Shore	1,033	12.8%	50	38
Waimea	1,237	19.7%	331	46
Total	**14,344**	**19.6%**	**3,099**	**455**

HEAT

Heat impacts were not calculated quantitatively. No modeling is currently available to anticipate the losses experienced by various heat events. A qualitative vulnerability assessment for the Heat hazard can be found in Section 13.2.

EARTHQUAKE

Table K-33 and Table K-34 present the effects to structures and populations exposed to the Earthquake hazard.

Table K-33. Estimated Building Exposure, Economic Loss, and Debris Generation, 500-Year Probabilistic Earthquake

Jurisdiction	Debris Generated	Buildings Exposed	Value of Buildings Exposed in $1,000	Building Loss to Structures in $1,000	Content Loss to Structures in $1,000	Total Value (Structures + Contents) Damaged in $1,000	% of Total Value
East Kauaʻi	0.52	7,630	5,379,897	1,031	165	1,197	0.02%
Hanapēpē - Eleʻele	0.02	983	511,507	27	3	30	0.01%
Kōloa -Poʻipū-Kalāheo	0.63	5,216	4,836,386	1,138	164	1,302	0.03%
Līhuʻe	1.49	4,991	7,408,818	2,525	449	2,974	0.04%
North Shore	0.16	4,052	3,455,784	318	37	355	0.01%
Waimea	0.19	3,630	3,010,291	241	21	262	0.01%
Total	**3.01**	**26,502**	**24,602,683**	**5,281**	**839**	**6,120**	**0.02%**

Table K-34. Estimated Population Exposure, Population Displaced, and Population Requiring Shelter, 500-Year Probabilistic Earthquake

Jurisdiction	Estimated Population Exposed	% of Population Exposed	Estimated Displaced Population	Estimated Population Requiring Short-Term Shelter
East Kauaʻi	22,935	100%	0.23	0.13
Hanapēpē - Eleʻele	5,952	100%	0.00	0.00
Kōloa -Poʻipū- Kalāheo	12,962	100%	0.19	0.10
Līhuʻe	16,858	100%	0.49	0.27
North Shore	8,073	100%	0.03	0.01
Waimea	6,272	100%	0.06	0.04
Total	**22,935**	**100%**	**1**	**1**

County of Kaua‘i Multi-Hazard Mitigation and Resilience Plan

Appendix L. Roads in Mapped Hazard Areas

L. Roads in Mapped Hazard Areas

Only minor changes to the roads in the planning area occurred between the writing of the 2021 MHMRP Update and the 2026 MHMRP Update. As changes to the roads were not considered substantial, the roads exposed to each hazard were not reassessed for the 2026 MHMRP Update unless changes in hazard exposure occurred. The layers used to assess hazard exposure were only notably different for the dam failure and landslide hazards. For the Dam Failure hazard in the 2026 MHMRP Update, roads exposed to the inundation zones of all regulated dams in Kauaʻi, including 44 high-hazard dams, were assessed. This expanded the analysis done in the 2021 MHMRP Update of only three dams. For the Landslide hazard, a new layer from the USGS was used to assess hazard exposure. While changes to the roads in the planning area were considered to be minor, changes did still occur. Due to this, the total major and other roads listed for each jurisdiction differ for the Landslide and Dam Failure hazards compared to the totals for all other hazards. Table L-1 through Table L-26 present the number of road miles and percent of total road miles in each hazard area for each jurisdiction.

WILDFIRE COMMUNITIES AT RISK

High Risk

Table L-1. Major Roads: Wildfire (high risk)

Jurisdiction	Major Road Miles in Hazard Area	Total Major Road Miles in Jurisdiction	% of Total Major Roads
East Kaua'i.02	13.4	23.8	56.2%
Hanapēpē-'Ele'ele	2.8	7.2	38.7%
Kōloa-Po'ipū-Kalāheo	6.2	20.7	30.0%
Līhu'e	11.3	23.1	49.0%
North Shore	0.8	21.0	3.9%
Waimea	8.6	29.8	28.8%
Total	**43.1**	**125.5**	**34.3%**

Table L-2. Other Roads: Wildfire (high risk)

Jurisdiction	Other Road Miles in Hazard Area	Total Other Road Miles in Jurisdiction	% of Total Other Roads
East Kaua'i	77.6	113.7	68.3%
Hanapēpē-'Ele'ele	22.0	26.2	83.7%
Kōloa-Po'ipū-Kalāheo	38.4	94.7	40.5%
Līhu'e	40.4	91.5	44.2%
North Shore	0.8	67.4	1.3%
Waimea	58.7	145.6	40.3%
Total	**238.0**	**539.1**	**44.1%**

Medium Risk

Table L-3. Major Roads: Wildfire (medium risk)

Jurisdiction	Major Road Miles in Hazard Area	Total Major Road Miles in Jurisdiction	% of Total Major Roads
East Kauaʻi	3.6	23.8	15.3%
Hanapēpē-ʻEleʻele	0.0	7.2	0.0%
Kōloa-Poʻipū-Kalāheo	0.9	20.7	4.2%
Līhuʻe	1.3	23.1	5.6%
North Shore	0.0	21.0	0.0%
Waimea	0.0	29.8	0.0%
Total	**5.8**	**125.5**	**4.6%**

Table L-4. Other Roads: Wildfire (medium risk)

Jurisdiction	Other Road Miles in Hazard Area	Total Other Road Miles in Jurisdiction	% of Total Other Roads
East Kauaʻi	23.4	113.7	20.6%
Hanapēpē-ʻEleʻele	0.0	26.2	0.0%
Kōloa-Poʻipū-Kalāheo	10.4	94.7	11.0%
Līhuʻe	9.8	91.5	10.7%
North Shore	0.0	67.4	0.0%
Waimea	0.0	145.6	0.0%
Total	**43.6**	**539.1**	**8.1%**

HURRICANE STORM SURGE CATEGORY 4

Table L-5. Major Roads: Category 4 Hurricane Storm Surge

Jurisdiction	Major Road Miles in Hazard Area	Total Major Road Miles in Jurisdiction	% of Total Major Roads
East Kauaʻi	4.6	23.8	19.6%
Hanapēpē-ʻEleʻele	0.5	7.2	6.6%
Kōloa-Poʻipū-Kalāheo	0.0	20.7	0.0%
Līhuʻe	1.6	23.1	6.8%
North Shore	2.3	21.0	11.1%
Waimea	8.5	29.8	28.5%
Total	**17.5**	**125.5**	**14.0%**

Table L-6. Other Roads: Category 4 Hurricane Storm Surge

Jurisdiction	Other Road Miles in Hazard Area	Total Other Road Miles in Jurisdiction	% of Total Other Roads
East Kauaʻi	10.7	113.7	9.4%
Hanapēpē-ʻEleʻele	3.5	26.2	13.2%
Kōloa-Poʻipū-Kalāheo	1.3	94.7	1.4%
Līhuʻe	3.0	91.5	3.2%
North Shore	3.2	67.4	4.8%
Waimea	14.9	145.6	10.2%
Total	**36.6**	**539.1**	**6.8%**

TSUNAMI INUNDATION

Table L-7. Major Roads: Tsunami

Jurisdiction	Major Road Miles in Hazard Area	Total Major Road Miles in Jurisdiction	% of Total Major Roads
East Kauaʻi	5.3	23.8	22.1%
Hanapēpē-ʻEleʻele	0.4	7.2	5.6%
Kōloa-Poʻipū-Kalāheo	0.0	20.7	0.0%
Līhuʻe	0.7	23.1	2.9%
North Shore	7.6	21.0	36.5%
Waimea	10.7	29.8	36.0%
Total	**24.7**	**125.5**	**19.7%**

Table L-8. Other Roads: Tsunami

Jurisdiction	Other Road Miles in Hazard Area	Total Other Road Miles in Jurisdiction	% of Total Other Roads
East Kauaʻi	11.4	113.7	10.1%
Hanapēpē-ʻEleʻele	3.1	26.2	11.7%
Kōloa-Poʻipū-Kalāheo	2.8	94.7	3.0%
Līhuʻe	3.4	91.5	3.7%
North Shore	9.3	67.4	13.8%
Waimea	41.0	145.6	28.2%
Total	**71.0**	**539.1**	**13.2%**

LANDSLIDE

High, Higher, and Highest Susceptibility

Table L-9. Major Roads: Landslide (high–highest susceptibility)

Jurisdiction	Major Road Miles in Hazard Area	Total Major Road Miles in Jurisdiction	% of Total Major Roads
East Kauaʻi	1.86	12.74	14.6%
Hanapēpē-ʻEleʻele	0.92	7.16	12.8%
Kōloa-Poʻipū-Kalāheo	2.24	7.5	29.9%
Līhuʻe	1.43	14.59	9.8%
North Shore	5.75	21.43	26.8%
Waimea	13.54	38.87	34.8%
Total	**25.74**	**102.29**	**25.2%**

Table L-10. Other Roads: Landslide (high–highest susceptibility)

Jurisdiction	Other Road Miles in Hazard Area	Total Other Road Miles in Jurisdiction	% of Total Other Roads
East Kauaʻi	23.82	125.63	19.0%
Hanapēpē-ʻEleʻele	2.65	27.57	9.6%
Kōloa-Poʻipū-Kalāheo	19.33	110.3	17.5%
Līhuʻe	11.04	102.27	10.8%
North Shore	11.53	67.84	17.0%
Waimea	41.24	136.49	30.2%
Total	**109.61**	**570.1**	**19.2%**

Moderate Susceptibility

Table L-11. Major Roads: Landslide (moderate susceptibility)

Jurisdiction	Major Road Miles in Hazard Area	Total Major Road Miles in Jurisdiction	% of Total Major Roads
East Kauaʻi	1.6	12.74	12.2%
Hanapēpē-ʻEleʻele	0.8	7.16	11.7%
Kōloa-Poʻipū-Kalāheo	0.8	7.5	10.8%
Līhuʻe	1	14.59	6.6%
North Shore	1.7	21.43	7.7%
Waimea	4.4	38.87	11.2%
Total	**10.2**	**102.29**	**10.0%**

Table L-12. Other Roads: Landslide (moderate susceptibility)

Jurisdiction	Other Road Miles in Hazard Area	Total Other Road Miles in Jurisdiction	% of Total Other Roads
East Kauaʻi	13.27	125.63	10.6%
Hanapēpē-ʻEleʻele	1.79	27.57	6.5%
Kōloa-Poʻipū-Kalāheo	9.85	110.3	8.9%
Līhuʻe	5.36	102.27	5.2%
North Shore	5.68	67.84	8.4%
Waimea	12.03	136.49	8.8%
Total	**47.98**	**570.1**	**8.4%**

INLAND FLOODING

The results presented below assume the levees on the Waimea River and Hanapēpē Stream are certified.

100-Year Flood (1% annual chance riverine flood)

Table L-13. Major Roads: Inland Flooding (1% annual chance riverine flood)

Jurisdiction	Major Road Miles in Hazard Area	Total Major Road Miles in Jurisdiction	% of Total Major Roads
East Kauaʻi	2.9	23.8	12.1%
Hanapēpē-ʻEleʻele	0.5	7.2	7.6%
Kōloa-Poʻipū-Kalāheo	0.5	20.7	2.3%
Līhuʻe	0.8	23.1	3.4%
North Shore	3.8	21.0	18.2%
Waimea	7.0	29.8	23.5%
Total	**15.5**	**125.5**	**12.3%**

Table L-14. Other Roads: Inland Flooding (1% annual chance riverine flood)

Jurisdiction	Other Road Miles in Hazard Area	Total Other Road Miles in Jurisdiction	% of Total Other Roads
East Kauaʻi	6.1	113.7	5.4%
Hanapēpē-ʻEleʻele	4.6	26.2	17.5%
Kōloa-Poʻipū-Kalāheo	5.1	94.7	5.4%
Līhuʻe	1.7	91.5	1.8%
North Shore	3.0	67.4	4.5%
Waimea	17.3	145.6	11.9%
Total	**37.9**	**539.1**	**7.0%**

500-Year Flood (0.2% annual chance riverine flood)

Table L-15. Major Roads: Inland Flooding (0.2% annual chance riverine flood)

Jurisdiction	Major Road Miles in Hazard Area	Total Major Road Miles in Jurisdiction	% of Total Major Roads
East Kaua‘i	3.4	23.8	14.2%
Hanapēpē-‘Ele‘ele	0.6	7.2	8.2%
Kōloa-Po‘ipū-Kalāheo	0.6	20.7	2.7%
Līhu‘e	0.8	23.1	3.7%
North Shore	3.8	21.0	18.2%
Waimea	10.1	29.8	33.9%
Total	**19.3**	**125.5**	**15.4%**

Table L-16. Other Roads: Inland Flooding (0.2% annual chance riverine flood)

Jurisdiction	Other Road Miles in Hazard Area	Total Other Road Miles in Jurisdiction	% of Total Other Roads
East Kaua‘i	8.0	113.7	7.0%
Hanapēpē-‘Ele‘ele	5.5	26.2	21.0%
Kōloa-Po‘ipū-Kalāheo	7.0	94.7	7.4%
Līhu‘e	1.8	91.5	1.9%
North Shore	4.3	67.4	6.4%
Waimea	21.0	145.6	14.4%
Total	**47.6**	**539.1**	**8.8%**

COASTAL FLOOD AND SEA LEVEL RISE

100-Year Flood (1% annual chance coastal flood event)

Table L-17. Major Roads: Coastal Flood and Sea Level Rise (1% annual chance coastal flood event)

Jurisdiction	Major Road Miles in Hazard Area	Total Major Road Miles in Jurisdiction	% of Total Major Roads
East Kaua‘i	0.0	23.8	0.0%
Hanapēpē-‘Ele‘ele	0.0	7.2	0.0%
Kōloa-Po‘ipū-Kalāheo	0.0	20.7	0.0%
Līhu‘e	0.2	23.1	0.7%
North Shore	3.3	21.0	16.0%
Waimea	0.7	29.8	2.2%
Total	**4.2**	**125.5**	**3.3%**

Table L-18. Other Roads: Coastal Flood and Sea Level Rise (1% annual chance coastal flood event)

Jurisdiction	Other Road Miles in Hazard Area	Total Other Road Miles in Jurisdiction	% of Total Other Roads
East Kauaʻi	1.0	113.7	0.9%
Hanapēpē-ʻEleʻele	0.7	26.2	2.5%
Kōloa-Poʻipū-Kalāheo	1.2	94.7	1.3%
Līhuʻe	0.2	91.5	0.2%
North Shore	4.8	67.4	7.2%
Waimea	11.0	145.6	7.5%
Total	**18.9**	**539.1**	**3.5%**

Chronic Coastal Flood

Table L-19.Major Roads: Chronic Coastal Flood

Jurisdiction	Major Road Miles in Hazard Area	Total Major Road Miles in Jurisdiction	% of Total Major Roads
East Kauaʻi	0.2	23.8	0.8%
Hanapēpē-ʻEleʻele	0.0	7.2	0.7%
Kōloa-Poʻipū-Kalāheo	0.0	20.7	0.0%
Līhuʻe	0.2	23.1	0.7%
North Shore	1.4	21.0	6.6%
Waimea	2.0	29.8	6.9%
Total	**3.8**	**125.5**	**3.0%**

Table L-20. Other Roads: Chronic Coastal Flood

Jurisdiction	Other Road Miles in Hazard Area	Total Other Road Miles in Jurisdiction	% of Total Other Roads
East Kauaʻi	0.7	113.7	0.6%
Hanapēpē-ʻEleʻele	0.2	26.2	0.7%
Kōloa-Poʻipū-Kalāheo	0.5	94.7	0.5%
Līhuʻe	0.0	91.5	0.0%
North Shore	1.0	67.4	1.5%
Waimea	2.5	145.6	1.7%
Total	**4.9**	**539.1**	**0.9%**

Sea Level Rise, Future Chronic Coastal Flood

Table L-21. Major Roads: Sea Level Rise, Future Chronic Coastal Flood

Jurisdiction	Major Road Miles in Hazard Area	Total Major Road Miles in Jurisdiction	% of Total Major Roads
East Kauaʻi	1.5	23.8	6.1%
Hanapēpē-ʻEleʻele	0.1	7.2	0.7%
Kōloa-Poʻipū-Kalāheo	0.0	20.7	0.0%
Līhuʻe	0.2	23.1	0.7%
North Shore	2.6	21.0	12.6%
Waimea	3.3	29.8	11.2%
Total	**7.6**	**125.5**	**6.1%**

Table L-22. Other Roads: Sea Level Rise, Future Chronic Coastal Flood

Jurisdiction	Other Road Miles in Hazard Area	Total Other Road Miles in Jurisdiction	% of Total Other Roads
East Kauaʻi	3.1	113.7	2.7%
Hanapēpē-ʻEleʻele	1.1	26.2	4.1%
Kōloa-Poʻipū-Kalāheo	0.7	94.7	0.8%
Līhuʻe	0.5	91.5	0.6%
North Shore	2.2	67.4	3.2%
Waimea	10.4	145.6	7.1%
Total	**18.0**	**539.1**	**3.3%**

Sea Level Rise, Event-Based Coastal Flood

Table L-23. Major Roads: Sea Level Rise, Event-Based Coastal Flood

Jurisdiction	Major Road Miles in Hazard Area	Total Major Road Miles in Jurisdiction	% of Total Major Roads
East Kauaʻi	7.6	23.8	32.1%
Hanapēpē-ʻEleʻele	0.8	7.2	11.5%
Kōloa-Poʻipū-Kalāheo	0.4	20.7	1.7%
Līhuʻe	2.8	23.1	12.0%
North Shore	7.9	21.0	37.9%
Waimea	15.2	29.8	51.0%
Total	**34.7**	**125.5**	**27.7%**

Table L-24. Other Roads: Sea Level Rise, Event-Based Coastal Flood

Jurisdiction	Other Road Miles in Hazard Area	Total Other Road Miles in Jurisdiction	% of Total Other Roads
East Kaua‘i	17.0	113.7	15.0%
Hanapēpē-‘Ele‘ele	7.5	26.2	28.5%
Kōloa-Po‘ipū-Kalāheo	7.2	94.7	7.6%
Līhu‘e	5.1	91.5	5.6%
North Shore	10.6	67.4	15.8%
Waimea	55.4	145.6	38.0%
Total	**102.8**	**539.1**	**19.1%**

DAM FAILURE

The analysis of roads exposed to the Dam Failure hazard reflect the roads that fall within the dam inundation area of all regulated dams in Kaua‘i—47 total dams, of which 44 are high hazard. It is extremely unlikely these dams would simultaneously fail and impact the total length of all roads listed at once.

Table L-25. Major Roads: Dam Failure

Jurisdiction	Major Road Miles in Hazard Area	Total Major Road Miles in Jurisdiction	% of Total Major Roads
East Kaua‘i	0.48	12.74	3.8%
Hanapēpē-‘Ele‘ele	0.49	7.16	6.8%
Kōloa-Po‘ipū-Kalāheo	0.45	7.5	6.0%
Līhu‘e	0.83	14.59	5.7%
North Shore	0.44	21.43	2.1%
Waimea	1.96	38.87	5.0%
Total	**4.65**	**102.29**	**4.5%**

Table L-26. Other Roads: Dam Failure

Jurisdiction	Other Road Miles in Hazard Area	Total Other Road Miles in Jurisdiction	% of Total Other Roads
East Kaua‘i	5.94	125.63	4.7%
Hanapēpē-‘Ele‘ele	2.63	27.57	9.5%
Kōloa-Po‘ipū-Kalāheo	45.68	110.3	41.4%
Līhu‘e	1.29	102.27	1.3%
North Shore	0.04	67.84	0.1%
Waimea	4.88	136.49	3.6%
Total	**60.46**	**570.1**	**10.6%**

County of Kaua‘i Multi-Hazard Mitigation and Resilience Plan

Appendix M. Non-Natural Hazard Information

M. Non-Natural Hazard Information

The Steering Committee decided that this 2026 Multi-Hazard Mitigation and Resilience Plan (MHMRP) Update would include a profile of non-natural hazards that could impact the planning area: pandemic, bioterrorism threats, port closures, and food insecurity. This appendix profiles these hazards; however, a full risk assessment was not performed, and the hazards are not included in the risk ranking.

HEALTH HAZARDS AND PANDEMICS

The State of Hawaii Department of Health and the Kaua‘i District Health Office (KDHO) both plan for and respond to health-related hazards stemming from human diseases. These diseases are generally seen at three levels of spread:

- An outbreak is defined by the U.S. Centers for Disease Control and Prevention (CDC) as the occurrence of more cases of disease than normally expected within a specific place or group of people over a given period of time. State and local regulations require immediate reporting of any known or suspected outbreaks by health care providers, health care facilities, laboratories, veterinarians, schools, child day care facilities, and food service establishments.
- An epidemic is a localized outbreak that spreads rapidly and affects a large number of people or animals in a community.
- A pandemic is an epidemic that occurs worldwide or over a very large area and affects a large number of people or animals.

All levels of spread pose a threat to public health, but pandemics present the greatest risk, as evidenced by the COVID-19 pandemic. If a health-related hazard arises, the State of Hawai‘i Department of Health’s Disease Outbreak Control Division has a Disease Investigation Branch and an Immunization Branch that work together to monitor, investigate, prevent, and control infectious diseases, especially those preventable through immunization. These branches also support Hawai‘i’s ability to respond to emergencies that threaten public health and work to strengthen the relationships between the Department of Health and other partners, including laboratories, hospitals, schools, emergency response agencies, private organizations, and the military.

The COVID-19 pandemic constituted a global public health crisis. In Hawaii, over 2,200 people died from the disease, including approximately 80 people in Kaua‘i as of June 2025 (State of Hawai'i Department of Health, Disease Outbreak Control Division 2025a). The State of Hawai‘i Department of Health’s Disease Outbreak Control Division was mobilized to manage the COVID-19 pandemic using the tools previously discussed. The KDHO also has systems to prepare for emergencies, investigate disease outbreaks, provide public health services and nursing, and manage communicable disease outbreaks (KDHO 2025). These state and county resources were employed during the COVID-19 pandemic. As future outbreaks or pandemics occur, the County of Kaua‘i and State of Hawai‘i have these resources in place to address them, informed by lessons learned from the COVID-19 pandemic.

More information on health-related hazards is available at:

- The KDHO website (KDHO 2025): https://health.hawaii.gov/kauai/
- The State of Hawai'i Department of Health, Disease Outbreak Control Division website (State of Hawaii Department of Health, Disease Outbreak Control Division 2025b): https://health.hawaii.gov/docd/.

Location, Extent and Magnitude

Health hazards that affect the residents of Kauaʻi County may arise in a variety of situations, such as during a communicable disease outbreak, after a natural disaster, or as a result of a bioterrorism incident. All populations in Kauaʻi County are susceptible to bioterrorism or pandemic events. Populations who are young, elderly, have compromised immune systems, or work as first responders are likely to be more vulnerable. The relative ease of worldwide travel, in addition to the world's expanding global food industry, positions all countries as vulnerable to pandemic events at any time.

Identified Health-Related Hazards in Hawaiʻi

The State of Hawaiʻi Department of Health, Disease Outbreak Control Division has identified the diseases described in Table M-1 as human diseases that could contribute to a serious epidemic in the state. Significantly, many of these diseases may worsen or spread more easily due to climate change (State of Hawaiʻi Emergency Management Agency [HI-EMA] 2023).

Table M-1. Naturally Spread Diseases Seen In Hawaiʻi

Description	Examples	
Animal Transmitted		
These are diseases that are transmitted to humans by domestic or non-domestic animals.	Brucellosis (undulant fever) Campylobacteriosis Cat scratch disease Cryptosporidiosis Escherichia coli (E. coli) Giardiasis Middle eastern respiratory syndrome (MERS) Plague	Psittacosis (ornithosis, parrot fever) Q Fever Rabies Ringworm Salmonellosis Toxoplasmosis Tularemia
Bloodborne		
Viruses, bacteria and parasites that can be carried in blood and cause disease are known as bloodborne pathogens. Transmission of these diseases may be from direct blood contact, needle sticks, intravenous drug use, sexual behavior, insects or other vectors.	Ebola Hepatitis C Malaria	
Community-Acquired Infections		
Community-acquired infections are infections that are contracted outside of a hospital (or are diagnosed within 48 hours of admission) without any previous health care encounter.	Adenovirus Bed bugs Body lice Campylobacteriosis Conjunctivitis (pink eye) Common cold viruses Enterovirus, non-polio Hand, foot, and mouth disease Head lice (ʻukus) Impetigo Influenza (flu) Invasive Group A Streptococcus (necrotizing fasciitis) Legionnaires' disease/pontiac fever	Methicillin-resistant staphylococcus aureus (MRSA) Norovirus Pinworm disease Respiratory syncytial virus Ringworm Scabies Smallpox Staphylococcus aureus Strep throat/scarlet fever Streptococcus, Group B Tularemia Viral meningitis

Description	Examples	
Foodborne		
Foodborne diseases can be spread when food becomes contaminated with fecal matter containing bacteria, viruses, or parasites. This contamination can happen at a farm, manufacturing plant, restaurant, or home. Foodborne diseases usually result in gastrointestinal illness, which can include symptoms such as diarrhea, vomiting, nausea, stomachache, and fever. People who are ill with a foodborne disease can give the infection to others, so proper hygiene and hand washing practices are essential to limit the spread of the disease. People experiencing gastrointestinal symptoms should not prepare or handle food for others.	Amebiasis Angiostrongyliasis (rat lungworm) Anisakiasis Botulism Brucellosis (undulant fever) Campylobacteriosis Cholera Ciguatera fish poisoning Cryptosporidiosis Cyclosporiasis Escherichia coli (E. coli)	Giardiasis Listeriosis Norovirus Salmonellosis Scombroid Shigellosis Tularemia Typhoid fever Vibriosis Yersinia enterocolitica
Influenza		
Influenza is an infectious viral disease of birds and mammals commonly transmitted through airborne aerosols such as coughing or sneezing. Symptoms are chills, headache, fever, nausea, muscle pain, and occasionally pneumonia.	Flu pandemics in the late 19th and 20th centuries: Russian flu 1918 Spanish flu Asian flu Hong Kong flu A/H1N1 or the swine flu Avian flu strains H5N1 and H7N9 caused human deaths but did not escalate to pandemic proportions.	
Mosquito-Transmitted		
Mosquito-borne diseases are not an immediate threat in Hawaiʻi because travelers are usually vaccinated (yellow fever) or disease spread requires an infected animal to travel all the way from the mainland (West Nile virus). Some mosquito-transmitted diseases (e.g., malaria or Japanese encephalitis) are not likely to ever be a threat because the mosquito species that spread them are not found in Hawaiʻi. However, travelers should be aware of these diseases and where they occur in the world so they may protect themselves.		
Respiratory Viruses		
Respiratory viruses are responsible for influenza-like illness. They can also cause the common cold. The virus that caused the COVID-19 pandemic is a respiratory virus. People at high risk (those with certain underlying conditions, the elderly, the very young, and pregnant women) can develop severe illness that results in hospitalization or death. The best protection is proper hygiene and avoiding contact with sick individuals. The best way for those who are infected to protect others is to cover their nose and mouth when sneezing and coughing, use good hand hygiene, and stay home from work or school.	Adenovirus Coronaviruses (including SARS and MERS CoV) Influenza Parainfluenza Parvovirus B19	Respiratory syncytial virus Rhinovirus (common cold) Measles Pertussis (whooping cough)
Waterborne Diseases		
Diseases caused by micro-organisms transmitted in water can be spread while bathing, washing, drinking water, or eating food exposed to contaminated water.	Cholera Giardiasis Legionnaires' disease /pontiac fever	Leptospirosis Typhoid fever Vibriosis
Sexually Transmitted Disease		
HIV/AIDS, chlamydia, gonorrhea, and syphilis are the predominant sexually transmitted infections handled by the Hawaiʻi State Department of Health Harm Reduction Services Branch, whose responsibilities include awareness, prevention, and control of these infections.	Chlamydia Genital warts Gonorrhea Hepatitis A, B, and C Herpes	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) Human papillomavirus Syphilis Zika

CLIMATE CHANGE AND HEALTH-RELATED HAZARDS

Climate change presents a significant risk to human health in Kaua'i. All hazards profiled in this 2026 MHMRP Update can adversely impact human health, and most of their impacts are exacerbated by climate change. Figure M-1 shows the various impacts of climate change on human health in the state of Hawai'i.

Climate change presents diverse and profound human health impacts ranging from worsening air pollution and extreme heat to invasive vectors spread and challenges to food systems. Crucially, these impacts are complex and can compound upon one another, leading to and exacerbating environmental degradation, social inequities, and mental health challenges. For instance, increases in high temperatures and drought can lead to increased wildfires and worsening air quality that are particularly impactful in vulnerable communities due to factors such as higher rates of pre-existing health conditions or a lack of resources for mitigation.

Part 2: Risk Assessment presents more information about anticipated climate change effects on natural hazard risk, along with information regarding natural hazard impacts on human health and social vulnerability.

Additional information is also available from the Hawai'i Climate Change and Health Working Group's website (2025a) and their comprehensive vulnerability assessment (2025b) at the following sources:

- Climate Change and Health in Hawaii: Comprehensive Vulnerability Assessment
- Hawai'i Climate Change and Health Working Group

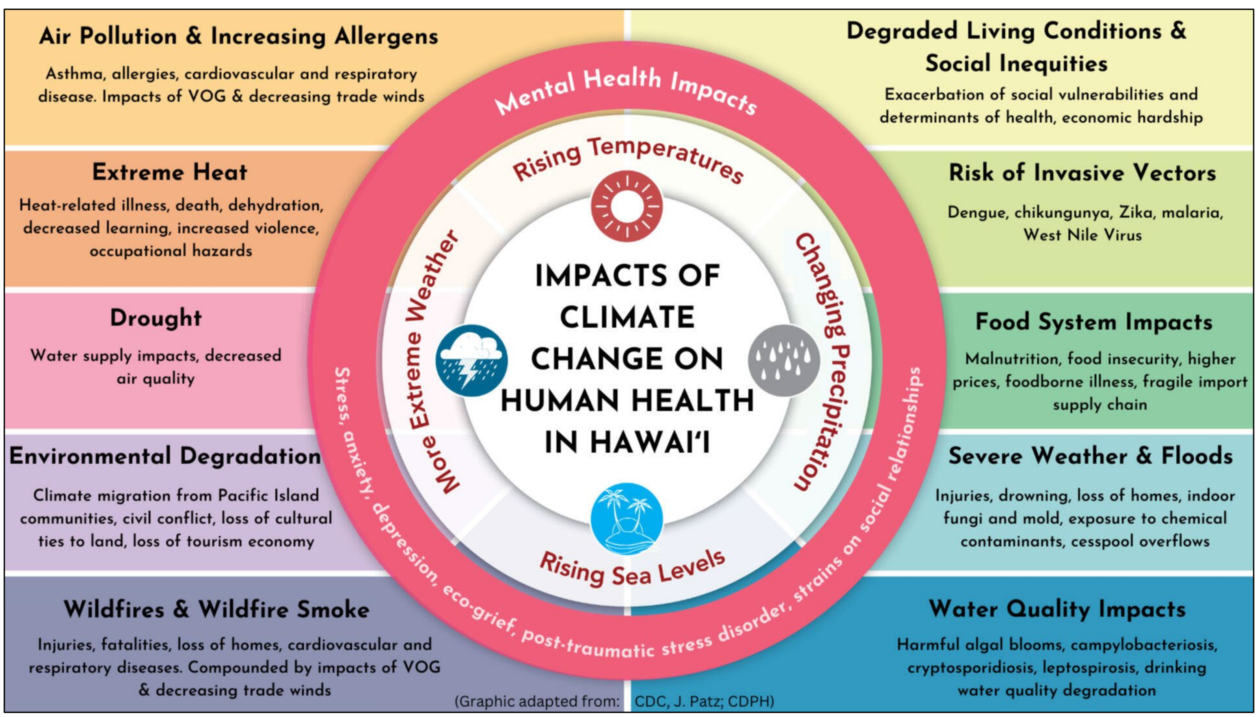


Figure M-1. Human Health Impacts Resulting from Climate Change in the State of Hawaii (Hawai'i Climate Change and Health Working Group 2025a, 2025b)

BIOTERRORISM-RELATED HEALTH HAZARDS

Bioterrorism is a type of terrorist attack that targets public health and intends to cause illnesses or fatalities among people, animals, or plants. These attacks occur through the intentional release of viruses, bacteria, or other biological agents (State of Hawaii Department of Health, Disease Outbreak and Control Division 2024). There are three different categories of biological agents that may be used in bioterrorism attacks, and each has a different threat level associated with it based on how easily they spread and the severity of illness associated with them. According to the State of Hawaii Department of Health's Disease Outbreak and Control Division, these categories are as follows (State of Hawaiʻi Department of Health, Disease Outbreak and Control Division 2025c):

- **Category A pathogens:** Organisms or biological agents that pose the highest risk to national security and public health because they:
  - Can be easily spread or transmitted from person to person
  - Result in high death rates and have the potential for major public health impact
  - Might cause public panic and social disruption
  - Require special action for public health preparedness.
- **Category B pathogens:** The second highest priority organisms/biological agents. They:
  - Are moderately easy to disseminate
  - Result in moderate morbidity rates and low mortality rates
  - Require specific enhancements for diagnostic capacity and enhanced disease surveillance.
- **Category C pathogens:** The third highest priority, including emerging pathogens that could be engineered for mass dissemination in the future because of:
  - Availability
  - Ease of production and dissemination
  - Potential for high morbidity and mortality rates and major health impact

For more information related to bioterrorism hazards, please visit the State of Hawaiʻi Department of Health's Disease Outbreak and Control Division website (State of Hawaiʻi Department of Health, Disease Outbreak and Control Division 2025b) at: https://health.hawaii.gov/docd/.

SUPPLY CHAIN AND FOOD SECURITY CONCERNS

The 2026 MHMRP Update additionally examines some of the food security hazards that could impact the planning area. While these hazards are profiled, they are not subject to a full risk assessment or included in the risk ranking.

Similar to other counties in the state, Kauaʻi imports the vast majority (80%–90%) of the food consumed on island, as well as most other commodities. This puts residents and visitors in a precarious position, dependent on a usually reliable, but lengthy, just-in-time supply chain. Any interruption in the transportation network from the West Coast through Honolulu Harbor and the county's ports (Nawiliwili Harbor, Port Allen and Līhuʻe Airport) to the shelves of the various stores and outlets can have dramatic impacts on the food supply and the well-being of the county's residents and visitors. Given Kauaʻi's limited storage capacity and minimal reserves, a lengthy disruption could lead to food shortages, price increases and long-term economic and social challenges. Kauaʻi has a tradition of self-sufficiency and resilience to disasters, but the increased vulnerability to the impacts of natural hazards, global events, pandemics, and economic instability either locally, state-wide, or regionally poses a challenge to emergency managers and policy makers.

Some examples of supply chain and food security concerns in Kauaʻi are:

- The primary highway crosses the Wailua River at the Wailua Bridge. Any long-term closure would severely disrupt the north-south traffic on the East Side of the island. A substantial portion of Kauaʻi's population lives in Kapaʻa, Anahola, Kīlauea and the North Shore and many of them work in Līhuʻe and further south and west. Currently there is no viable alternative to the bridge. Its closure would have enormous detrimental impacts on the island's economy.
- There is concern over the ability of aging state and county roads and bridges to withstand heavy container loads and equipment. This infrastructure was not designed for these loads, and risk may be amplified during natural hazard events. However, the level of risk posed by these roads and bridges is unclear and may be further examined as part of the mitigation action identified in this 2026 MHMRP Update to develop infrastructure hardening plans where needed. Similar to above, the closure of major roads in the county would impede the ability of goods to be distributed to other parts of the island and may prevent people getting to their places of employment.
- Kauaʻi County's primary harbor is Nawiliwili. A long-term closure (e.g., damage to the harbor facilities, a sunken vessel clogging the harbor, fire or explosions at the fuel tanks,) would severely disrupt the flow of commodities through the harbor. Kauaʻi has limited resources to address, repair or recover from any of these events. The logistical challenges to bring in the necessary equipment and technical skills would also likely be significant. Additionally, resupplying the island via air transport at Līhuʻe Airport would require substantial expense and effort. Concerns over damage to harbor facilities are heightened by aging fuel tanks at the harbor, which pose a potential hazard. However, the risk associated with them is unclear and may be further examined through the mitigation action identified in this 2026 MHMRP Update to develop infrastructure hardening plans where needed.
- Port Allen is more isolated from the main transportation nodes but does receive fuel for Kauaʻi Island Utility Cooperative's (KIUC's) generators, co-located to the harbor. A closure of Port Allen would have a detrimental impact on electricity generation.
- The Līhuʻe Airport is less important for the import of food and commodities. However, it is the main entry point for almost all of the island's visitors and its long-term closure would have a tremendous impact on the island's economy. As the county experienced during the Covid-19 pandemic, a large reduction in the number of visitors results in a substantial decline in economic activity and business shut-downs while increasing unemployment.
- Honolulu Harbor is the primary entry point for 90%–95% of the food and commodities that the state imports. The incoming cargo going to the neighbor islands is transferred to barges that bring commodities onward. Kauaʻi could be completely unaffected by some event that severely damages and closes Honolulu Harbor. This could still have the result of effectively closing down Kauaʻi. Without cranes or the facilities to receive cargo from the West Coast, Kauaʻi would have to wait until cargo could be repacked on ships with a crane on board or with a "roll-on-roll-off" capacity. If an event that closes the Honolulu Harbor also shuts down the Honolulu Airport, Kauaʻi would have limited resources to support ongoing transpacific flights.
- Finally, closure of the West Coast ports would have an impact on Kauaʻi similar to the closure of Honolulu Harbor. The threat of West Coast ports closing has resulted in tremendous runs on commodities at Costco, Walmart, and other local stores.

In 2017 and 2018, HI-EMA analyzed the impact of the Honolulu Harbor closure on the state (primarily Honolulu) and investigated the option for recovery and restoration of the harbor. The Governor’s Office of Resilience is initiating a review and update of that analysis and intends to more robustly consider the neighbor island impacts.

Additional information on food security in the state of Hawai‘i is available from the University of Hawai‘i Sea Grant Program (University of Hawai‘i Sea Grant College Program 2018) and can be found at: Ka Pili Kai – Hawaii Sea Grant.

Appendix N. Detailed Capabilities Assessment

N. Detailed Capabilities Assessment

Table N-1 through Table N-7 summarize the specific capabilities associated with each category described in Section 15.1 Capabilities Assessment.

Table N-1. Legal and Regulatory Capability

Codes, Ordinances, and Requirements	Local Authority	Capability Ranking (High, Medium, Low)	State Mandated
Building Code	Yes	Medium	Yes
Zoning Code	Yes	High	Yes
Subdivisions	Yes	Medium	Yes
Stormwater Management	Yes	Low	No
Post-Disaster Recovery	Yes	Medium	No
Real Estate Disclosure	Unknown	Unsure	Yes
Growth Management	Yes	High	N/A
Site Plan Review	Yes	High	N/A
Environmental Protection	Yes	Medium	Yes
Flood Damage Prevention	Yes	Unsure	Yes
Emergency Management	Yes	Medium	Yes
Climate Change Adaptation and Mitigation	Yes	Medium	Yes
Coastal Zone/Shoreline Management	Yes	High	Yes
Plantation Camp Districts Wildfire and Wildland Urban Interface Ordinance	Yes	High	No
Planning Documents			
2020 General Plan	Yes	High	Yes
Capital Improvement Plan	Yes	Medium	Yes
Disaster Debris Management Plan	Yes	Low	N/A
Floodplain or Watershed Plan	No	Medium	N/A
Stormwater regulations that address either water quality, water quantity or both	No	Medium	Yes
Urban Water Management Plan	No	Unsure	N/A
Habitat Conservation Plan	No	Unsure	N/A
Economic Development Plan	Yes	Medium	N/A
Shoreline Management Plan	No	Medium	Yes
Community Wildfire Protection Plan	Yes	Medium	Yes
Climate Action/Adaptation Plan	Yes	High	N/A
Comprehensive Emergency Management Plan or Emergency Operations Plan	Yes	Medium	Yes
Threat and Hazard Identification and Risk Assessment (THIRA)	Yes	Medium	Yes
Pre-Disaster Recovery Plan	Yes	Medium	Yes
Continuity of Operations Plan or Continuity of Government Plan	Yes	Medium	Yes
Public Health Plan	Yes	High	Yes

Table N-2. Development and Permitting Capability

Criterion	Response
Does the County issue development permits?	Yes
If no, who does? If yes, which department?	County of Kaua'i Planning Department
Does the County have the ability to track permits by hazard area?	Yes
Does the County have a buildable lands inventory?	Yes. Kaua'i County Use Analysis and Buildout Report (2015)*

Source: Kaua'i County Use Analysis and Buildout Report (PBR Hawai'i and Associates, Inc. 2015).

Table N-3. Fiscal Capability

Financial Resources	Accessible or Eligible to Use?
Community Development Block Grants	Yes
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas, or Electric Service	Yes
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	No
Withhold Public Expenditures in Hazard-Prone Areas	No
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	No
Land Bank or Other Support for Transfer of Development Rights	No

Table N-4. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency
Planners or engineers with knowledge of land development and land management practices	Yes	County Department of Public Works (DPW) Engineering Division
Engineers or professionals trained in building or infrastructure construction practices	Yes	County DPW Engineering Division
Planners or engineers with an understanding of natural hazards and climate change	Yes	County DPW Engineering Division; County Planning Department
Staff with training in benefit/cost analysis	Yes	KEMA
Surveyors	No	PWD
Personnel skilled or trained in GIS applications	Yes	County Planning Department; KEMA
Scientist familiar with natural hazards in local area	Yes	Range of private and government expertise (University of Hawai'i Sea Grant College Program extension)
Emergency manager	Yes	KEMA
Grant writers	To be determined	Various

Table N-5. National Flood Insurance Program Compliance

Criterion	Response
What local department is responsible for floodplain management?	County DPW
Who is the floodplain administrator? (department/position)	County DPW Engineering Division – Civil Engineer VI
Are any Certified Floodplain Managers on County staff?	No
What is the date that your flood damage prevention ordinance was last amended?	September 2005
Does the floodplain management program meet or exceed minimum requirements?	Exceeds
If exceeds, in what ways?	The County requires substantial improvements to structures, measured as the culmination of improvements over the course of a year to comply with floodplain management program requirements. The County requires an additional minimum one foot of freeboard above the BFE for all machinery and equipment, including electrical, heating, ventilation, and plumbing.
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact?	2003 CAV/2009 North Shore Audit (FEMA Natural Hazards Program Specialist 2017)
Does the County have any outstanding NFIP compliance violations to be addressed?	No
If so, state what they are.	Not Applicable
Are any RiskMAP projects currently underway in the County?	Yes
If so, state what they are.	The State of Hawaii Department of Land and Natural Resources is a Cooperating Technical Partner and has worked with a consultant, Stantec Inc., to provide improved best available, non-regulatory data to better understand flood risk. For more information on the details of the project, including the specific products produced, please see Volume 1, Section 10.1.3. National Flood Insurance Program.
Do local flood hazard maps adequately address the flood risk within the County?	No
If no, state why.	Compound flood hazards from sea level rise and flooding are not addressed; chronic sea level rise is not addressed; areas are not mapped or adequately mapped
Does the floodplain management staff need any assistance or training to support its floodplain management program?	Yes
If so, what type of assistance/training is needed?	Floodplain management training for new personnel
Does the County participate in the Community Rating System (CRS)?	Yes
If yes, is the County interested in improving its CRS Classification?	Yes (see Volume 1, Inland Flooding – National Flood Insurance Program). The County entered the CRS Program April 1, 2023 and is currently a Class 8 community.
For NFIP claims and coverage information, see Volume 1, Inland Flooding – National Flood Insurance Program	

Table N-6. Education and Outreach Capability

Criterion	Response	Department/Agency
Do you have a public information officer or communications office?	Yes	Office of the Mayor
Do you have personnel skilled or trained in website development?	Yes	Various
Do you have hazard mitigation information available on your website?	Yes	
If yes, briefly describe.	See kauai.gov/mitigation	
Do you use social media for hazard mitigation education and outreach?	Yes	
If yes, briefly describe.	See kauai.gov/mitigation	
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	Yes	
If yes, briefly describe.	Multi-Hazard Mitigation and Resilience Plan Core Planning Team and Steering Committee; North Shore Community Group; Hanapēpē-‘Ele‘ele Hawai‘i Hazards Awareness and Resilience Program; ‘Aina Alliance in Anahola	
Do you have any other programs in place that could be used to communicate hazard-related information?	Yes	
If yes, briefly describe.	County Facebook page; Sea Grant Extension Agent; County department websites	
Do you have any established warning systems for hazard events?	Yes	
If yes, briefly describe.	County Sirens – part of Statewide Siren Network	

Table N-7. Adaptive Capacity for Climate Change

Criterion	Department/ Division with Capacity	Rating*
County-level understanding of potential climate change impacts on critical infrastructures, housing, natural and cultural resources critical ecosystems, etc.	Kaua‘i County Planning Department (Planning), Office of Economic Development (OED)	Medium
Comment: Kaua‘i Climate Adaptation and Action Plan (KCAAP)†		
County-level monitoring of climate change impacts on critical infrastructures, housing, natural and cultural resources critical ecosystems, etc.	Planning, OED	Low
Comment: KCAAP		
Technical resources to assess proposed strategies for feasibility and externalities	Planning, OED	Medium
Comment: Some resources exist (see KCAAP)		
County-level capacity for development of greenhouse gas emissions inventory	Planning, OED	High
Comment: KCAAP		
Capital planning and land use decisions informed by potential climate impacts	Planning, OED	Medium
Comment: KCAAP		
Participation in regional groups addressing climate risks	Planning, OED	Medium
Comment: Four County Sustainability Network and statewide collaboration; Statewide Ocean Resources Management Plan group; participation with national and international groups such as the Urban Sustainability Directors Network		

Criterion	Department/ Division with Capacity	Rating*
Clear authority/mandate to consider climate change impacts during public decision-making processes	Planning, OED, Office of the Mayor	Medium
Comment: Various Mayor's executive orders and directives; statewide framework		
Identified strategies for greenhouse gas mitigation efforts	Planning, OED	High
Comment: KCAAP		
Identified strategies for adaptation to impacts	Planning, OED	Low
Comment: KCAAP		
Champions for climate action in local government departments	Planning, OED	Low
Comment: KCAAP		
Political support for implementing climate change adaptation strategies	Planning, OED	Low
Financial resources devoted to climate change adaptation	Planning, OED	Low
Comment: KCAAP; OED Innovation Grants		
County authority over sectors likely to be negatively impacted	Planning, OED	Medium
Local residents' knowledge of and understanding of climate risk	–	Low
Comment: Hanalei Watershed Hui's Community Disaster Resilience Action Plan‡ *Anahola Build Back Better Report*§		
Local residents' support of adaptation efforts	–	Medium
Comment: KCAAP		
Local residents' capacity to adapt to climate impacts	–	Medium
Comment: KCAAP		
Local economy current capacity to adapt to climate impacts	–	Low
Comment: KCAAP		
Local ecosystems capacity to adapt to climate impacts	–	Medium
Comment: KCAAP		

Note:

*High = Capacity exists and is in use.

Medium = Capacity may exist but is not used or could use some improvement.

Low = Capacity does not exist or could use substantial improvement.

Unsure = Not enough information is known to assign a rating.

†*Kaua‘i Climate Adaptation and Action Plan* (KCAAP) (County of Kaua‘i 2025d).

‡*Hanalei to Hā`ena Community Disaster Resilience and Climate Adaptation Action Plan* (Henly-Shepard 2023).

§*Anahola Build Back Better Report* (County of Kaua‘i 2025n).

County of Kauaʻi Multi-Hazard Mitigation and Resilience Plan

Appendix O. Mitigation Best Practices Catalogs

O. MITIGATION BEST PRACTICES CATALOGS

BEST PRACTICES CATALOGS

Catalogs of hazard mitigation alternatives were developed that present a broad range of alternatives to be considered for use in the planning area, in compliance with 44 Code of Federal Regulations (CFR) Section 201.6(c)(3)(ii). One catalog was developed for each hazard of concern evaluated in this 2026 Multi-Hazard Mitigation and Resilience Plan (MHMRP) Update. A catalog was also developed for climate change due to the impacts it presents to most hazards evaluated in this plan. The catalogs for each hazard are listed in Table O-1 through Table O-11 (in the order in which they appear in the 2026 MHMRP Update). The catalogs present alternatives that are categorized in two ways:

- What the alternative would do:
    - Manipulate a hazard
    - Reduce exposure to a hazard
    - Reduce vulnerability to a hazard
    - Build local capacity to respond to or prepare for the hazard
- Who would have responsibility for implementation:
    - Individuals
    - Businesses
    - Government

Table O-1. Potential Mitigation Actions for Wildfire

Potential Mitigation Action	Individuals	Businesses	Government
Manipulate the hazard	Clear potential fuels on property such as dry overgrown underbrush and diseased trees	Clear potential fuels on property such as dry underbrush and diseased trees	Clear potential fuels on property such as dry underbrush and diseased trees Implement best management practices on public lands
Reduce exposure to the hazard	Maintain defensible space around structures Locate outside of hazard area Mow regularly	Maintain defensible space around structures and infrastructure Locate outside of hazard area	Maintain defensible space around structures and infrastructure Locate outside of hazard area Enhance building code to include use of fire resistant materials in high hazard area
Reduce vulnerability to the hazard	Create and maintain defensible space around structures and provide water on-site Use fire-resistant building materials Maintain defensible spaces around home	Maintain defensible space around structures and infrastructure and provide water on-site Use fire-resistant building materials Use fire-resistant plantings in buffer areas of high wildfire threat	Maintain defensible space around structures and infrastructure Use fire-resistant building materials Use fire-resistant plantings in buffer areas of high wildfire threat. Consider higher regulatory standards (such as Class A roofing) Establish biomass reclamation initiatives Reintroduce fire (controlled or prescribed burns) to fire-prone ecosystems Manage fuel load through thinning and brush removal Establish integrated performance standards for new development to harden homes. Establish a management program to track forest and rangeland health Provide incentives for existing structures to be hardened against wildfire
Build local capacity to respond to or prepare for the hazard	Employ techniques from the National Fire Protection Association's Firewise USA program to safeguard home Identify alternative water supplies for fire fighting Install/replace roofing material with non-combustible roofing materials and implement other strategies to harden homes from embers and flame impingement	Support Firewise USA community initiatives. Establish stored water supplies to be used for firefighting	More public outreach and education efforts, including an active Firewise USA program Possible weapons of mass destruction funds available to enhance fire capability in high-risk areas Identify fire response and alternative evacuation routes and establish where needed Seek alternative water supplies Become a Firewise USA community Use academia to study impacts/solutions to wildfire risk Establish/maintain mutual aid agreements between fire service agencies Develop, adopt, and implement integrated plans for mitigating wildfire impacts in wildland areas bordering on development Consider the probable impacts of climate change on the risk associated with the wildfire hazard in future land use decisions

Table O-2. Potential Mitigation Actions for Tropical Cyclone/High Windstorm

Potential Mitigation Actions	Individuals	Businesses	Government
Manipulate the hazard	None	None	None
Reduce exposure to the hazard	Trim trees away from structures	Relocate or underground electrical infrastructure	Relocate or underground electrical infrastructure
Reduce vulnerability to the hazard	Build home in compliance with building codes Incorporate building design standards to minimize wind damage Retrofit home to reduce future wind damage	Build facilities in compliance with building codes Incorporate building design standards to minimize wind damage Retrofit facilities to reduce future wind damage.	Adopt and enforce building codes to prevent wind damage Promote or require site and building design standards to minimize wind damage Regularly maintain utilities to prevent wind damage Retrofit public buildings and critical facilities to reduce future wind damage
Build local capacity to respond to or prepare for the hazard	Create a retrofit savings plan	Develop a continuity of operations plan to address operations before, during and after high wind events	Assess vulnerability to severe wind Improve public awareness of severe wind through outreach activities

Table O-3. Potential Mitigation Actions for Tsunami

Potential Mitigation Actions	Individuals	Businesses	Government
Manipulate the hazard	None	None	Build wave abatement structures (e.g., the "Jacks" looking structure designed by the Japanese)
Reduce exposure to the hazard	Locate outside of hazard area	Locate structure or mission critical functions outside of hazard area whenever possible	Locate structure or functions outside of hazard area whenever possible Harden infrastructure for tsunami impacts Relocate identified critical facilities located in tsunami high hazard areas
Reduce vulnerability to the hazard	Apply personal property mitigation techniques to your home such as anchoring your foundation and foundation openings to allow flow though	Mitigate personal property for the impacts of tsunami	Adopt higher regulatory standards that will provide higher levels of protection to structures built in a tsunami inundation area Use tsunami mapping to guide development away from high risk areas through land use planning

Potential Mitigation Actions	Individuals	Businesses	Government
Build local capacity to respond to or prepare for the hazard	Develop and practice a household evacuation plan Educate yourself on the risk exposure from the tsunami hazard and ways to minimize that risk Understand tsunami warning signs and signals	Develop and practice a corporate evacuation plan Educate employees on the risk exposure from the tsunami hazard and ways to minimize that risk	Use probabilistic tsunami mapping and land use guidance from the state when published Provide incentives to guide development away from hazard areas Improve the tsunami warning and response system Provide residents with tsunami inundation maps Join the National Oceanic and Atmospheric Administration (NOAA) TsunamiReady program Develop and communicate evacuation routes Enhance the public information program to include risk reduction options for the tsunami hazard

Table O-4. Potential Mitigation Actions for Landslide

Potential Mitigation Actions	Individuals	Businesses	Government
Manipulate the hazard	Stabilize slope (dewater, armor toe) Reduce weight on top of slope Minimize vegetation removal and the addition of impervious surfaces.	Stabilize slope (dewater, armor toe) Reduce weight on top of slope	Stabilize slope (dewater, armor toe) Reduce weight on top of slope
Reduce exposure to the hazard	Locate structures outside of hazard area (off unstable land and away from slide run-out area)	Locate structures outside of hazard area (off unstable land and away from slide run-out area)	Acquire properties in high-risk landslide areas. Adopt land use policies that prohibit the placement of habitable structures in high-risk landslide areas.
Reduce vulnerability to the hazard	Retrofit home	Retrofit at-risk facilities	Adopt higher regulatory standards for new development within unstable slope areas. Armor/retrofit critical infrastructure against the impact of landslides.
Build local capacity to respond to or prepare for the hazard	Institute warning system, and develop evacuation plan Keep cash reserves for reconstruction Educate yourself on risk reduction techniques for landslide hazards	Institute warning system, and develop evacuation plan Keep cash reserves for reconstruction Develop a continuity of operations plan Educate employees on the potential exposure to landslide hazards and emergency response protocol	Produce better hazard maps Provide technical information and guidance Enact tools to help manage development in hazard areas: better land controls, tax incentives, information Develop strategy to take advantage of post-disaster opportunities Warehouse critical infrastructure components Develop and adopt a continuity of operations plan Educate the public on the landslide hazard and appropriate risk reduction alternatives. Consider the probable impacts of climate change on the risk associated with the landslide hazard

Table O-5. Potential Mitigation Actions for Drought

Potential Mitigation Actions	Individuals	Businesses	Government
Manipulate the hazard	None	None	Groundwater recharge through stormwater management Develop a water recycling program
Reduce exposure to the hazard:	None	None	Identify and create groundwater backup sources
Reduce vulnerability to the hazard	Drought-resistant landscapes Reduce water system losses Modify plumbing systems (through water saving kits) For homes with on-site water systems: increase storage, use rainwater catchment	Drought-resistant landscapes Reduce private water system losses Support alternative irrigation techniques to reduce water use and encourage use of climate-sensitive water supplies For businesses with on-site water systems: increase storage, use rainwater catchment	Water use conflict regulations Reduce water system losses Distribute water saving kits Increase conventional storage that is filled during high-flow periods
Increase the ability to respond to or be prepared for the hazard	Practice active water conservation	Practice active water conservation	Public education on drought resistance Identify alternative water supplies for times of drought; mutual aid agreements with alternative suppliers Develop drought contingency plan Develop criteria "triggers" for drought-related actions Improve accuracy of water supply forecasts Modify rate structure to influence active water conservation techniques Consider the probable impacts of climate change on the risk associated with the drought hazard

Table O-6. Potential Mitigation Actions for Inland Flood

Potential Mitigation Action	Individuals	Businesses	Government
Manipulate the hazard	Clear storm drains and culverts Use low-impact development technique	Clear storm drains and culverts Use low-impact development techniques	Maintain drainage system Institute low-impact development techniques on property Dredging, levee construction, and providing regional retention areas Structural flood control, levees, channelization, or revetments. Stormwater management regulations and master planning Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff

Potential Mitigation Action	Individuals	Businesses	Government
Reduce exposure to the hazard	Locate outside of hazard area Elevate utilities above base flood elevation Use low-impact development techniques	Locate critical facilities or functions outside hazard area Use low-impact development techniques	Locate or relocate critical facilities outside of hazard area Acquire or relocate identified repetitive loss properties Promote open space uses in identified high hazard areas via techniques such as: planned unit developments, easements, setbacks, greenways, sensitive area tracks. Adopt land development criteria such as planned unit developments, density transfers, clustering Institute low impact development techniques on property Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff Preserve undeveloped and vulnerable shoreline Restore existing flood control and riparian corridors
Reduce vulnerability to the hazard	Raise structures above base flood elevation Elevate items within house above base flood elevation Build new homes above base flood elevation Flood-proof structures	Build redundancy for critical functions or retrofit critical buildings Provide flood-proofing when new critical infrastructure must be located in floodplains	Harden infrastructure, bridge replacement program Provide redundancy for critical functions and infrastructure Adopt regulatory standards such as freeboard standards, cumulative substantial improvement or damage, lower substantial damage threshold; compensatory storage, non-conversion deed restrictions. Adopt "no-adverse impact" floodplain management policies that strive to not increase the flood risk on downstream communities Facilitate managed retreat from, or upgrade of, the most at-risk areas

Potential Mitigation Action	Individuals	Businesses	Government
Build local capacity to respond to or prepare for the hazard	:Buy flood insurance Develop household plan, such as retrofit savings, communication with outside, 72-hour self-sufficiency during and after an event	Keep cash reserves for reconstruction Support and implement hazard disclosure for sale of property in risk zones. Solicit cost-sharing through partnerships with others on projects with multiple benefits.	Produce better hazard maps Provide technical information and guidance Enact tools to help manage development in hazard areas (stronger controls, tax incentives, and information) Incorporate retrofitting or replacement of critical system elements in capital improvement plan Develop strategy to take advantage of post-disaster opportunities Warehouse critical infrastructure components Develop and adopt a continuity of operations plan Consider participation in the Community Rating System Maintain and collect data to define risks and vulnerability Train emergency responders Create an elevation inventory of structures in the floodplain Develop and implement a public information strategy Charge a hazard mitigation fee Integrate floodplain management policies into other planning mechanisms within the planning area. Consider the probable impacts of climate change on the risk associated with the flood hazard Consider the residual risk associated with structural flood control in future land use decisions Enforce National Flood Insurance Program requirements Adopt a Stormwater Management Master Plan Develop an adaptive management plan to address the long-term impacts of sea level rise Stormwater management regulations and master planning.

Table O-7. Potential Mitigation Actions for High Surf, Coastal Flood, Erosion, and Sea Level Rise

Potential Mitigation Actions	Individuals	Businesses	Government
Manipulate the hazard	Protect, preserve and restore beaches and dunes	Protect, preserve, restore wetlands. Protect, preserve and restore beaches and dunes	Protect, preserve, restore wetlands. Protect, preserve and restore beaches and dunes Structural flood control, such as floodwalls, berms and levels

Potential Mitigation Actions	Individuals	Businesses	Government
Reduce exposure to the hazard	Participate in voluntary property acquisition/ relocation programs sponsored by federal, state or local agencies	Participate in voluntary property acquisition/relocation programs sponsored by federal, state or local agencies Preserve open space to benefit natural resources and reduce risk to structures from potential sea level rise	Consider open space land uses in areas of high risk exposure to coastal storms Acquire or relocate vulnerable properties in high risk areas impacted by coastal storms Place utilities underground when and where appropriate Consider low-density land use in high risk coastal zones Require accounting of sea level rise in all applications for new development in shoreline areas Manage development in areas at risk of sea level rise Prevent infrastructure expansion in areas at risk of sea level rise Acquire and demolish or relocate structures in areas at risk of sea level rise Preserve open space to benefit natural resources and reduce risk to structures from potential sea level rise Examine the appropriate use of beach nourishment, sand scraping, dune-gap plugs, etc., for coastal hazards Implement dune restoration, plantings, and use of natural materials Examine the appropriate use of sediment-trapping vegetation, sediment mounds, etc., for coastal hazards Plant sediment-trapping vegetation to buffer the coast against coastal storms by collecting sediment in protective features such as dunes Use bulldozers to deposit the top foot of sand above the high-tide line—to reinforce the beach without adding new sand
Reduce vulnerability to the hazard	Elevate home, especially above potential sea level rise levels. Retrofit home to meet current building code standards for wind driven forces	Retrofit facilities to meet current building code standards for wind driven forces Maintain drainage facilities that service your property	Consider higher regulatory standards to the risk exposure to coastal storms such as: higher freeboard, enclosure prohibitions, coastal zone setbacks, lower substantial damage thresholds, non-conversion deed restrictions Elevate vulnerable properties in high risk areas impacted by coastal storms Adopt/amend building codes such that they will address pre-existing properties Implement tree management programs Elevate roads that are vital/critical to evacuation and local community operations Design or enhance existing drainage systems for higher design storms to provide increased capacity of the drainage system Maintain the drainage infrastructure to levels that equal or exceed their design specifications Retrofit structures to elevate them above potential sea level rise levels

Potential Mitigation Actions	Individuals	Businesses	Government
Build local capacity to respond to or prepare for the hazard	Buy flood Insurance Stockpile property protection measures to be used once you receive notice of pending coastal storms	Develop a continuity of operations plan to address operations before, during and after coastal storm events. Buy flood Insurance Partner with personal scale and government scale partners to provide property protection components such as plywood and water resistant barriers in the preparedness phase pending coastal storms.	Develop or enhance existing plans to include comprehensive evaluation of coastal storms and the reduction of their impacts at the local level. Seek to coordinate all levels of planning with this regard Support/enhance code enforcement programs at the local level Continue to develop, enhance and implement existing emergency response plans to use new and developing technology/ information as it becomes available Develop a post-disaster action plan for coastal storm events that will address the local government operations post disaster Promote the purchase of flood insurance Adopt regulations that require the disclosure of ocean-related hazards at the time of the purchase or sale of real property Implement measures that will provide or help to provide property protection measures to property owners prior to the arrival of coastal storms Use the best available technology to provide early warning of pending coastal storms to provide ample time to implement property protection measures Educate the public on ways to protect their property before and during coastal storms, and where they can acquire the appropriate property protection measures Map and assess vulnerability to sea level rise Improve public awareness of risks due to sea level rise through outreach activities

Table O-8. Potential Mitigation Actions for Dam Failure

Potential Mitigation Actions	Individuals	Businesses	Government
Manipulate the hazard	None	Remove dams Harden dams	Remove dams Harden dams
Reduce exposure to the hazard	Relocate out of dam failure inundation areas	Replace earthen dams with hardened structures	Replace earthen dams with hardened structures Relocate critical facilities out of dam failure inundation areas Consider open space land use in designated dam failure inundation areas
Reduce vulnerability to the hazard	Elevate home to appropriate levels	Flood-proof facilities within dam failure inundation areas	Adopt higher floodplain standards in mapped dam failure inundation areas Retrofit critical facilities within dam failure inundation areas

Potential Mitigation Actions	Individuals	Businesses	Government
Build local capacity to respond to or prepare for the hazard	Learn about risk reduction for the dam failure hazard Learn the evacuation routes for a dam failure event Educate yourself on early warning systems and the dissemination of warnings	Educate employees on the probable impacts of a dam failure Develop a continuity of operations plan	Enhance emergency operations plan to include a dam failure component Institute monthly communications checks with dam operators Inform the public on risk reduction techniques Adopt real-estate disclosure requirements for the re-sale of property located within dam failure inundation areas Consider the probable impacts of climate change in assessing the risk associated with the dam failure hazard Establish early warning capability downstream of listed high hazard dams Consider the residual risk associated with protection provided by dams in future land use decisions

Table O-9. Potential Mitigation Actions for Heat

Potential Mitigation Actions	Individuals	Businesses	Government
Manipulate the hazard	None	None	None
Reduce exposure to the hazard	None	None	None
Reduce vulnerability to the hazard	Insulate house and other relevant structures Provide redundant power	Insulate buildings and other structures Provide redundant power	Consider "cool roofs" and "green roofs"
Increase the ability to respond to or be prepared for the hazard	Obtain a NOAA weather radio.	Educate employees on symptoms of heat-related illness and steps to take if they occur	Provide NOAA weather radios to the public Public education on heat safety Consider the probable impacts of climate change on the risk associated with the heat hazard Integrate cooling centers in vulnerable communities and implement public outreach to ensure people are aware of their locations

Table O-10. Potential Mitigation Actions for Earthquake

Potential Mitigation Action	Individuals	Businesses	Government
Manipulate the hazard	None	None	None
Reduce exposure to the hazard	Locate outside of hazard area (off soft soils)	Locate or relocate mission-critical functions outside hazard area where possible	Locate critical facilities or functions outside hazard area where possible

Potential Mitigation Action	Individuals	Businesses	Government
Reduce vulnerability to the hazard	Retrofit structure (anchor house structure to foundation) Secure household items that can cause injury or damage (such as water heaters, bookcases, and other appliances) Build to higher design	Build redundancy for critical functions and facilities Retrofit critical buildings and areas housing mission-critical functions	Harden infrastructure Provide redundancy for critical functions Adopt higher regulatory standards
Build local capacity to respond to or prepare for the hazard	Practice “drop, cover, and hold” Develop household mitigation plan, such as creating a retrofit savings account, communication capability with outside, 72-hour self-sufficiency during an event Keep cash reserves for reconstruction Become informed on the hazard and risk reduction alternatives available. Develop a post-disaster action plan for your household	Adopt higher standard for new construction; consider “performance-based design” when building new structures Keep cash reserves for reconstruction Inform your employees on the possible impacts of earthquake and how to deal with them at your work facility. Develop a continuity of operations plan	Provide better hazard maps Provide technical information and guidance Enact tools to help manage development in hazard areas (e.g., tax incentives, information) Include retrofitting and replacement of critical system elements in capital improvement plan Develop strategy to take advantage of post-disaster opportunities Warehouse critical infrastructure components such as pipe, power line, and road repair materials Develop and adopt a continuity of operations plan Initiate triggers guiding improvements (such as <50% substantial damage or improvements) Further enhance seismic risk assessment to target high hazard buildings for mitigation opportunities. Develop a post-disaster action plan that includes grant funding and debris removal components.

Table O-11. Potential Mitigation Actions for Climate Change

Potential Mitigation Action	Individuals	Businesses	Government
Manipulate the hazard	Modify at-home practices to reduce carbon footprint	Modify business practices to reduce carbon footprint	Adopt goals and policies for reduction of greenhouse gases
Reduce exposure to the hazard	None	Implement strategies discussed as potential mitigation actions in the other hazard charts in this section	Implement strategies discussed as potential mitigation actions in the other hazard charts in this section
Reduce vulnerability to the hazard	Implement strategies discussed as potential mitigation actions in the other hazard charts in this section	Retrofit structures to meet current building code standards discussed in the other hazard charts in this section	Retrofit structures to meet current building code standards discussed in the other hazard charts in this section

Potential Mitigation Action	Individuals	Businesses	Government
Build local capacity to respond to or prepare for the hazard	Become educated about the climate change hazard and ways to reduce greenhouse gas emissions Create a retrofit savings account	Educate employees about climate change, how it impacts natural hazard risk, and ways to reduce greenhouse gas emissions Solicit cost-sharing through partnerships with others on projects with multiple benefits.	Improve public awareness of climate change risks through outreach activities

ADAPTIVE CAPACITY

Adaptive capacity is defined as “the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences” (Intergovernmental Panel on Climate Change 2018). This term is typically used while discussing climate change adaptation; however, it is similar to the alternatives presented in the tables for building local capacity. In addition to hazard-specific capacity building, the following list provides general alternatives that the County considered to build capacity for adapting to both current and future risks:

- Incorporate climate change adaptation into relevant local and regional plans and projects.
- Establish a climate change adaptation and hazard mitigation public outreach and education program.
- Build collaborative relationships between regional entities and neighboring communities to promote complementary adaptation and mitigation strategy development and regional approaches.
- Establish an ongoing monitoring program to track local and regional climate impacts and adaptation strategy effectiveness.
- Increase participation of low-income, immigrant, non-English-speaking, racially and ethnically diverse, and special-needs residents in planning and implementation.
- Ask local employers and business associations to participate in local efforts to address climate change and natural hazard risk reduction.
- Conduct a community-wide assessment and develop a program to address health, socioeconomic, and equity vulnerabilities.
- Focus planning and intervention programs on neighborhoods that currently experience social or environmental injustice or bear a disproportionate burden of potential public health impacts.
- Use performance metrics and data to evaluate and monitor the impacts of climate change and natural hazard risk reduction strategies on public health and social equity.
- Develop coordinated plans for mitigating future flood, landslide, and related impacts through concurrent adoption of an updated general plan and local hazard mitigation plan.
- Update the 2018 *Kaua‘i Kākou–Kaua‘i County General Plan* (County General Plan) (County of Kaua‘i 2018) to reflect existing hazards and projected climate change impacts on hazards.
- Implement County General Plan hazard resiliency requirements through zoning and subdivision practices that restrict development in floodplains, landslide, and other natural hazard areas.
- Identify and protect locations where native species may shift or lose habitat due to climate change impacts (sea level rise, loss of wetlands, warmer temperatures, drought).
- Collaborate with agencies managing public lands to identify, develop, or maintain corridors and linkages between undeveloped areas.
- Promote economic diversity.
- Incorporate consideration of climate change impacts as part of infrastructure planning and operations.
- Conduct a climate impact assessment on community infrastructure.
- Identify gaps in legal and regulatory capabilities and develop ordinances or guidelines to address those gaps.
- Identify and pursue new sources of funding for hazard mitigation and adaptation activities.
- Hire new staff or provide training to current staff to ensure an adequate level of administrative and technical capability to pursue hazard mitigation and adaptation activities.

County of Kaua‘i Multi-Hazard Mitigation and Resilience Plan

Appendix P. Action Plan Detail

P. Action Plan Detail

STATUS OF ACTIONS RECOMMENDED IN THE PREVIOUS MHMRP

Table P-1 shows the status of all mitigation actions from the 2021 Multi-Hazard Mitigation and Resilience Plan (MHMRP) Update that were not directly carried over into the 2026 MHMRP Update.

Table P-1. 2021 MHMRP Update Completed or Removed Actions

2021 Action #	Short Title and Description	Contact Agency	Removal Justification
KC 1 and KC 2	Adopt and Implement International Building Code	Kauaʻi County Department of Public Works (DPW)	KC 1 and KC 2 combined into Action #1 in the 2026 MHMRP Update
KC 4	Harden State of Hawaiʻi Department of Land and Natural Resources (DLNR) radio repeater sites and base station	DLNR Division of Forestry and Wildlife (DOFAW)	Completed
KC 5	Install photovoltaic system at Kauaʻi Community College (KCC)	KCC	Completed
KC 6	Procure 4,000-gallon water truck	DLNR DOFAW	Completed
KC 7	Alternative electrical distribution feed at airport	Kauaʻi Island Utility Cooperative	Withdrawn – covered in another development project
KC 16	Develop Public Health Emergency Action Plan	State of Hawaiʻi Department of Health (DOH)	Completed
KC 17	Develop Kauaʻi Climate Adaptation and Action Resilience Plan (KCAAP)	Kauaʻi County Planning Department	Completed
KC 21	Develop tools to identify socially vulnerable population for hazard mitigation actions	Planning Department	Completed – tool developed as part of KCAAP
KC 32	Install five repeater sites for DOFAW base-yard communications	DLNR DOFAW	Completed
KC 36	Early Warning System for flood events on North Shore	Kauaʻi Emergency Management Agency (KEMA), State of Hawaiʻi Emergency Management Agency (HI-EMA)	Withdrawn – system exists
KC 37	Encourage local hazard mitigation plans	KEMA, Hanalei Watershed Hui (HWH)	KC 37 combined with KC 26 into Action 16
KC 38	Install siren on Ni'ihau	HI-EMA, KEMA	Completed
KC 39	Install public address system at KCC	KCC	Completed
KC 42	Shoreline Setback Ordinance	Planning Department	Completed – maintenance is ongoing
KC 44	Conduct Hydraulic/Hydrologic studies for North Shore rivers	HWH, Hale Hālāwai	Completed – studies conducted for the Hanalei and Waipa Rivers
KC 48	Develop program for participation in Community Rating System (CRS)	DPW	Completed – Kauaʻi County participates in CRS

2026 MHMRP UPDATE MITIGATION ACTIONS

Table P-2 shows all the mitigation actions identified for implementation as part of the mitigation strategy for the 2026 MHMRP Update. This guide will be updated as Kauaʻi County implements and prioritizes integrated actions from the 2026 MHMRP Update, the 2018 Kauaʻi County General Plan, Kauaʻi Climate Adaptation and Action Plan, Kauaʻi County Community Wildfire Protection Plan, and community plans.

There are a variety of federal, state, and local funding sources available to support the implementation of mitigation actions in the 2026 MHMRP Update. Federal funding sources include FEMA's Hazard Mitigation Grant Program, Flood Mitigation Assistance, and Emergency Management Preparedness Grants. Federal agencies such as the USACE, NOAA, and EPA also provide funding that may support the implementation of mitigation actions. The State of Hawaii has several potential funding options for mitigation actions as well. These include the State's General Fund, Capital Improvements Fund, and funding available from different state agencies. The State also recently implemented a Green Fee Program. This program increased the tax on transient accommodations to create a funding source for projects that promote environmental stewardship, visitor experience, or, notably, hazard mitigation and resilient infrastructure throughout the state (Green Fee Advisory Council 2025). There are also potential funding sources at the local level, which include the County's Capital Improvement Program and General Fund.

Table P-2. 2026 MHMRP Update Mitigation Actions

MHMRP Mitigation Actions

Mitigation Actions Applicable to All Hazards – High Priority

Action 1

Implement IBC – Continue to adopt and implement the most current IBCs and standards.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
High	All hazards	DPW, Planning	Ongoing	County General Fund (Public Works Budget) and FEMA Pre-Disaster Mitigation Funding (pending)	Medium

2021 Action Status (2021 Action Number) – combines KC 1 and KC 2, ongoing

Action 2

Infrastructure hardening plans – Assess needs for and develop implementation plans to harden critical County infrastructure and vulnerable lifelines, focusing on the elements most at risk from natural hazards

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
High	All hazards	DPW, DOT, HDOT	Long-term	FEMA HMGP, U.S. Department of Transportation (DOT), USGS, State Capital Improvements Program, and State Green Fee Funding	Medium

2021 Action Status (2021 Action Number) – KC 8, KC 13, and KC 14, ongoing, needs project specificity

Action 3

BARA Needs Assessment – Conduct an island-wide BARA needs assessment to identify refuge locations in new and existing buildings and pursue funding for retrofit of identified shortcomings to ensure refuge areas are ready for use.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
High	All hazards	KEMA, DPR, DOE	Short-term	U.S. National Guard Innovation Readiness Training (IRT), FEMA HMGP, State Capital Improvements Program, and State Green Fee Funding	High

2021 Action Status (2021 Action Number) – KC 11, ongoing, KEMA partnered with IRT teams to complete BARA assessments, working on funding for retrofits

Action 4

LCC Emergency Power Enhancement – The LCC Emergency Power application under the FEMA DR-4724 HMGP intends to strengthen LCC's emergency power and IT systems by ensuring continued County operations, response, and recovery services post-disaster, upgrading generators, transfer switches, and electrical components. This $12 million project will be implemented in two phases: P1 assess power needs, develop design and prepare bid documents; and P2 purchase and install new generator(s) and electrical systems.

MHMRP Mitigation Actions

	Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
	High	All hazards	IT, KEMA, KPD, and KFD	Short-term	FEMA HMGP, State Capital Improvements Program, State Green Fee Funding, and County Capital Improvement Program	High

2021 Action Status (2021 Action Number) – LCC Emergency Power application submitted to HI-EMA and FEMA under the DR-4724 HMGP

Action 5

KPD Emergency Power Enhancement – Emergency Power for Ka Hale Maka'i o Kaua'i (KPD) application under the FEMA DR-4724 HMGP intends to strengthen KPD's emergency power and IT systems by ensuring continued County operations, response, and recovery services post-disaster, upgrading generators, transfer switches, and electrical components. This project will be implemented in two phases: P1 – assess power needs, develop design, and prepare bid documents and P2 – purchase and install new generator(s) and electrical systems.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
High	All hazards	IT, KEMA, KPD, and KFD	Short-term	FEMA HMGP, State Capital Improvements Program, State Green Fee Funding, and County Capital Improvement Program	High

2021 Action Status (2021 Action Number) – Emergency Power for Ka Hale Maka'i o Kaua'i application submitted to HI-EMA and FEMA under DR-4724 HMGP

Action 6

DOW Emergency Power Enhancement – DOW Pump Station application under the FEMA DR-4724 HMGP intends to strengthen DOW's ability to supply water during and after emergencies. The emergency generators will allow the DOW to operate the pump stations during periods of power loss.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
High	All hazards	DOW, KIUC, KEMA	Short-term	FEMA HMGP, State Capital Improvements Program, State Green Fee Funding, and County Capital Improvement Program	High

2021 Action Status (2021 Action Number) – DOW Pump Station Emergency Power application submitted to HI-EMA and FEMA under DR-4724 HMGP

Action 7

KFD High Wind Retrofit – Fire Station High Wind Retrofit (KFD) application under the FEMA DR-4724 HMGP intends to strengthen KFD's eight fire stations by replacing the current roll-up station apparatus doors to hurricane-resistant side-mounted bifold doors. The newly retrofitted high wind doors will create a more resilient fire department that will be able to respond to multiple hazards more effectively. The doors will be operable during periods of power loss.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness

MHMRP Mitigation Actions						
	High	All hazards	KFD, KEMA	Short-term	FEMA HMGP, State Capital Improvements Program, State Green Fee Funding, and County Capital Improvement Program	High
	2021 Action Status (2021 Action Number) – Fire Station High Wind Retrofit application submitted to HI-EMA, and FEMA under DR-4724 HMGP					
Mitigation Actions Applicable to Multiple Hazards – High Priority						
Action 8	**Levee and Dam Maintenance –** Inspect, repair, and maintain levees and dams to reduce and/or prevent impacts from potential dam failure disasters.					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**
	High	Dam failure, inland flooding	DLNR Engineering, DPW, KEMA	Ongoing	FEMA HHPD, State General Fund, and Private Dam or Levee Owner/Operator	Medium
	2021 Action Status (2021 Action Number) – KC 25, ongoing, DLNR, County of Kaua'i, and FEMA hosted a series dam safety workshops under FEMA CTA program					
Action 9	**Assess Flood Drainage Problems –** Assess watershed and community flood drainage problems.					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**
	High	Inland flooding, hurricanes	DPW, Planning, OED, KEMA, ADC, DHHL	Ongoing	FEMA Flood Mitigation Assistance (FMA) Grant, NOAA, EPA, State Capital Improvements Program, State Green Fee Funding, and County Capital Improvement Program	Medium
	2021 Action Status (2021 Action Number) – KC 46, ongoing, some studies on North Shore rivers with Hau tree removal to improve drainage					
Action 10	**Repetitive Loss Property Analysis** – Conduct an analysis of NFIP repetitive loss and severe repetitive loss properties. Identify mitigation actions to reduce the impact of flood.					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**
	High	Inland and coastal flooding	KEMA	Short-term	FEMA Swift Current Grant Program, State Capital Improvements Program, and County Capital Improvement Program	High

MHMRP Mitigation Actions

2021 Action Status (2021 Action Number) – new action

Mitigation Actions Applicable to Multiple All – Medium Priority

Action 11

Mitigate Community Climate Change Risks – Reduce impacts from Climate Change risks through the implementation of mitigation actions, including those already identified in regional community plans and assessments, such as the West Kauaʻi Community Plan, the West Kauaʻi Community Vulnerability Assessment, and the East Kauaʻi Community and Circulation Plan.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	All hazards	Planning, DLNR, HDOT	Short-term	State General Fund, State Green Fee Funding, and County General Fund	Medium

2021 Action Status (2021 Action Number) – KC 18, ongoing

Action 12

Community Disaster Resilience Plans – Integrate community-based disaster resilience plans into future community plan updates.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	All hazards	Planning, KEMA, OED	Ongoing	State General Fund, State Green Fee Funding, County General Fund, and FEMA HMGP	Medium

2021 Action Status (2021 Action Number) – KC 26 and KC 37, ongoing, Opportunity with Anahola Aina Alliance Build Back Better Report

Action 13

Code and Regulation Updates to Facilitate Adaptation Strategies – Review, update, and implement codes and regulations to incorporate adaptation strategies, nature-based solutions, and low impact development strategies.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	All hazards	Planning, PW, KEMA	Ongoing	County General Fund, USDA, and EPA	Medium

2021 Action Status (2021 Action Number) – KC 43, ongoing

Action 14

GIS and Data Enhancement – Update, maintain, and enhance the use of the County's GIS and databases to improve decision-making and ensure consistency in planning, permitting, and construction regulations to reduce disaster risk.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	All hazards	Planning, DPW, KEMA	Ongoing	FEMA HMGP, State General Fund, and County General Fund	High

2021 Action Status (2021 Action Number) – KC 40, Planning submitted an application under FEMA DR-4724 HMGP to improve County's GIS capabilities

MHMRP Mitigation Actions

Action 15

Establish resilience hubs – Establish resilience hubs for community coordination, sheltering, public education, and other goals. In addition, the hubs would serve as decentralized command/supply centers.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	All hazards	OED, Planning, KEMA	Long-term	State General Fund, County General Fund, FEMA HMGP, and NOAA	Medium

2021 Action Status (2021 Action Number) – KC 29, several communities are interested, several folks attended Vibrant Hawaiʻi Resilience Hub conference

Action 16

Implement Kauaʻi Pre-Disaster Recovery Framework Next Steps – Implement the Policy Recommendations and Recommended Next Steps from the 2025 Strategic Way Forward Report for the Kauaʻi Pre-Disaster Recovery Framework.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	All hazards	Planning, KEMA, OED	Short-term	State General Fund, County General Fund, NOAA, and FEMA HMGP	Medium

2021 Action Status (2021 Action Number) – new action implementing KC 27, KC 30, and KC 37

Action 17

Multi-Hazard Event Preparedness – Conduct training and exercises for multi-hazard events.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	All hazards	KEMA, HI-EMA	Ongoing	U.S. Department of Homeland Security (DHS) Emergency Management Performance Grant (EMPG), DHS Homeland Security Grant Program, State General Fund, and County General Fund	Medium

2021 Action Status (2021 Action Number) – KC 28, ongoing

Action 18

Update County Emergency Management Plans – Review and update County Emergency Management Plans.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	All hazards	KEMA	Ongoing	DHS EMPG, US National Guard IRT, State General Fund, and County General Fund	Medium

2021 Action Status (2021 Action Number) – KC 41, ongoing

MHMRP Mitigation Actions

Action 19 **Increase Disaster Management Capacity –** Identify Federal, State, and County resources to build capacity for preparedness, response, recovery, and mitigation.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	All hazards	KEMA, HI-EMA	Ongoing	DHS EMPG, DHS HSGP, State General Fund, and County General Fund	Medium

2021 Action Status (2021 Action Number) – KC 27 and KC 30, ongoing

Action 20 **Hazard Mitigation Public Outreach** – Develop and maintain public awareness of hazards, vulnerability, mitigation, and adaptation strategies.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	All hazards	Planning Department, KEMA, DLNR	Ongoing	NOAA, HUD, FEMA HMGP, State General Fund, and County General Fund	Medium

2021 Action Status (2021 Action Number) – KC 20, ongoing

Action 21 **Public Health Preparedness Campaign –** Conduct a public awareness and education campaign to promote public health preparedness, highlighting results of annual CASPER survey.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	All hazards	KDHO, KEMA	Long-term	Hawaii State Department of Health	Medium

2021 Action Status (2021 Action Number) – KC 15, ongoing, most recent CASPER completed June, 2025

Action 22 **Agriculture Outreach and Mitigation –** Assess vulnerability of agricultural properties and develop public outreach and mitigation strategies.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	All hazards	OED, Planning, KEMA, ADC, DHHL, OHA	Ongoing	USDA, NRCS, EPA, and State General Fund	Medium

2021 Action Status (2021 Action Number) – KC 45, ongoing

Action 23 **UH Sea Grant Program Public Resources Campaign –** Distribute UH Sea Grant publication and Homeowners Handbook to support education and outreach to increase awareness of hazards and hazard mitigation. Target audience to include island youth (e.g., CSAV), visitor populations, and other vulnerable populations.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	All hazards	UH Sea Grant, KEMA, Planning	Ongoing	NOAA, HUD, EPA, FEMA HMGP, State Capital Improvements Program, and State Green Fee Funding	Medium

2021 Action Status (2021 Action Number) – KC 19, ongoing, UH Sea Grant considering updating Handbook

MHMRP Mitigation Actions						
Action 24	**Habitat Protection and Restoration –** Protect and restore the integrity of native habitats, especially Kauaʻi's last remaining pristine native habitats in the upper watersheds**.** Focus on areas most at risk from natural hazards.					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**
	Medium	All hazards	DLNR	Long-term	FEMA HMGP, State Capital Improvements Program, State Green Fee Funding, NOAA, and EPA	Medium
	2021 Action Status (2021 Action Number) – KC 9, ongoing**,** needs project specificity					
Action 25	**Invasive Species Mitigation –** Develop and implement strategies to mitigate the impacts of invasive species, including post-disaster biosecurity measures, that increase Kauaʻi's vulnerability to natural hazards: inland flooding, coastal flooding, SLR, high wind, wildfire, and landslide					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**
	Medium	All hazards	DLNR	Long-term	NOAA, EPA, FEMA HMGP, State Capital Improvements Program, and State Green Fee Funding	Medium
	2021 Action Status (2021 Action Number) – KC 10, ongoing, needs project specificity					
Mitigation Actions Applicable to Multiple Hazards – Medium Priority						
Action 26	**Beach and Dune Restoration** – Pursue beach and dune restoration to mitigate impacts from coastal hazards and SLR.					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**
	Medium	Coastal flood, SLR	DPR, DPW, Planning	Long-term	NOAA, USFWS, State General Fund, State Green Fee Funding, and County General Fund	Medium
	2021 Action Status (2021 Action Number) – KC 31, ongoing, applications for grant funding pending					
Action 27	**Update and Implement Shoreline Setback Ordinance –** Continue to update and implement the shoreline setback ordinance, taking into account the best available science with respect to erosion and SLR.					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**
	Medium	Coastal flood, SLR	Planning, DPW, KEMA	Ongoing	County General Fund	Medium
	2021 Action Status (2021 Action Number) – KC 42, ongoing					
Action 28	**Analyze Wastewater Vulnerabilities –** Conduct analysis of vulnerable lifelines to County WWF: Eleʻele, Waimea, Līhuʻe, and Wailua WWF and implement mitigation actions.					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**

MHMRP Mitigation Actions						
	Medium	Flooding, tsunami, SLR, wildfire	DPW, DOH, EPA	Long-term	EPA, NOAA, State Capital Improvements Program, State Green Fee Funding	Medium
	2021 Action Status (2021 Action Number) – KC 12, could also be merged with Action #3					
Mitigation Actions for Wildfire						
Action 29	**Kaua‘i CWPP Mitigation Action Implementation** – Implement priority projects and actions from 2024 Kaua‘i CWPP appendix, including Fire-Adapted Kaua‘i, Anahola Resilient Landscapes, and Kōke‘e Fuels Reduction.					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**
	High	Wildfire	KFD, DPW, HWMO	Short-term	USFS, FEMA HMGP, State General Fund, State Green Fee, and County General Fund	Medium
	2021 Action Status (2021 Action Number) – new actions, implementing KC 34					
Action 30	**Wildfire Mitigation Action Implementation** – Implement priority projects and actions from 2024 Kaua‘i CWPP appendix, including Fire-Adapted Kaua‘i, Anahola Resilient Landscapes, and Kōke‘e Fuels Reduction, along with other wildfire mitigation activities.					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**
	High	Wildfire	KFD, DPW, HWMO	Short-term	USFS, FEMA HMGP, State General Fund, State Green Fee Funding, and County General Fund	Medium
	2021 Action Status (2021 Action Number) – new actions, implementing KC 34					
Action 31	**Increase Wildfire Fighting Capability –** Integrate new equipment to increase wildfire fighting capability.					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**
	High	Wildfire	KFD, DLNR DOFAW	Ongoing	State General Fund, State Green Fee Funding, County General Fund, and USFS	High
	2021 Action Status (2021 Action Number) – KC 33**,** ongoing acquisitions by KFD and DOFAW					
Mitigation Actions for Tropical Cyclones and Other High Winds						
Action 32	**KWMCH High Wind Retrofit –** High Wind Retrofit of exhibition halls in the KWMCH to current building codes. The KWMCH to be used as a BARA during natural disasters. Project to be funded under FEMA HMGP.					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**

MHMRP Mitigation Actions						
	High	Tropical cyclones and other high winds	DPR, KEMA	Short-term	FEMA HMGP, State Capital Improvements Program, County Capital Improvement Program	High
	2021 Action Status (2021 Action Number) – KC 3, Phase 1 completed, awaiting FEMA review and approval of Phase 2 (Implementation)					
Mitigation Actions for Landslides						
Action 33	**Landslide Risk and Mitigation** – Identify landslide risk areas, geospatial data needs, and mitigation strategies.					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**
	High	Landslide	Planning, DPW, KEMA, DLNR	Ongoing	USGS, FEMA HMGP, DOT, State General Fund	Medium
	2021 Action Status (2021 Action Number) – KC 49, ongoing together with Action #24					
Mitigation Actions for Drought						
Action 34	**Water Scarcity Infrastructure Hardening Plan –** Conduct a needs assessment and develop implementation plans for hardening the County's water and wastewater critical infrastructure and lifelines, increasing resiliency during periods of water scarcity.					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**
	High	Drought	DOW	Ongoing	USGS, NOAA, EPA, FEMA HMGP, State Capital Improvements Program, State Green Fee	High
	2021 Action Status (2021 Action Number) – new action					
Mitigation Actions for Inland Flooding						
Action 35	**Maintain NFIP Compliance –** Maintain NFIP compliance through implementation of floodplain management programs.					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**
	High	Inland flooding	DPW, Planning, OED, KEMA	Ongoing	State General Fund, County General Fund, FEMA FMA, NOAA	Medium
	2021 Action Status (2021 Action Number) – KC 47, ongoing, Kaua'i continues to be under CRS (KC 48)					
Action 36	**Waimea River Levee Reestablishment** – Implement USACE assessment of Waimea River levee to reestablish USACE/FEMA accreditation and coverage under the NFIP.					
	Priority	**Hazards Mitigated**	**Lead Agency, Supporting Agencies**	**Timeline**	**Sources of Funding**	**Cost-Effectiveness**

MHMRP Mitigation Actions

High	Inland flooding	DPW, KEMA, USACE	Short-term	Act 35 funds, State Capital Improvements Program, USACE (via Senator Schatz’s office)	High

2021 Action Status (2021 Action Number) – KC 24, USACE completed Semiquantitative Risk Assessment and will provide recommendations on steps for levee to be reaccredited

Action 37 **Hanapēpē River Levee Reestablishment –** Implement USACE assessment of Hanapēpē River levee to reestablish USACE/FEMA accreditation and coverage under the NFIP.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
High	Inland flooding	DPW, KEMA, USACE	Short-term	Act 35 funds, State Capital Improvements Program, USACE (via Senator Schatz’s office)	High

2021 Action Status (2021 Action Number) – KC 23, USACE completed Semiquantitative Risk Assessment and will provide recommendations on steps for levee to be reaccredited

Mitigation Actions for Tsunamis

Action 38 **Tsunami Education and Outreach –** Prepare and implement a comprehensive tsunami education and outreach campaign to reduce impact of the hazard. Examples include public service announcements, web page updates, and flyers. Maintain signage and sirens that were installed as part of the updated scenarios for tsunami evacuation zones.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	Tsunami	KEMA, HI-EMA, DPR	Ongoing	NOAA Tsunami Hazard Mitigation Program, FEMA, State General Fund, and County General Fund	Medium

2021 Action Status (2021 Action Number) – KC 35, ongoing, sirens = all hazards, evacuation signage

Mitigation Actions for Dam Failure

Action 39 **Studies for Twin Reservoir Dams Decommission:** Conduct the planning, permitting, and design necessary to decommission Two Reservoir Dams, including topographic mapping, subsurface geotechnical investigation, structural engineering services, resubmittal of the Conditional Letter of Map Revision and geomorphological recommendations to restore the section of Konohiki Stream through the project site and establish stable channel geometries.

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	Dam failure	KEMA, State of Hawai‘i Dam Safety Program	Short-term	FEMA HHPD, State General Fund	High

2021 Action Status (2021 Action Number) – new action

Mitigation Actions for Cyber Security

Action 40 **Cyber Security Enhancement** – Identify and implement enhanced cyber-security measures across County government agencies.

MHMRP Mitigation Actions

Priority	Hazards Mitigated	Lead Agency, Supporting Agencies	Timeline	Sources of Funding	Cost-Effectiveness
Medium	Cyber	IT, KEMA, KPD, and KFD	Short-term	U.S. National Guard IRT, State Office of Homeland Security, State Capital Improvements Program	Medium

2021 Action Status (2021 Action Number) – KC 22, ongoing, KEMA arranged for an IRT Mission for initial assessment, applied for follow-up mission next year

Notes:
ADC = Agribusiness Development Corporation
BARA = Best Available Refuge Area
CASPER = Community Assessment for Public Health Emergency Response
County = County of Kaua‘i
CRS = Community Rating System
CSAV = Center for the Study of Active Volcanoes
CTA = Planning for Dam Emergencies Collaborative Technical Assistance
CWPP = Community Wildfire Protection Plan
DHHL = Department of Hawaiian Home Lands
DHS = U.S. Department of Homeland Security
DLNR Engineering = Hawai‘i Department of Land and Natural Resources Engineering Division
DOE = U.S. Department of Energy
DOH = State of Hawai‘i Department of Health
DOT = U.S. Department of Transportation
DOW = Kaua‘i County Department of Water
DPR = County of Kaua‘i Department of Parks and Recreation
DPW = County of Kaua‘i Department of Public Works
EMPG = Emergency Management Prepardness Grant
EPA = U.S. Environmental Protection Agency
FEMA = Federal Emergency Management Agency
FMA = Flood Mitigaiton Assistance
GIS = geographic information system
HDOT = State of Hawai‘i Department of Transportation
HHPD = Rehabilitation of High Hazard Potential Dam Grant Program
HI-EMA = State of Hawai‘i Emergency Management Agency
HMGP = Hazard Mitigation Grant Program
HUD = U.S. Department of Housing and Urban Development
HWMO = Hawai‘i Wildfire Management Organization
IBC = International Building Code
IRT = Innovative Readiness Training
IT = information technology
KEMA = Kaua‘i Emergency Management Agency
KFD = Kaua‘i Fire Department
KIUC = Kaua‘i Island Utility Cooperative
KPD= Kaua‘i Police Department (Ka Hale Maka‘i o Kaua‘i)
KWMCH = Kaua‘i War Memorial Convention Hall
LCC = Līhu‘e Civic Center
NFIP = National Flood Insurance Program
NOAA = National Oceanic and Atmospheric Administration
OED= County of Kaua‘i Office of Economic Development
Planning = County of Kaua‘i Planning Department
SLR = Sea Level Rise
UH Sea Grant = University of Hawai‘i Sea Grant College Program
USACE = U.S. Army Corps of Engineers
USDA = U.S. Department of Agriculture
USFA = U.S. Fire Administration
USFS = U.S. Forest Service
USFWS = U.S. Fish and Wildlife Service
USGS = U.S. Geological Survey
WWF = wastewater facilities

County of Kauaʻi Multi-Hazard Mitigation and Resilience Plan

Appendix Q. Adoption and Approval

Q. Adoption and Approval

U.S. Department of Homeland Security
FEMA Region 9
1111 Broadway, Suite 1200
Oakland, CA 94607

FEMA

May 21, 2026

David Kennard
Disaster Assistance Project Manager
Kauai Emergency Management Agency
3990 Kaana Street, Suite 100
Lihue, HI 96766

Reference: Hazard Mitigation Plan Approval
Kauaʻi County, HI

Dear David Kennard:

The 2026 Kauaʻi County Hazard Mitigation Plan was officially adopted by Kauaʻi County and submitted for final review and approval to the Federal Emergency Management Agency (FEMA). FEMA confirms this plan meets the requirements of the Code of Federal Regulations, Title 44, Part 201, Section 6 (44 C.F.R. 201.6).

FEMA approves this plan for five years with an effective date of May 1, 2026, which is the completion date of our final review. To maintain grant eligibility, Kauaʻi County must review, update, and resubmit the plan to FEMA before **April 30, 2031**.

While local mitigation plans may include additional content to meet Element H: Additional State Requirements or other local objectives, FEMA's approval only applies to elements required by its *Local Mitigation Planning Policy Guide* (FP-206-21-0002).

This plan approval ensures eligibility for project grants under FEMA's Hazard Mitigation Assistance programs, including the Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC) program, HMGP Post-Fire, Flood Mitigation Assistance (FMA), and Safeguarding Tomorrow Revolving Loan Fund (STORM RLF). Funding requests are reviewed individually for eligibility and other program requirements.

In addition, Kauaʻi County met the requirements for addressing all dam risks listed in the local mitigation plan and is therefore eligible for project grants under FEMA's Rehabilitation of High Hazard Potential Dams Grant Program. Again, all requests for funding are evaluated individually according to eligibility and other program requirements.

Thank you for your continued commitment to reducing risk and enhancing community safety. If you have any questions about the planning or review process, please contact the FEMA Region 9 Hazard Mitigation Planning Team at fema-r9-mitigation-planning@fema.dhs.gov.

Sincerely,

KATHRYN J LIPIECKI

Digitally signed by KATHRYN J LIPIECKI
Date: 2026.05.21 21:01:55 -07'00'

Kathryn Lipiecki
Director, Mitigation Division
FEMA Region 9

Enclosure (1)
Kauaʻi County Plan Review Tool, dated May 1, 2026

cc: Alison Kearns, Planning and Implementation Branch Chief, FEMA Region 9
Kelsey Yamanaka, State Hazard Mitigation Officer, Hawai'i Emergency Management Agency

KAUA'I EMERGENCY MANAGEMENT AGENCY
ELTON S. USHIO, ADMINISTRATOR

DEREK S.K. KAWAKAMI, MAYOR
REIKO MATSUYAMA, MANAGING DIRECTOR

May 1, 2026

RE: Adoption of the County of Kaua'i Multi-Hazard Mitigation and Resilience Plan 2026

WHEREAS, Kaua'i County is subject to various natural hazards, including hurricanes, tsunamis, inland flooding, landslides, high surf, coastal erosion, wildfires, and droughts; and

WHEREAS, these natural hazards have caused and will continue to cause physical and financial impacts to the County's population, environment, economy, and infrastructure; and

WHEREAS, an effective mitigation strategy, including measures to prepare for and mitigate against the risks posed by these natural hazards, should be implemented to significantly reduce the vulnerabilities, risks, and impacts; and

WHEREAS, partnerships with all levels of government, the private sector, community organizations, and citizens can effectively plan, fund, and implement mitigation projects.

NOW, THEREFORE, I, DEREK S.K. KAWAKAMI, MAYOR OF THE COUNTY OF KAUA'I, approve and adopt this 2026 update of the County of Kaua'i Multi-Hazard Mitigation and Resilience Plan (Plan) in compliance with the Disaster Mitigation Act of 2000 (Public Law 106-390). This Plan updates the previous Plan adopted in 2021.

Kaua'i County is subject to various natural hazards, including hurricanes, tsunamis, inland flooding, landslides, high surf, coastal erosion, wildfires, and droughts. These hazards have caused and will continue to cause physical and financial impacts to the County's population, environment, economy, and infrastructure. The County continues to pursue a comprehensive, multi-hazard strategy to prepare for and mitigate against the risks posed by these natural hazards. Therefore, I approve and adopt this 2026 update of the County of Kaua'i Multi-Hazard Mitigation and Resilience Plan (Plan) in compliance with the Disaster Mitigation Act of 2000 (Public Law 106-390). This Plan updates the previous Plan adopted in 2021.

With the adoption of this Plan update, the County is positioned to prioritize and leverage its resources when applying for various hazard mitigation funding, particularly the FEMA Hazard Mitigation Assistance programs, in coordination with the State of Hawai'i Multi-Hazard Mitigation Plan, federal requirements, and in partnership with the County's citizens, private sector, and community organizations.

Approved:

Derek S.K. Kawakami
Mayor

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