

Preparing Your Family & Residence for Natural Hazards (Hurricanes, Tsunamis, Flooding, Wildfire)

By

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Resilient · Adaptive · Sustainable

University of Hawai'i Sea Grant College Program

Now Available online as free PDF –
<http://bit.ly/HawaiiHomeownersHandbook>



TSUNAMIS



HURRICANES



EARTHQUAKES



FLOODS

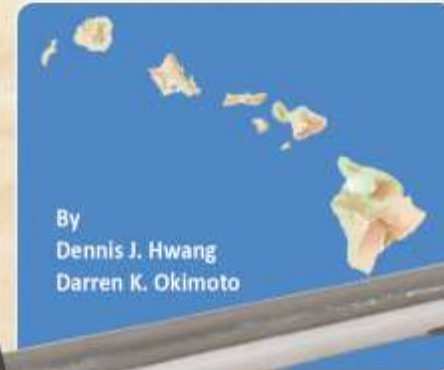


VOLCANO



CLIMATE CHANGE

HOMEOWNER'S HANDBOOK



**TO PREPARE FOR
NATURAL HAZARDS**

Fourth Edition



First Aid Kit



TSUNAMIS



HURRICANES



EARTHQUAKES



FLOODS

UNIVERSITY OF HAWAII'S SEA GRANT COLLEGE PROGRAM

2025

University of Hawai'i Sea Grant College Program HOMEOWNER'S HANDBOOK TO PREPARE FOR NATURAL HAZARDS

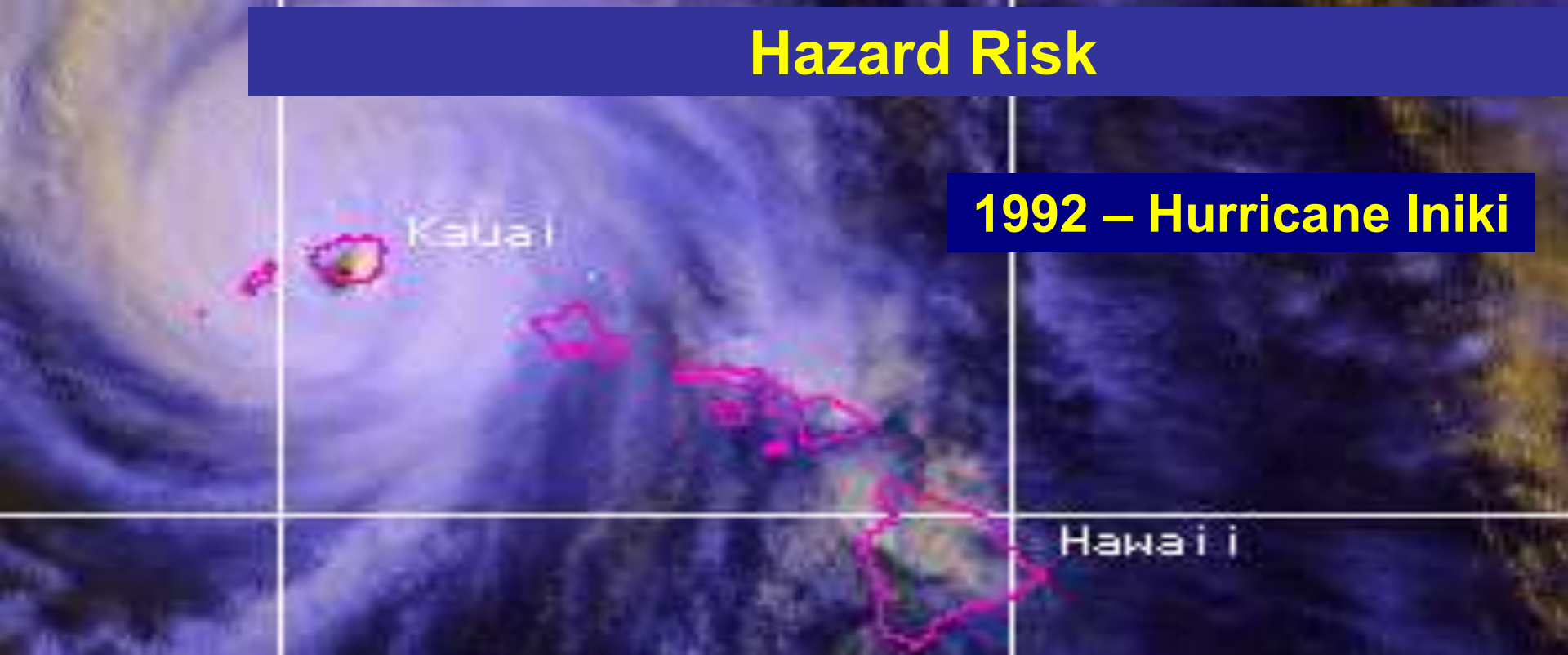


Scan the QR code to access the digital version of the "Homeowner's Handbook to Prepare for Natural Hazards"

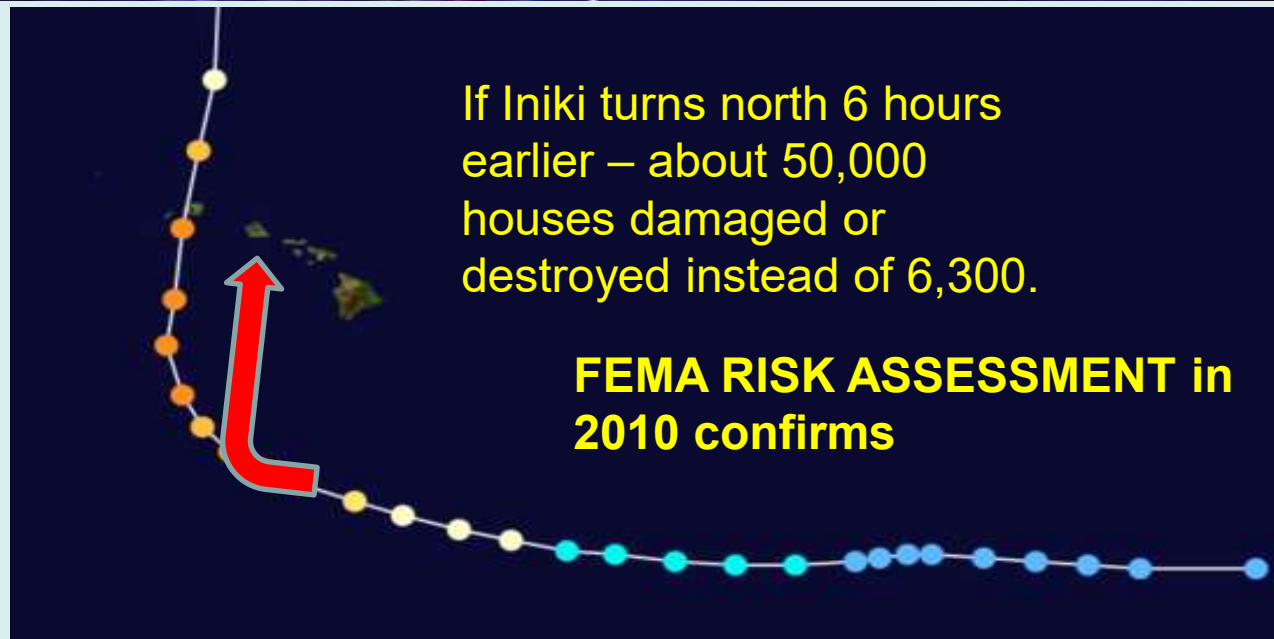
Scan the QR code to learn more about our risks and how to stay safe in this 16-minute 2025 Hawai'i Tsunami Preparedness video



Hazard Risk



1992 – Hurricane Iniki



If Iniki turns north 6 hours earlier – about 50,000 houses damaged or destroyed instead of 6,300.

FEMA RISK ASSESSMENT in 2010 confirms

March Kona Low Storms





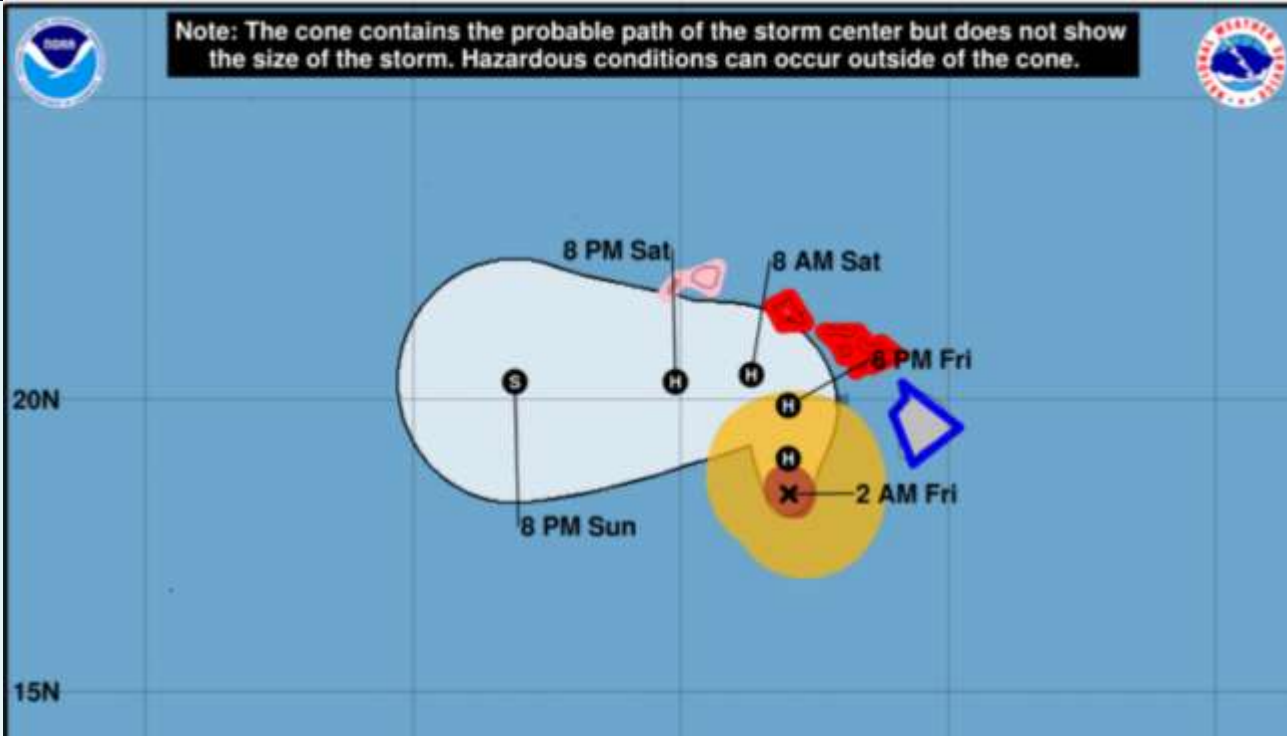
Triple Threat – Wind, Surge, and Flooding

- 1. Wind** greatest – right front quadrant. Significantly less left – front quadrant. Difference function of forward movement speed. For Iniki – right front quadrant - Cat. 4 left front quadrant – Cat 1 - Huge differences in wind forces.
- 2. Storm Surge** – Generally greatest on right front quadrant.
- 3. Flooding** – flooding - streams

Note – Iniki fast moving system. Not as much rainfall. Great dichotomy wind speed with quadrant.

2018 Hurricane Lane

If Category 2 hits Oahu,
52,000 households
displaced – \$27 billion
in damages – 2018
Pacific Disaster Center
Study using FEMA
HAZUS Tool.



14 – Day Supply of Non-Perishable Food and Water

1 case = 5.3 gallons
11 cases?

Get Sanitized
Plastic Containers

Water Bob at Amazon –
100 gallons - \$35



Tips:

- 1) Buy food will normally use
- 2) Long shelf life
- 3) Mark expiration with Sharpie
- 4) Consume year before and restock
- 5) If about to expire – give to Foodbank
- 6) Buy as much as you can for family – Excess if you can for the needy.

Evacuation Kit

Go Bag



Carry in a backpack or duffle bag, a three-day supply, or as much as you can if your emergency plan involves evacuation.

City and County of Honolulu Department of Emergency Management



HNL ALERT

OFFICIAL NOTIFICATION SYSTEM OF
THE CITY AND COUNTY OF HONOLULU

GET ALERTS ABOUT:
Severe Weather
Emergency Info
Road Closures
Ocean Conditions
Water Main Breaks
and more!

Sign up for O'ahu's
NEW notification
system at hnlalert.gov

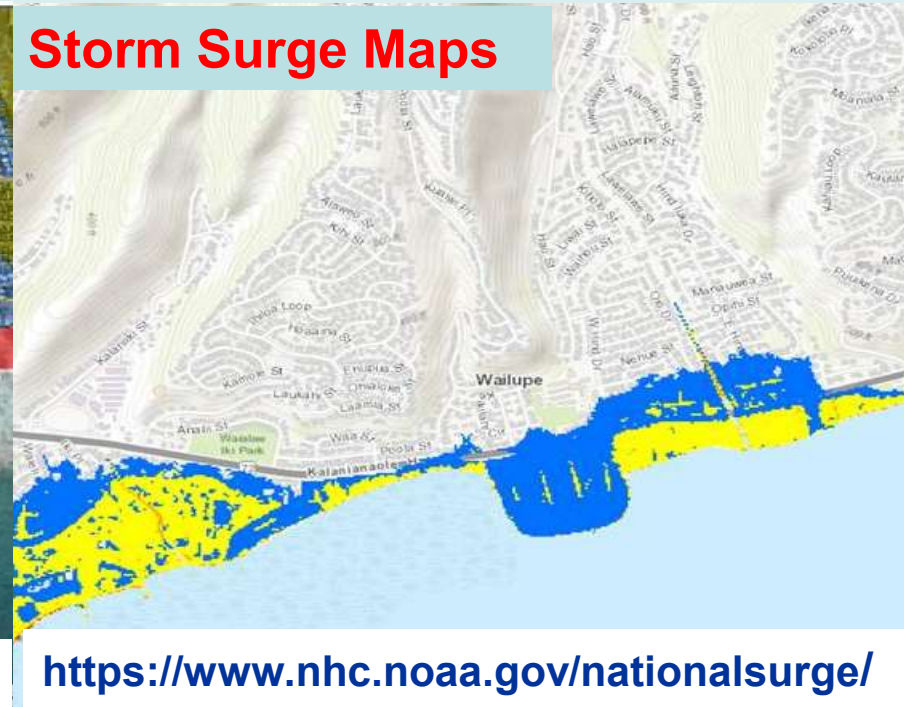
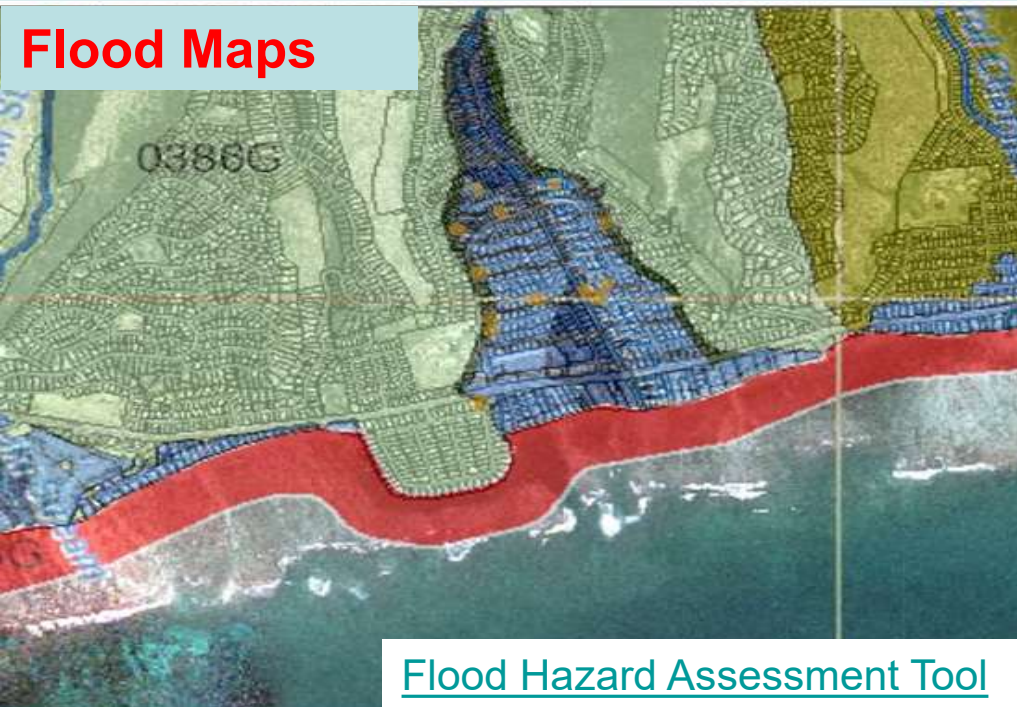
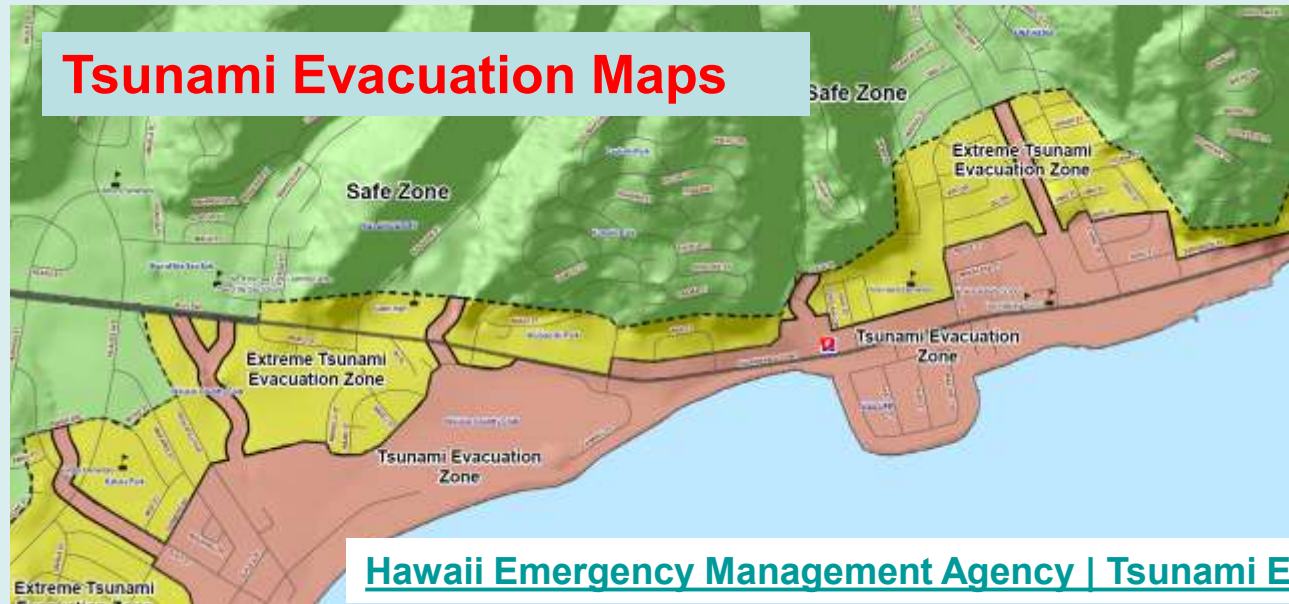
GET ALERTS BY TEXT, EMAIL, OR IN THE APP

County Website at: <http://www.honolulu.gov/dem>

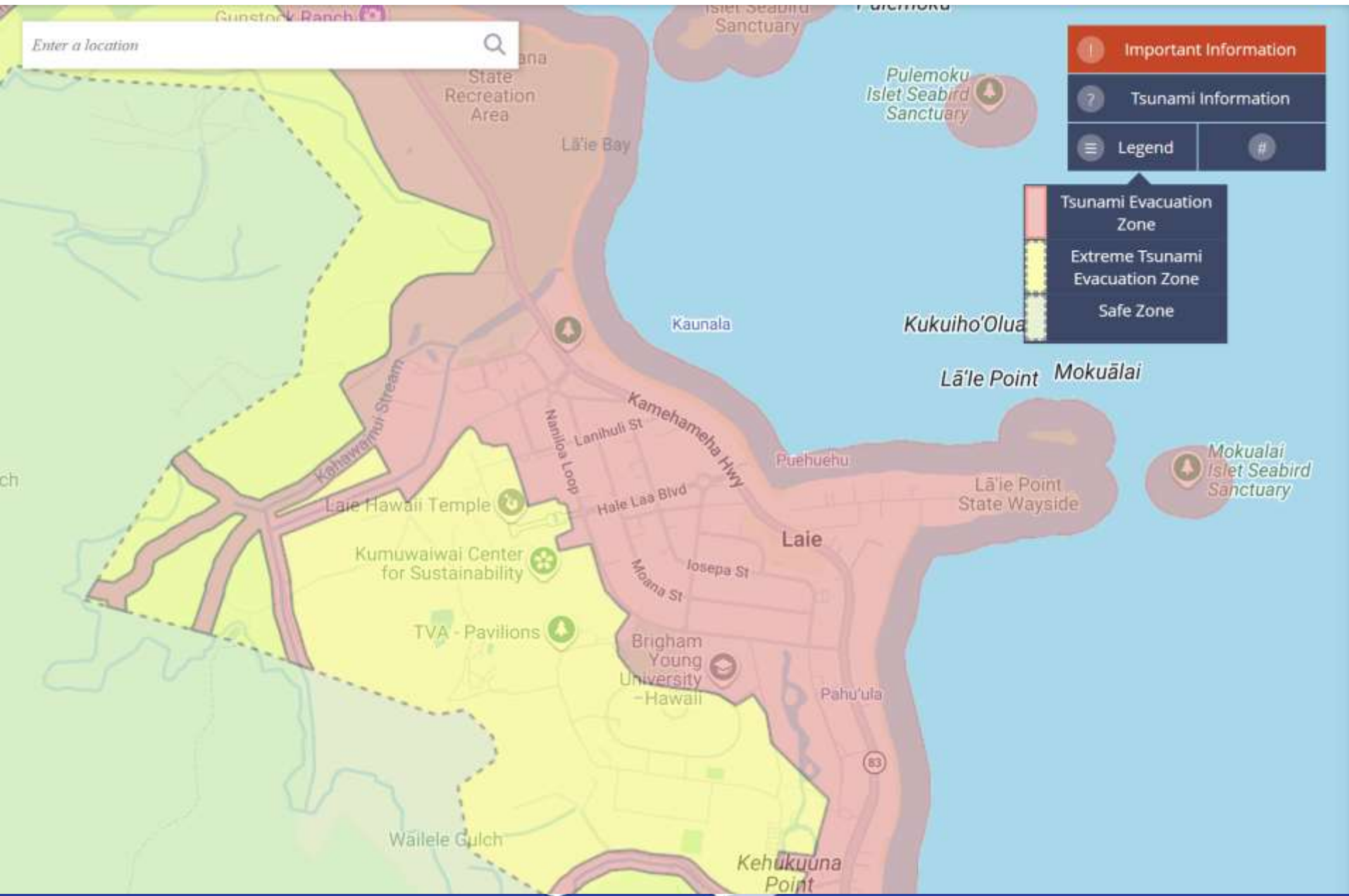
Emergency Notifications at: hnlalert.gov

Tsunami Evacuation Maps at: www.honolulu.gov/tsunamievac

Know Your Hazard Zones!!! Wait for Instructions from Local EM



Hawaii Emergency Management Agency | Tsunami Evacuation Zones

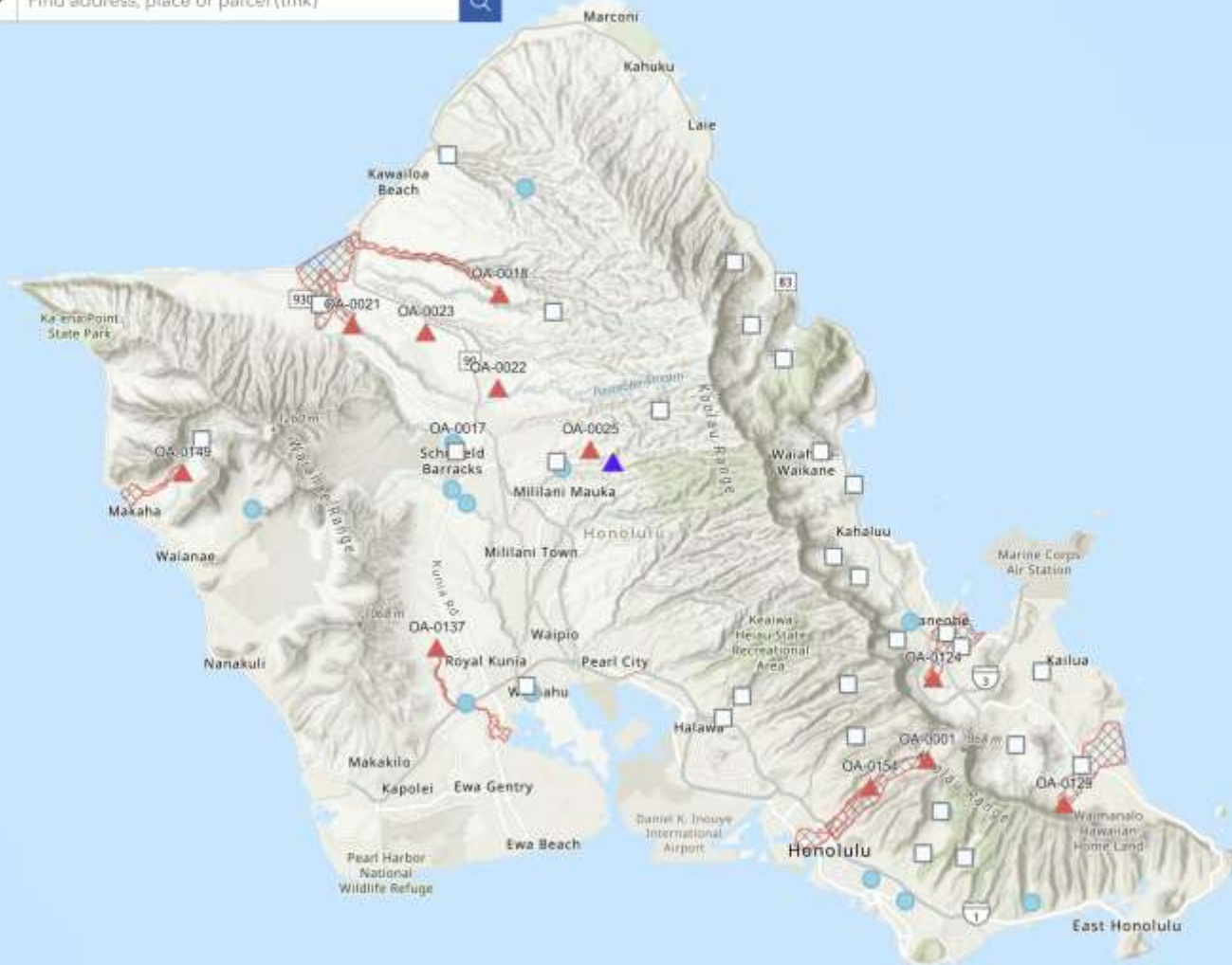


No Dam Evacuation Zone for Laie

State of Hawaii Dam Evacuation Zones



Find address, place or parcel (tmk)



Map Layers

Live Stream Gauges

Status

- Major Flood
- Moderate Flood
- Minor Flood
- Action Stage
- Low Flow
- Unknown
- No Flooding

Regulated Dams

Downstream Hazard Potential

- High
- Low
- Significant

Unregulated Dams and Other Water Bodies

Parcels (TMK)

Dam Evacuation Zones



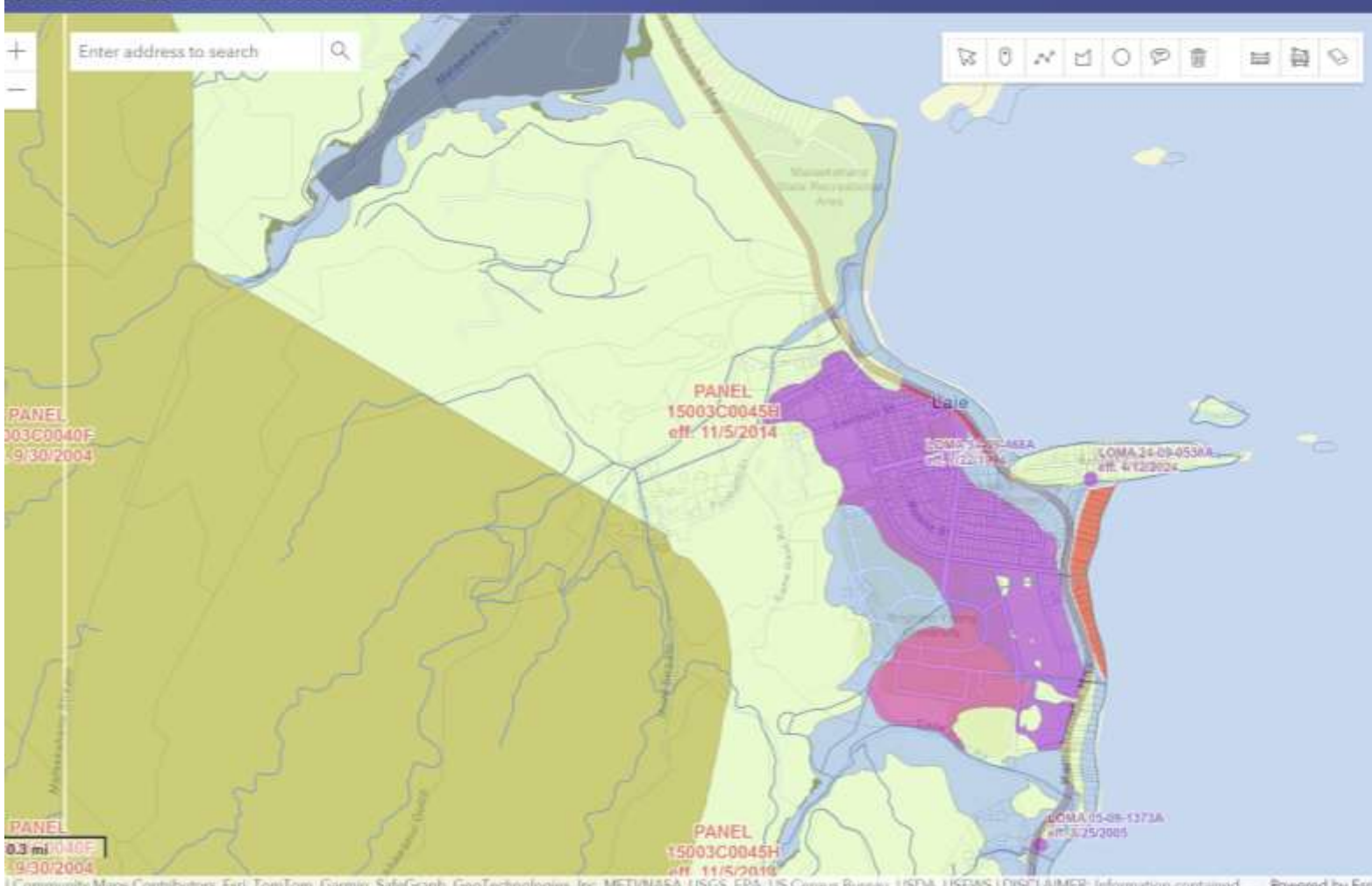
State of Hawaii Dam Evacuation Zones

UH Sea Grant College Program



SCHOOL OF OCEANOGRAPHY AND EARTH SCIENCE AND TECHNOLOGY

Flood Hazard Assessment Tool



- Water Lines
- Flood Hazard Zones
- Zone A
 - Zone AE
 - Zone AEF (Floodway)
 - Zone AH
 - Zone AO
 - Zone D
 - Zone VE
 - Zone VE
 - Zone X
 - Zone XS (X shaded)
 - Zone X Protected by Levee

Statewide Parcels

Parcels

- NGS Datasheets
- Elevation Certificate Generator
- Flood Insurance Studies
- State Regulated Dams

Community Maps Contributors, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc., METVNASA, USGS, EPA, US Census Bureau, USDA, USFWS | DISCLAIMER: Information contained ... Powered by Esri

UH Sea Grant College Program



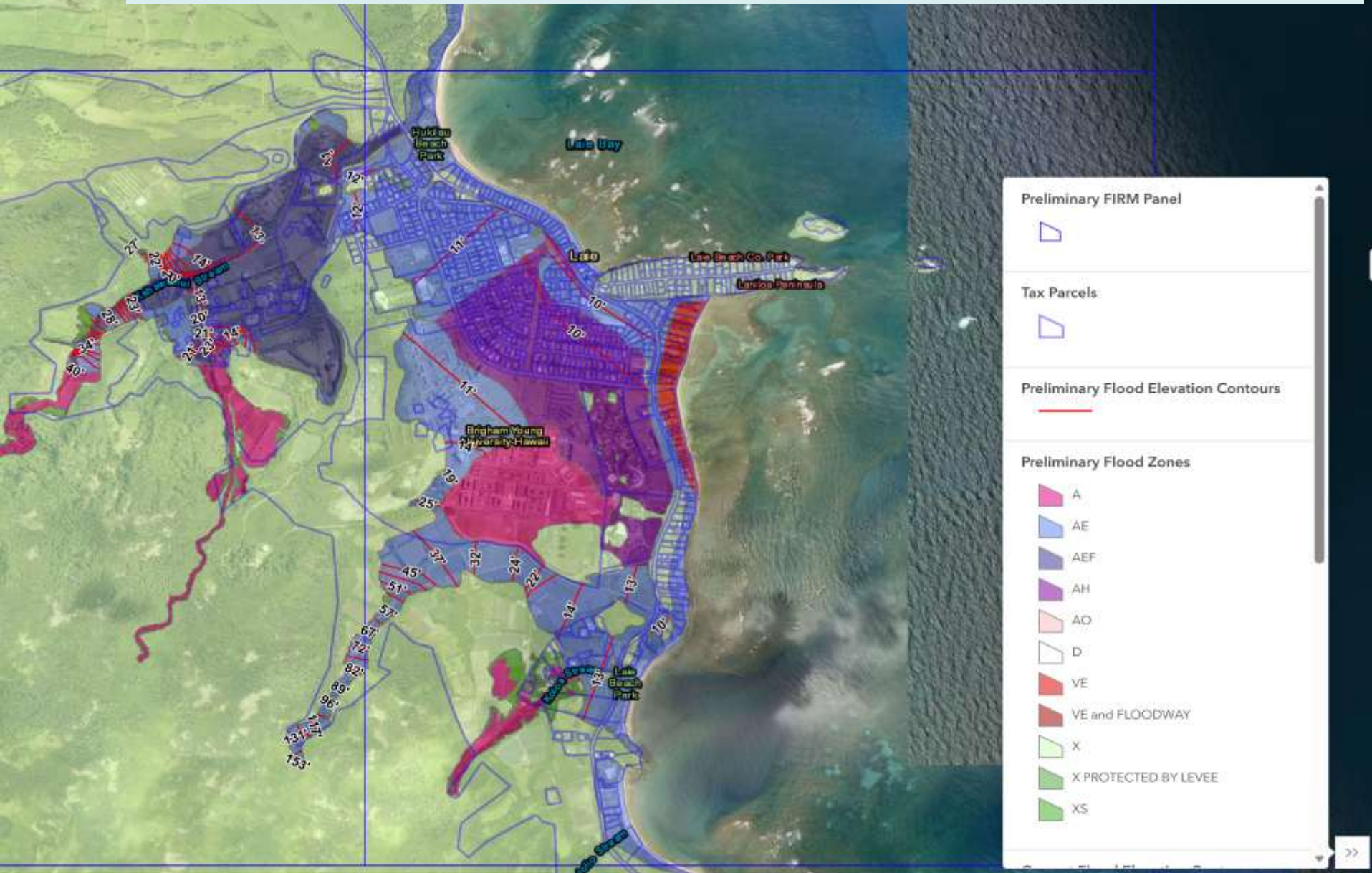
SCHOOL OF OCEANOGRAPHY AND EARTH SCIENCE AND TECHNOLOGY

Flood Map for Laie – Effective June 10, 2026

Major Difference Kahawainui Stream

[Preliminary Flood Zone Changes](#) or

<https://cchnl.maps.arcgis.com/apps/instant/media/index.html?appid=89832a7160374adeb2d6a89f11e25ab5>

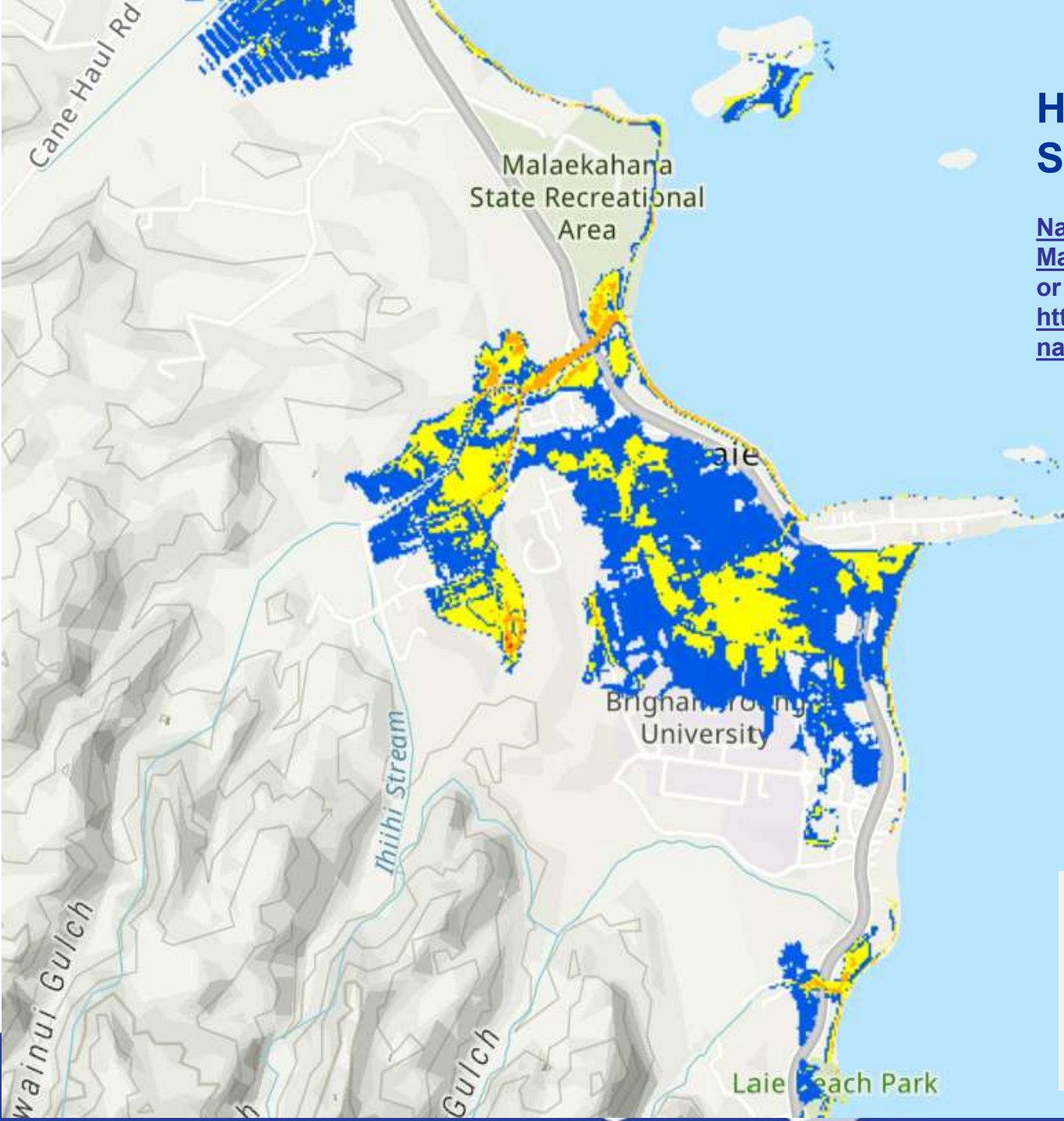


Hurricane Storm Surge – Category 4

National Storm Surge Risk
Maps - Version 4

or

<https://www.nhc.noaa.gov/nationalstormsurge/>



ABILITY TO SHELTER IN PLACE DURING A HURRICANE

PLEASE READ INSTRUCTIONS BEFORE USING THIS TABLE

FEMA or
Hawai'i
Residential
Safe Room

Safe room

Concrete or CMU wall house

Concrete CMU wall house in poor condition



Concrete CMU wall house in good condition



Concrete CMU wall house with hurricane clips



Concrete CMU wall house with hurricane clips & window protection



Concrete CMU wall house with hurricane clips exceeding code & window protection

Double wall house

Double wall house in poor condition



Double wall house in good condition



Double wall house with hurricane clips



Double wall house with hurricane clips & window protection



Double wall house with hurricane clips, window protection, garage & roof reinforced



Double wall with complete load path



Double wall with complete load path & window protection



Double wall with complete load path, window protection, garage & roof reinforced

Single wall house

Single wall house in poor condition



Single wall house in good condition



Single wall house with hurricane clips



Single wall house with hurricane clips & window protection



Single wall house with clips, window protection and foundation upgrades



Suggested Action

Unsafe
Evacuate! Do Not Shelter in place

Marginal
Shelter in place up to a Tropical Storm

Good
Shelter in place up to Category 1 hurricane

Better
Shelter in place up to Category 2 hurricane

Best
Shelter in place up to Category 3 hurricane

**Based on discussions and review with Ian Robertson, Professor, UH Mānoa, Civil and Environmental Engineering; Gary Chock, Structural Engineer, Martin & Chock Inc.; Tim Witte, PE, Simpson Strong-Tie; and Kevin Richards, Natural Hazards Officer, Hawai'i Emergency Management Agency.*

Do not shelter in your house if it is not strong enough for the wind. See pages 54-59 in the Handbook. This is a function of how it is built (single wall, double wall, concrete wall, built under what building code, and what measures were taken to strengthen the house (e.g., hurricane clips, window protection, roof upgrades) found in the Handbook.



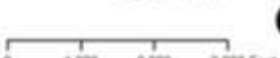
Wahiawa Dam Evacuation Zone

-  Evacuation Zone
-  Street_Centerline

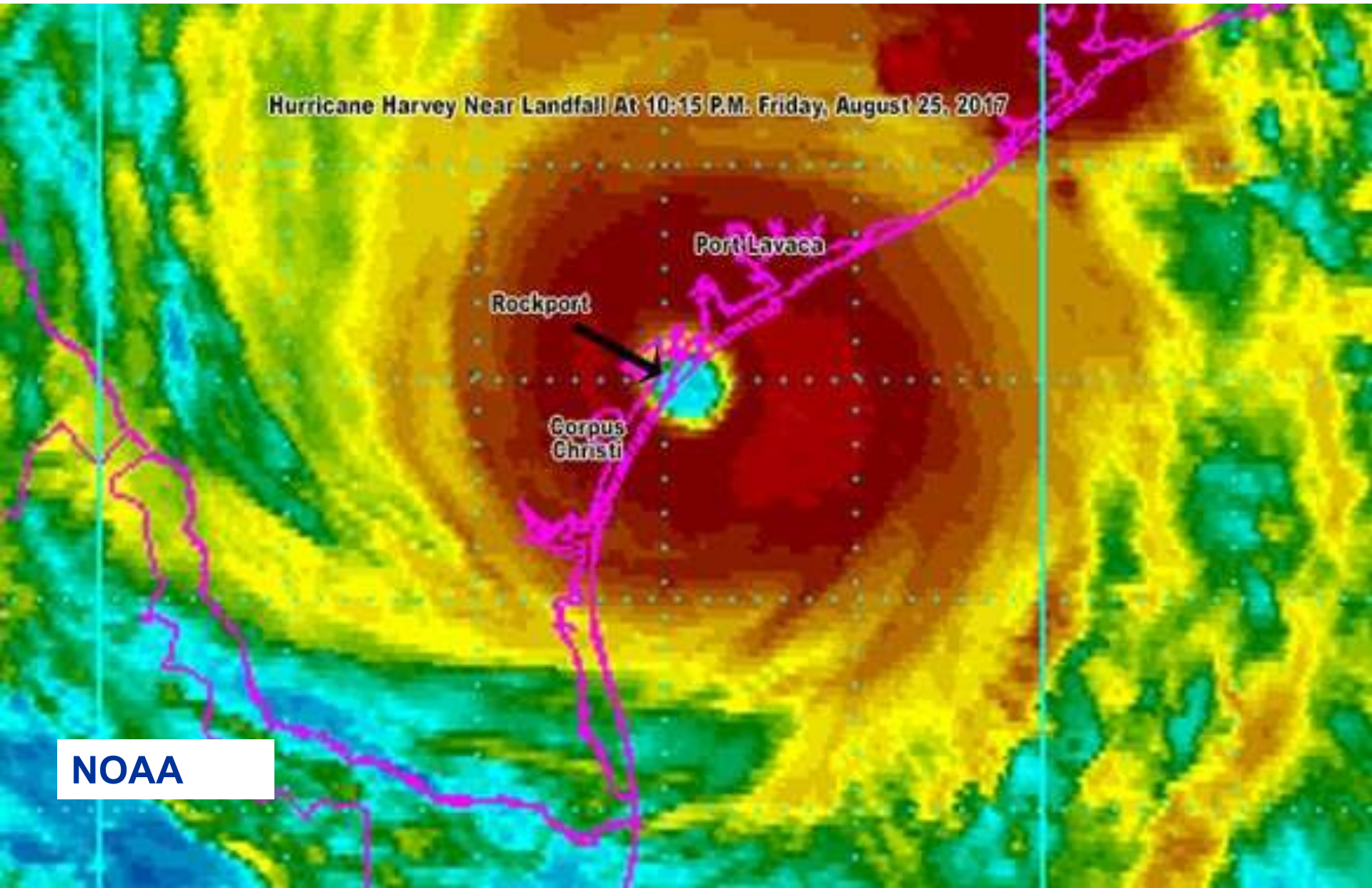
For official use only. Do not disseminate.
Contact: Honolulu DDP for details.
Note: Data represented on this map is not
intended to replace site surveys.

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All Rights Reserved 2015

FOUO



2017 Hurricane Harvey Impacting Texas



NOAA

4 – Destroyed House



3 – Major Damage



2 – Moderate Damage



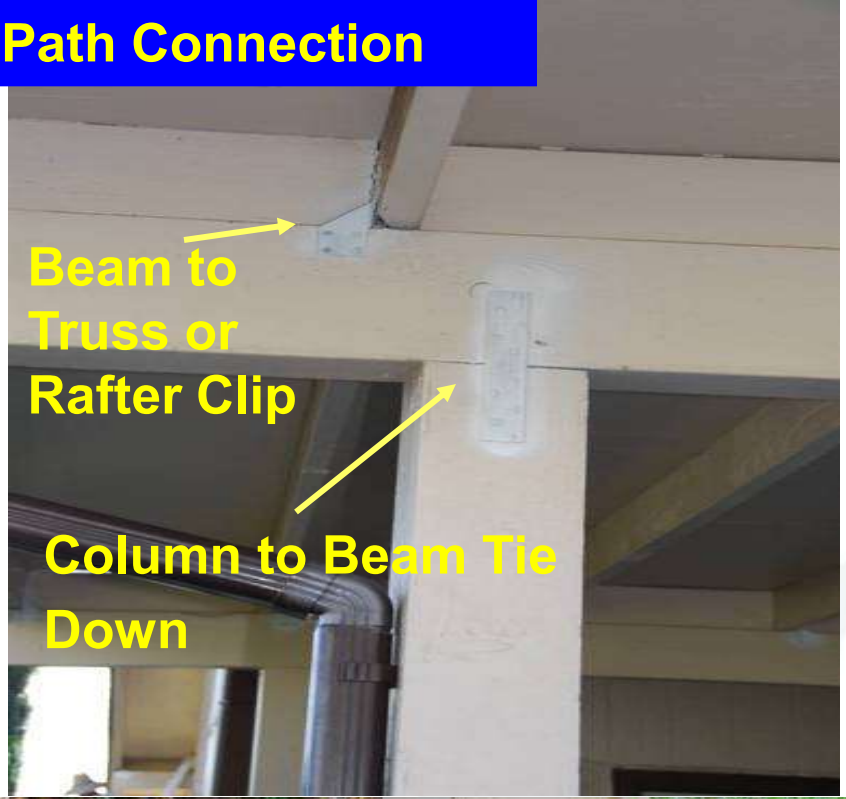
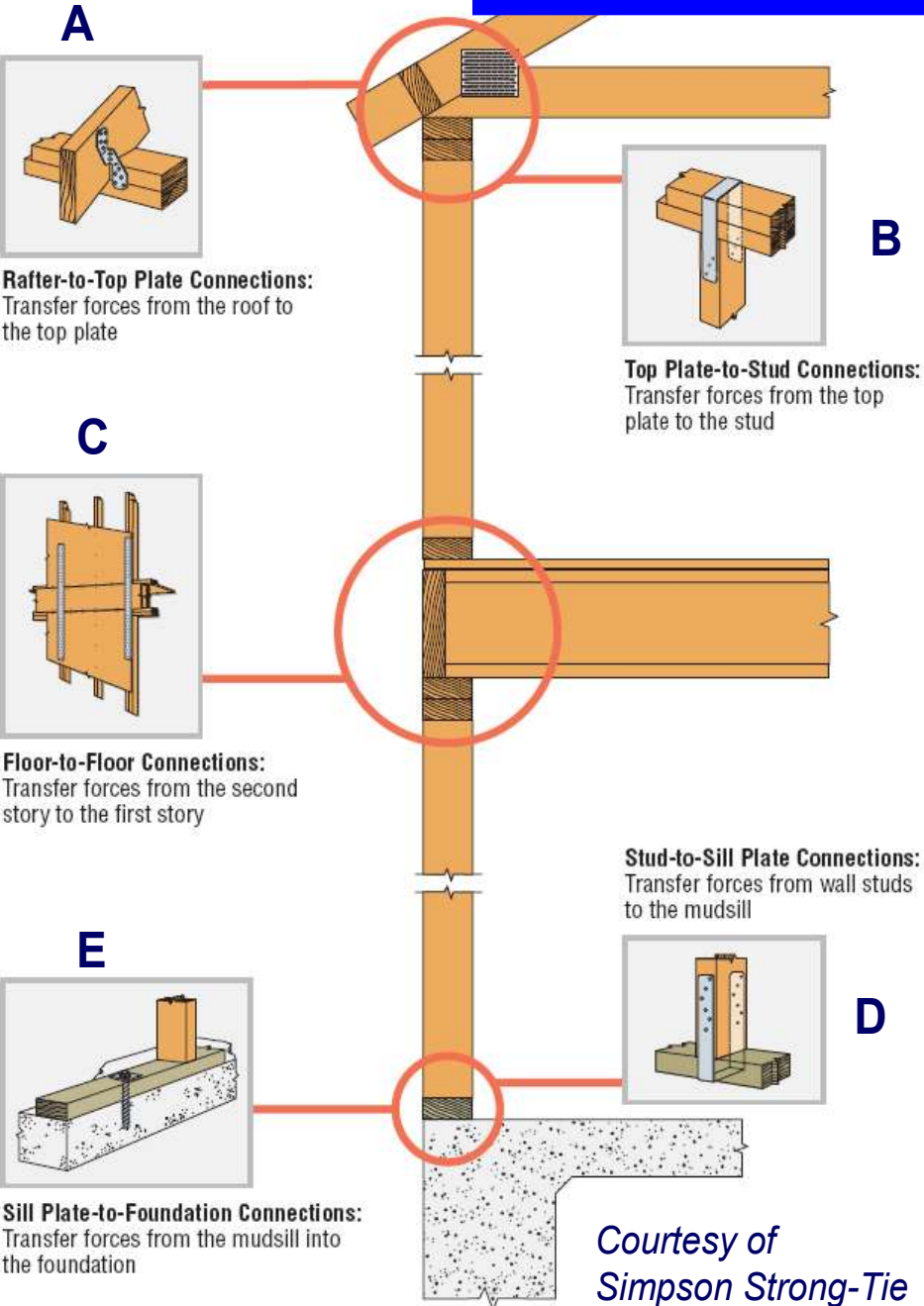
1 – Minor or No Damage



2017 House – built 3 months before Harvey - Modern Building Codes

- 1. Continuous Load Path Connection**
- 2. Strong Roof**
- 3. Window Protection**

Continuous Load Path Connection



Courtesy of Simpson Strong-Tie

Maunalani Heights – January 18, 2021



Courtesy Jocelyn O'Neill

Wind Damage from February 7-8, 2026

Salt
Lake



Nanakuli



Salt
Lake



Evidence of Roof Damage



Blown Soffits



Loose Shingles



Leaking Roof



Old Brittle Shingles on Ground

To Prevent This

Iniki 1992



Iniki 1992



2021
Maunalani
Heights



Tie Roof to Wall – Hurricane Ties/Clips

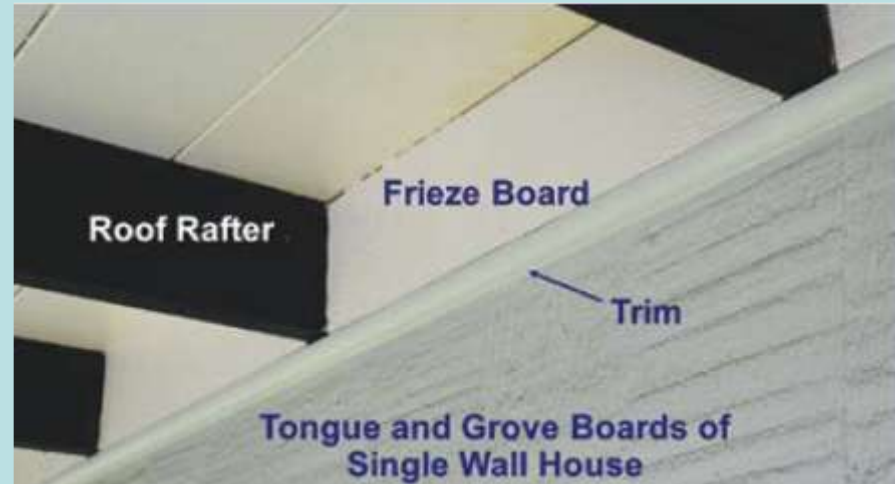


2 Saturdays and \$300 in material costs (seek advice of licensed architect or structural engineer first)

Or \$2,100 with licensed contractor

Guide for Installing Hawaii Plantation Tie (HPT) Hurricane Tie

For all retrofits – first seek advice of licensed structural engineer or architect.





Almost every house in the State can be relatively easily retrofitted.

About 6,000-7,000 homes retrofitted.



Structural Seismic Retrofits For Hawaii Single Family Residences With Post and Pier Foundations

Volume I

Results of Study, Structural Analysis
and Retrofit Strategies

Prepared for



FEMA

Hazard Mitigation Grant Program
DR-1664-HI



Final Report
May 15, 2009

Principal Investigators: Ian Robertson, Ph.D., P.E.
Gary Chock, P.E.

The following demonstration is based off the report by Dr. Ian Robertson and Gary Chock. You may be able to do most of the work yourself, but first, seek the advice of a licensed structural engineer. The work can reduce earthquake and hurricane damage.

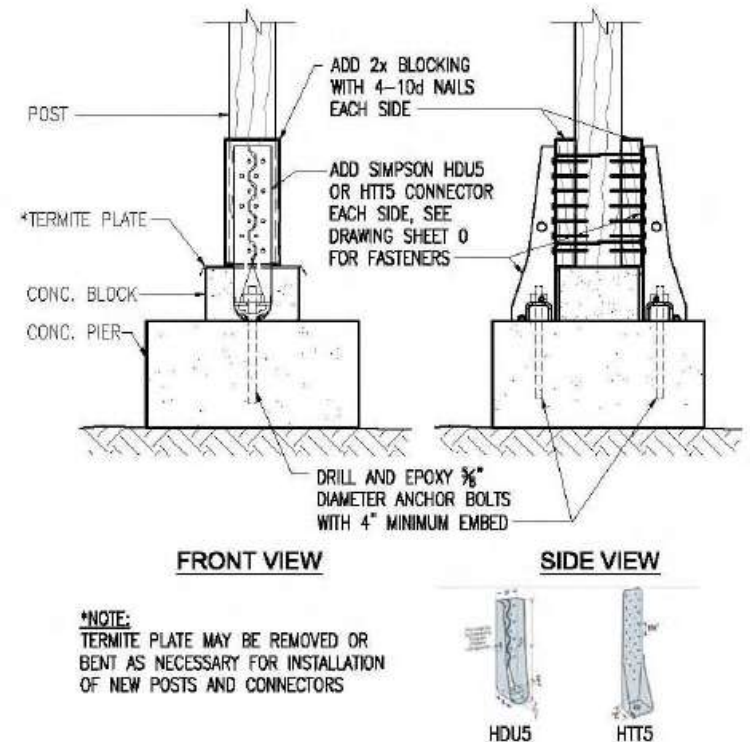
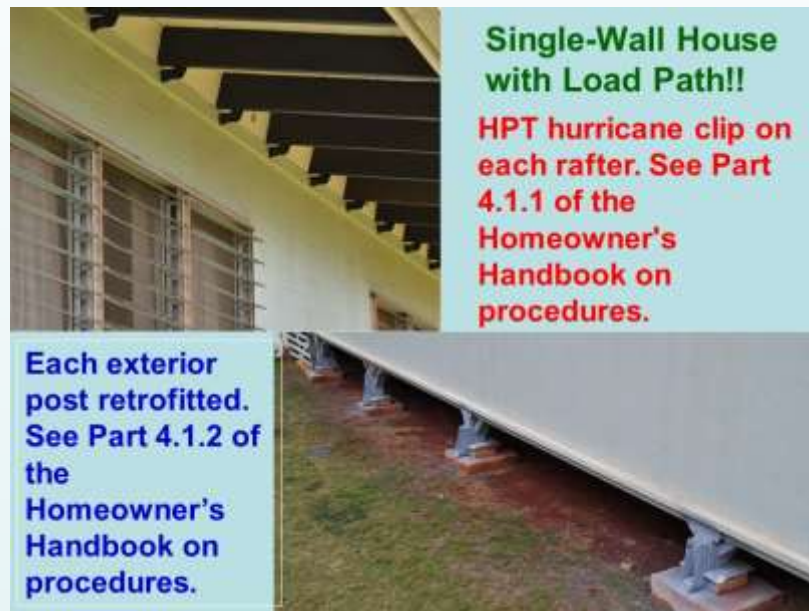


Figure 7: Simpson HDU Hold-down Connection



1956 single-wall house now has a continuous load path.

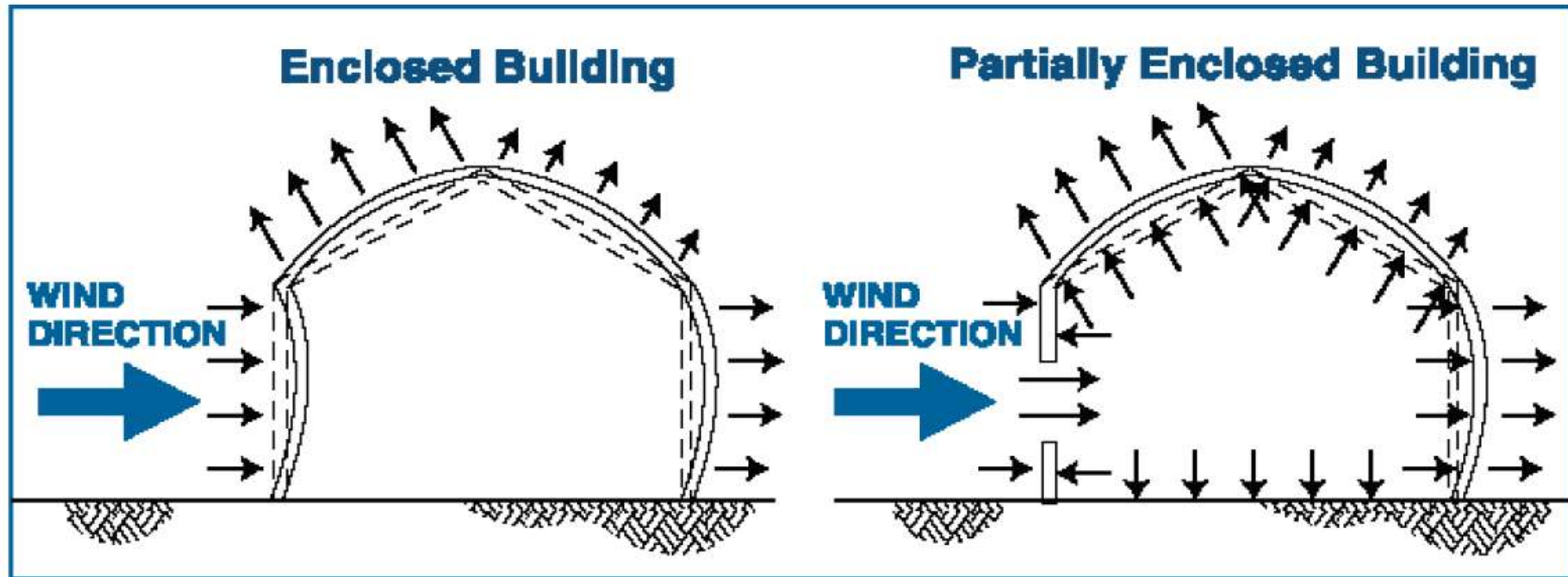


- 2020 Hurricane Insurance Premium per year \$1,184. With retrofit \$932 or \$252 savings per year.
- 2024, insurance premiums doubled so retrofit savings \$540 per year for a retrofit with material cost of \$500.

Creating Wind and Rain Resistant Envelope

Multi Hazard Design

From FEMA CCM



No masking tape!
Do not open windows!

Plywood



Polycarbonate Panels



Accordion Shutters



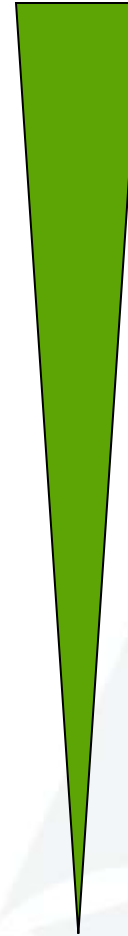
Impact Resistant Windows



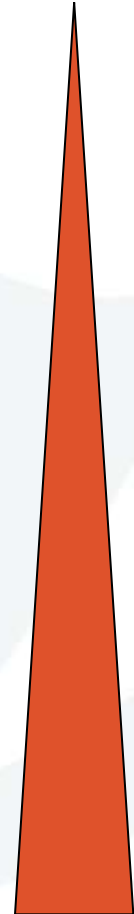
Window Coverings

- Impact Resistant Windows*
- Roll Downs*
- Colonial Shutters
- Bahama Shutters
- Accordion Shutters*
- Laminates
- Storm Panels*
- Polycarbonate Panels*
- Hurricane Screen
- Plywood*

Cost



Time to Deploy



Roofing – The Most Important Element in Resilient House

- 1) **Strong** – Able to withstand wind forces:
 - a. Roof tied down to the foundation (load path)
 - b. Proper attachment of roof deck & roofing material
 - c. Shingles wind rated
- 2) **Sealed** – No water leaks during a rain event
- 3) **Cool** – Heat reflective to lower energy costs
- 4) **Fire Resistant** – Class A shingles, metal roof

Types of Roof Damage

Roof Blow Off



Plywood Deck off the Trusses



Blown off Shingles



Soffits & Wall Covering





Roof Deck Attachment

Use ring shank nails, instead of smooth shank. Spacing tighter than current code.



A

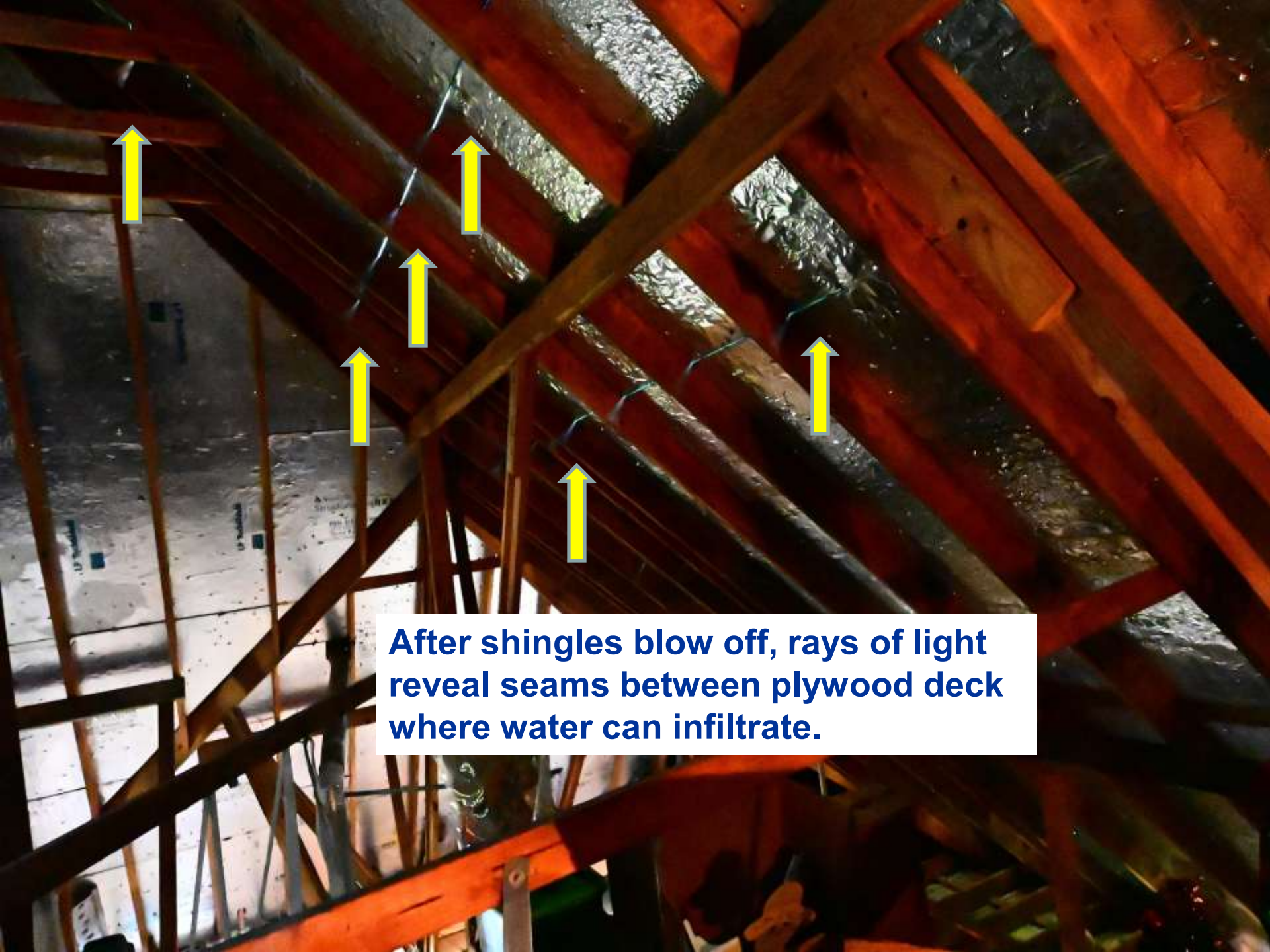
NAIL ROOF SHEATHING WITH 8D RING-SHANK OR SCREW-SHANK (0.131" x 2-1/2") NAILS AT 4" ON CENTER AT PANEL ENDS AND EDGES AND AT GABLE-END WALL, AND 6" ON CENTER ALONG INTERMEDIATE FRAMING

8d ring- or screw-shank (0.131" x 2-1/2") nails—
6" on center along intermediate framing

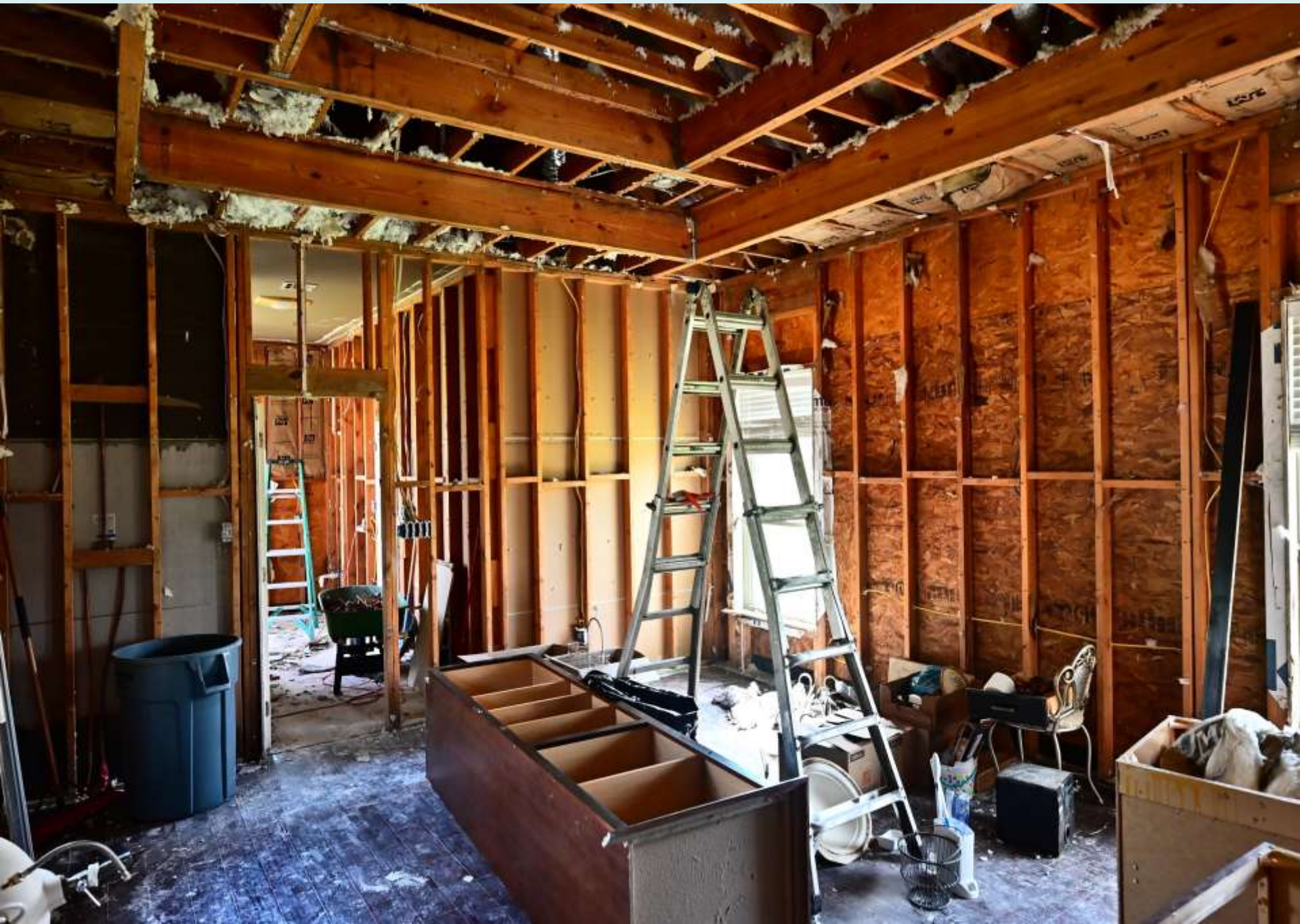
8d ring- or screw-shank
(0.131" x 2-1/2") nails—
4" on center at panel ends



APA report – Building for High Wind Resilience in Light Wood Frame Construction.



After shingles blow off, rays of light reveal seams between plywood deck where water can infiltrate.

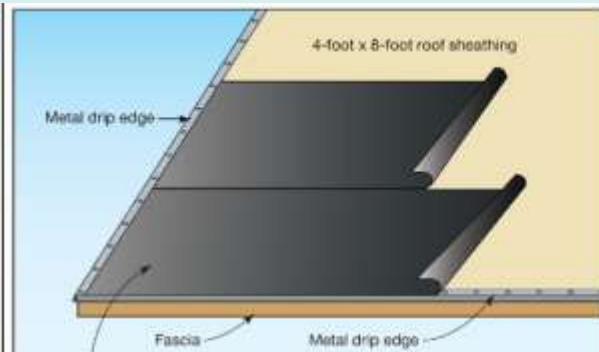


Blown off Shingles



Preventing the Damage

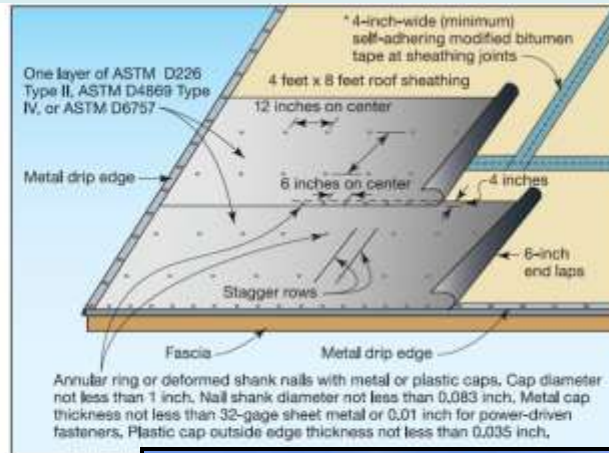
**Create a Sealed Roof – 3 Options -
FEMA Technical Fact Sheet 7.2 in Homebuilder's
Guide to Coastal Construction (FEMA P-499)**



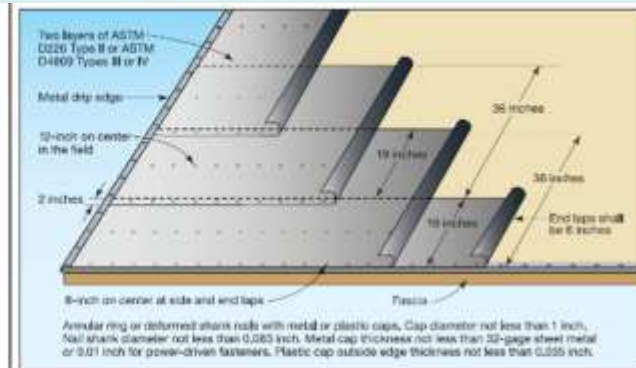
* Self-adhering polymer modified bitumen membrane complying with ASTM D1970 applied over the entire roof. All laps to be in accordance with the manufacturer's installation instructions.

*Self-Adhering Polymer Modified Bitumen Membranes:

Some oriented strand board (OSB) structural panels have a factory-applied coating that can interfere with the bonding of the self-adhering modified bitumen. To facilitate bonding, a field-applied primer is often needed. If self-adhering modified bitumen is applied to OSB, the OSB manufacturer should be contacted to determine whether a primer needs to be applied.



Annular ring or deformed shank nails with metal or plastic caps. Cap diameter not less than 1 inch. Nail shank diameter not less than 0.083 inch. Metal cap thickness not less than 32-gauge sheet metal or 0.01 inch for power-driven fasteners. Plastic cap outside edge thickness not less than 0.035 inch.



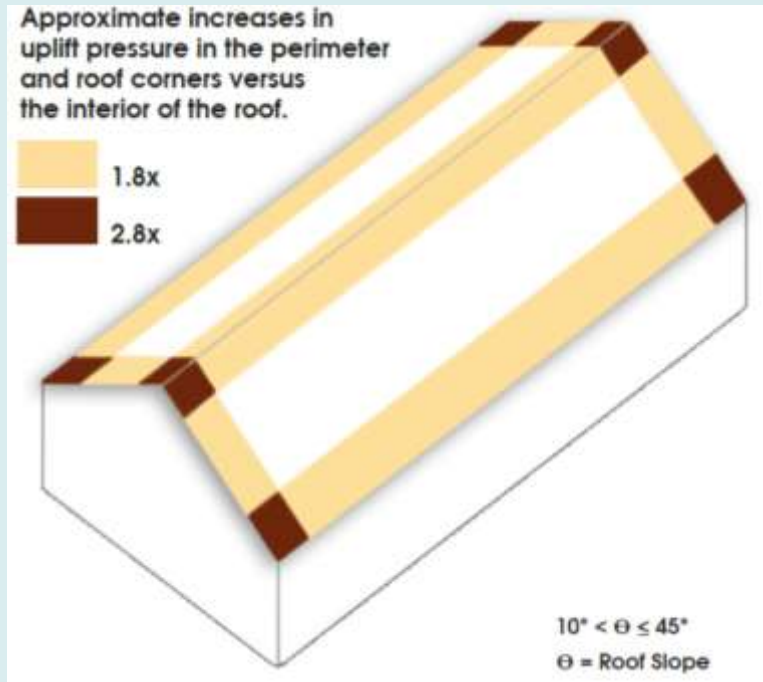
Annular ring or deformed shank nails with metal or plastic caps. Cap diameter not less than 1 inch. Nail shank diameter not less than 0.083 inch. Metal cap thickness not less than 32-gauge sheet metal or 0.01 inch for power-driven fasteners. Plastic cap outside edge thickness not less than 0.035 inch.

Self Adhering Modified Bitumen Layer – ASTM D1970 - Helps to prevent leaks – Sealed Roof



Asphalt Shingle Roofing (cont.)

Guideline Following FEMA Home Builders Guide to Coastal Construction



**Roof Pressures
Greatest on
edges, ridges and
corners.**

**Asphalt Roof Cement on
edges, ridges and
corners for most
vulnerable part of Roof**





National Weather Service Honolulu Hawaii

Total Rainfall 3/10/2026 through 3/24/2026

Analysis Data Source: Regional Observations



Created:
03/26/2026 02:12PM

Precipitation (in)



This is an experimental product of the NWS GAZPACHO software package. Care should be taken in using the data. Unofficial observations may be plotted. Values at interpolated locations may not represent actual reports at that location.



1,400 homes Impacted - 256 homes damaged



RESIDENTS BLINDSIDED BY SUDDEN FLOODING

MANOA

Patsy Mink Park



**2005 Hurricane Katrina – 220,000 houses damaged or destroyed.
1 million houses impacted in Gulf Area**

**Moisture wicks up porous
material – Causes Mold**

Water Level



2018 Hurricane Harvey 300,000 Structures Flooded Commercial Wortham Theater – Rehearsal Room



Water
to Here

2018 Hurricane Harvey 300,000 Structures Flooded



Gut 2-3 feet above



Water Level



Flood Resistant Materials



Flood Damage-Resistant Materials Requirements

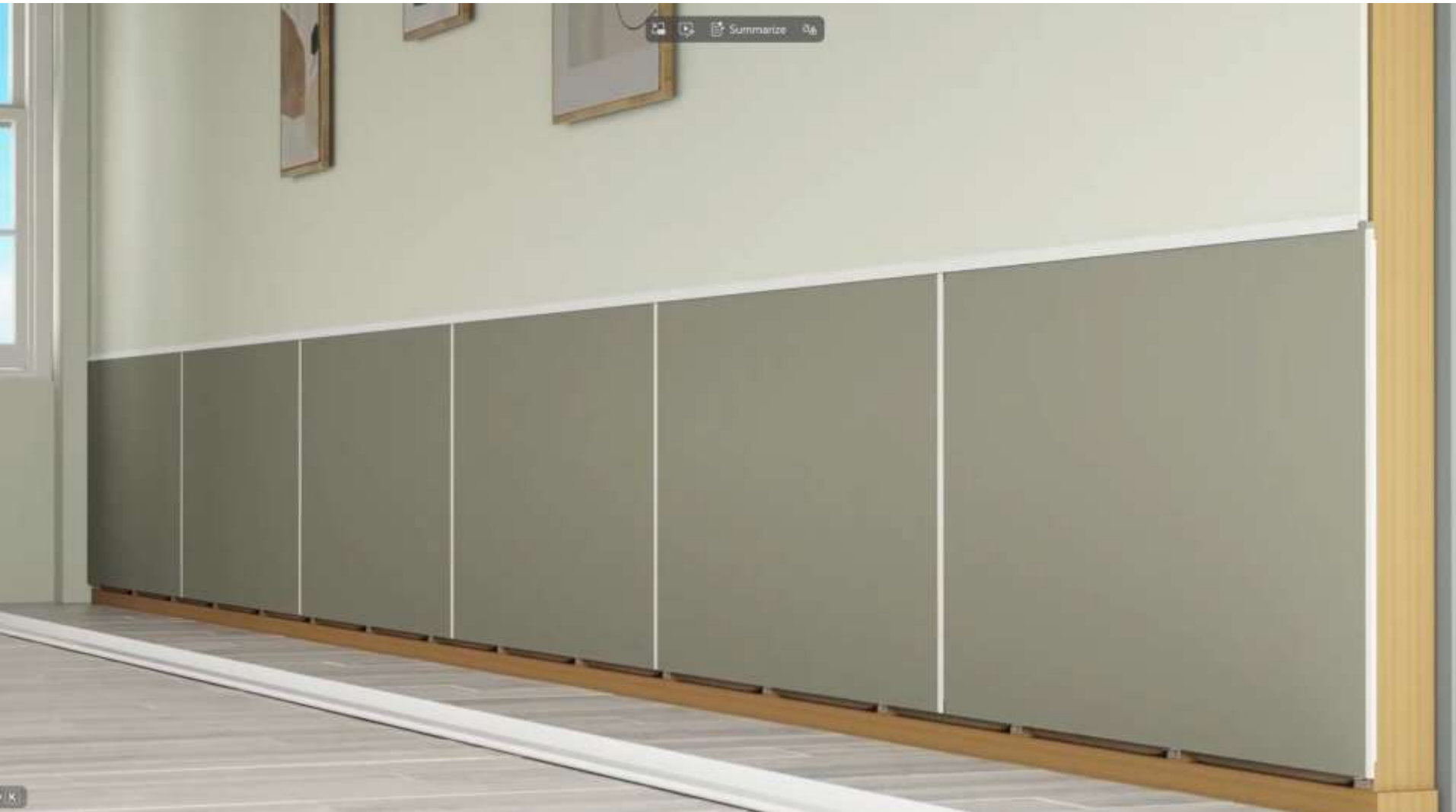
For Buildings Located in Special Flood Hazard Areas in Accordance with the National Flood Insurance Program
NFIP Technical Bulletin 2 / January 2025



- **Non-paper faced water resistant, fiber reinforced gypsum exterior sheathing**
- **Cement**
- **Fiber – Cement Board**
- **Concrete**
- **Stone**
- **Plastic**
- **Plastic lumber**

[NFIP Technical Bulletin 2 - Flood Damage-Resistant Materials Requirements](https://www.fema.gov/sites/default/files/documents/fema_tb_2_flood_damage-resistant_materials_requirements_01-22-2025.pdf) or https://www.fema.gov/sites/default/files/documents/fema_tb_2_flood_damage-resistant_materials_requirements_01-22-2025.pdf

Waterproof Plastic Polymer - Enduraflood



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SCHOOL OF OCEANOGRAPHY
SCIENCE AND TECHNOLOGY



I have peace of mind

UH Sea Grant College Program



Cement Boards

Best Seller



[+more options](#)

USG Durock Brand 1/2 in. x 3 ft. x 5 ft. Cement Board with EdgeGuard

★★★★★ (4.6 / 1768)

Model# 172954

\$15⁸⁵ (\$1.06/sq.ft.)

Pickup: 509 in stock at [Honolulu](#)

Delivery: Today

Add to Cart

Top Rated



BULK PRICE SAVINGS
EVERY DAY

[+more options](#)

James Hardie HardieBacker 1/2 in. x 3 ft. x 5 ft. Cement Backerboard

★★★★★ (4.6 / 1110)

Model# 220023

\$17⁵⁰ (\$1.17/sq.ft.)

Buy 30 or more \$15.75

Pickup: 410 in stock at [Honolulu](#)

Delivery: Today

Add to Cart

Top Rated



BULK PRICE SAVINGS
EVERY DAY

[+more options](#)

James Hardie HardieBacker 1/4 in. x 3 ft. x 5 ft. Cement Backerboard

★★★★★ (4.7 / 1371)

Model# 220022

\$13⁴⁰ (89c/sq.ft.)

Buy 30 or more \$12.06

Pickup: 211 in stock at [Honolulu](#)

Delivery: Today

Add to Cart

Top Rated



[+more options](#)

USG Durock Brand 1/4 in. x 3 ft. x 5 ft. Cement Board with EdgeGuard

★★★★★ (4.6 / 1771)

Model# 170215

\$12⁵⁰ (83c/sq.ft.)

Pickup: 109 in stock at [Honolulu](#)

Delivery: Today

Add to Cart

1/4 in. x 3 ft. x 5 ft. Cement Board, Screws (185-Pack), 2 in. x 150 ft. Tape, 50 lb. Mortar and 1 Gal. Membrane

★★★★★ (5089) Questions & Answers (1863)



Share Print

\$123⁴² /bundle



Pay **\$98.42** after **\$25 OFF** your total qualifying purchase upon opening a new card.

[Apply for a Home Depot Consumer Card](#)

- Waterproof tile projects with membrane and board
- Prevent cracks in tile floors with flexible membrane
- Strong tile bond with cement board and thin-set mortar
- [View More Details](#)

Items in this bundle (5)



USG Durock Brand

1/4 in. x 3 ft. x 5 ft. Cement Board with EdgeGuard

\$12⁵⁰ (83c/sq.ft.)

[View Item Specifications](#)



Backer-On

#9 x 1-1/4 in. Star Drive Serrated Head Cement Board Screws (185-Pack)

\$13⁸⁴

[View Item Specifications](#)



Saint-Gobain ADFORS

FibaTape Alkali-Resistant 2 in. x 150 ft. Self-Adhesive Cement Board Tape

\$8⁹⁴

[View Item Specifications](#)



Custom Building Products

VersaBond 50 lb. White Professional Polymer-Modified Thinsset Mortar

\$27⁵⁷

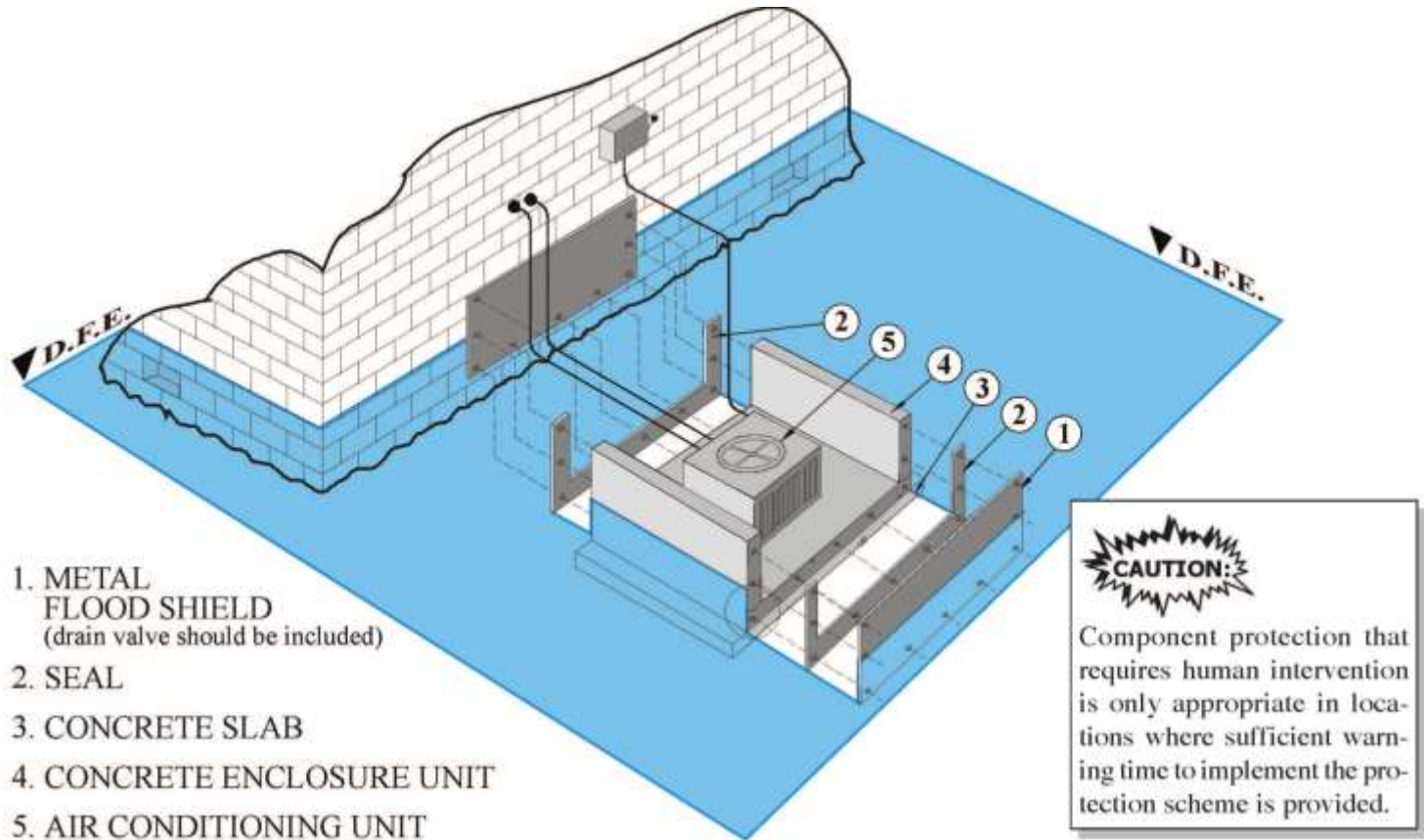
Buy 10 or more \$24.81

UH Sea Grant College Program



Mitigating Against Flood

All utilities and critical building components must also be elevated above the DFE.



For Minor Damage

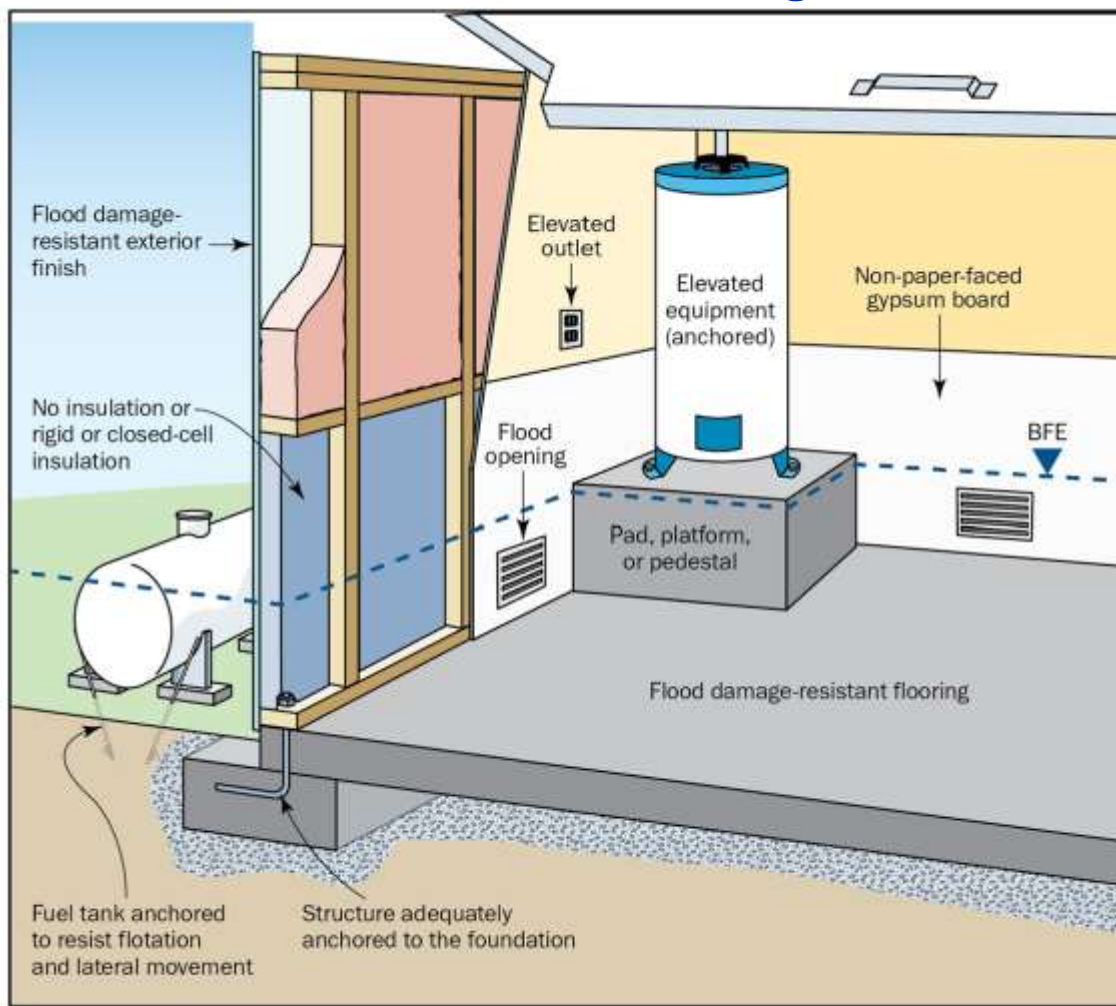


Figure 1: Typical wet floodproofing measures

If Substantially Damaged – Need to Build above BFE + 1 Foot = DFE

Which Policy Covers Me?

Hurricane Insurance

- Wind-related damage
- Water damage when wind creates a hole in the wall or roof
- **Think water damage from the top down.**



Flood Insurance

- Flood damage
- Tidal surge from ocean
- **Think water damage from the ground up.**



Homeowner's

- Theft, Liability, Wind
- Fire
- **Wind – not hurricane, tropical cyclone**



Typical Hurricane Insurance Discounts

Retrofit Type:

1. Roof to Wall – 10%
2. Windows – 15-18% for single family homes & 18% for condos
3. Wall to Foundation – 10-12%

For Flood Insurance – Elevation gives the Biggest Premium Discount

Floor Elevation above BFE	Reduction in Annual Flood Premium	Annual Premium	Savings
0	0%	\$ 1,622	\$ 0
1 foot	45%	\$ 897	\$ 725
2 feet	61%	\$ 638	\$ 984
3 feet	66%	\$ 548	\$ 1,074
4 feet	67%	\$ 530	\$ 1,092

Sample NFIP Flood Insurance Premiums for Buildings in Zone A \$250,000 Building/\$100,000 Contents Coverage

(Table 7-2, FEMA P-55)

Floor Elevation above BFE	Reduction in Annual Flood Premium	Annual Premium	Savings
0	0%	\$ 7,821	\$ 0
1 foot	33%	\$ 5,256	\$ 2,565
2 feet	55%	\$ 3,511	\$ 4,310
3 feet	65%	\$ 2,764	\$ 5,057
4 feet	71%	\$ 2,266	\$ 5,535

Sample NFIP Flood Insurance Premiums for Buildings in Zone V Free of Obstruction Below the Lowest Floor; \$250,000 Building/\$100,000 Contents Coverage

(Table 7-3, FEMA P-55)

Natural Hazard Preparation – To Do

1. **Emergency Supplies - 14-day Supply of Non-perishable Food & Water. Other Items & Medicine. Go bag if evacuation part of your plan.**
2. **Get Emergency Alerts – Register at hnlalert.gov or <https://www.honolulu.gov/dem/hnl-alert/>**
3. **Emergency Plan – Know Your Hazard Zone! – Tsunami, Hurricane (flood & storm surge), Dam. Where shelter? Your place, friends, relatives, or public shelter as last resort! Plan for triple threat (waves, flooding & wind).**
4. **Work on House – Simple things first. Clear debris, clutter & junk – in yard & around house.**
 - a. **Clear gutters, downspouts, drainage ways.**
 - b. **Maintain house – prevent wood rot, termite damage with proper maintenance and inspections!!**
 - c. **Add Hurricane Clips as a first step (generally - houses built on or before 1988 on Oahu, 1990 on Maui and Kauai, 1994 for Hawaii County).**
 - d. **See Handbook for more – window protection, roof, garage door, flooding**
5. **Check your insurance coverage – hurricane, flood & homeowner’s. Simple retrofits can reduce insurance premium.**
6. **Continuously Improve & Strengthen – Resilient, Adaptive, Sustainable**