

# AIA Honolulu



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**Questions related specific materials, methods, and services will addressed at the conclusion of this presentation.**

# *Resilient Design Strategies for the 21<sup>st</sup> Century*

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DEANsakamoto  
ARCHITECTS LLC

# Learning Objectives:

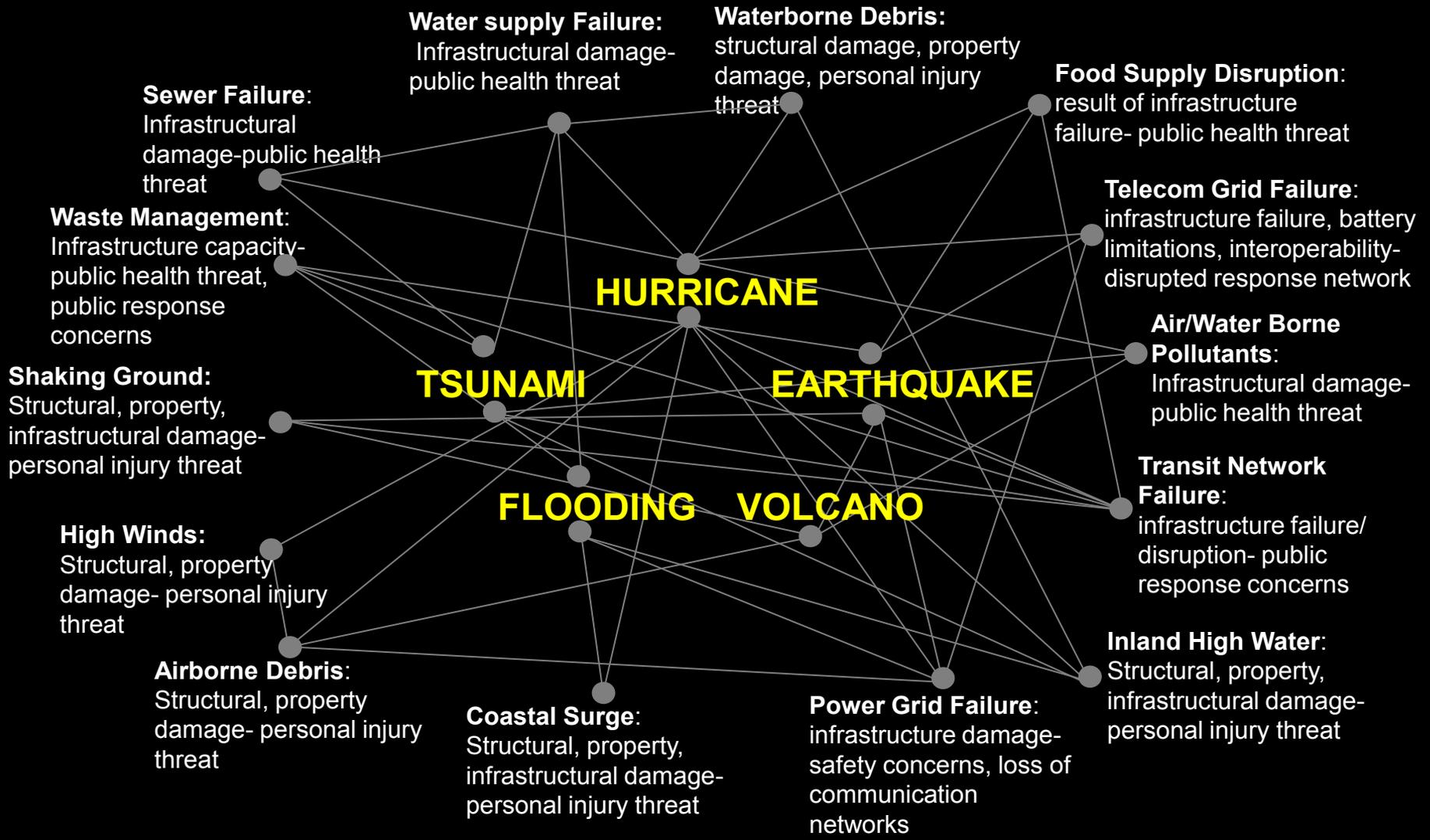
- Form a knowledge base and opinion on resilient design.
- Discuss hurricane resilient strategies in particular.

# Resilient Design?

- A building's ability to resist and recover from the impact of hazards due to a disaster.
- Ultimate form of humane and sustainable design.



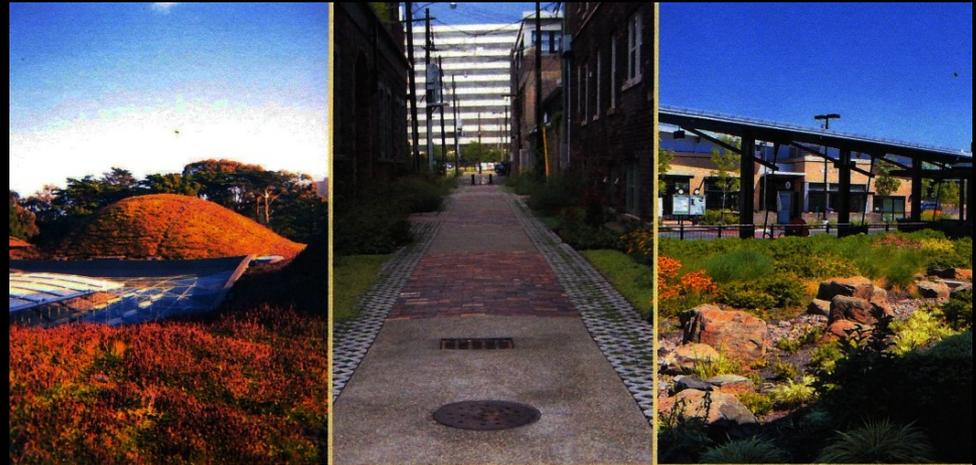
Hurricane Ike, 2009, Bolivar Peninsula , TX, David J. Phillip-Pool/Getty Images



**Multi-Disaster + Multi-Hazard and Associated Risks Diagram** **Urban Resilience Lab**



- **Majority of USGBC's LEED effort focused on reducing carbon emissions**
- **This report represents the first step in linking climate change mitigation & adaptation strategies to LEED program**
- **Report identifies climate-related vulnerabilities by U.S. regions using IPCC, USGCRP, NOAA data**



## GREEN BUILDING AND CLIMATE RESILIENCE

Understanding impacts and preparing  
for changing conditions

### University of Michigan

Larissa Larsen, Nicholas Rajkovich, Clair Leighton,  
Kevin McCoy, Roben Calhoun, Evan Mallen, Kevin  
Bush, Jared Enriquez

### U.S. Green Building Council

Chris Pyke, Sean McMahon

### With support from

Alison G. Kwok, University of Oregon



Taubman College of Architecture and Urban  
Planning, University of Michigan



U.S. Green Building Council

<http://www.usgbc.org>

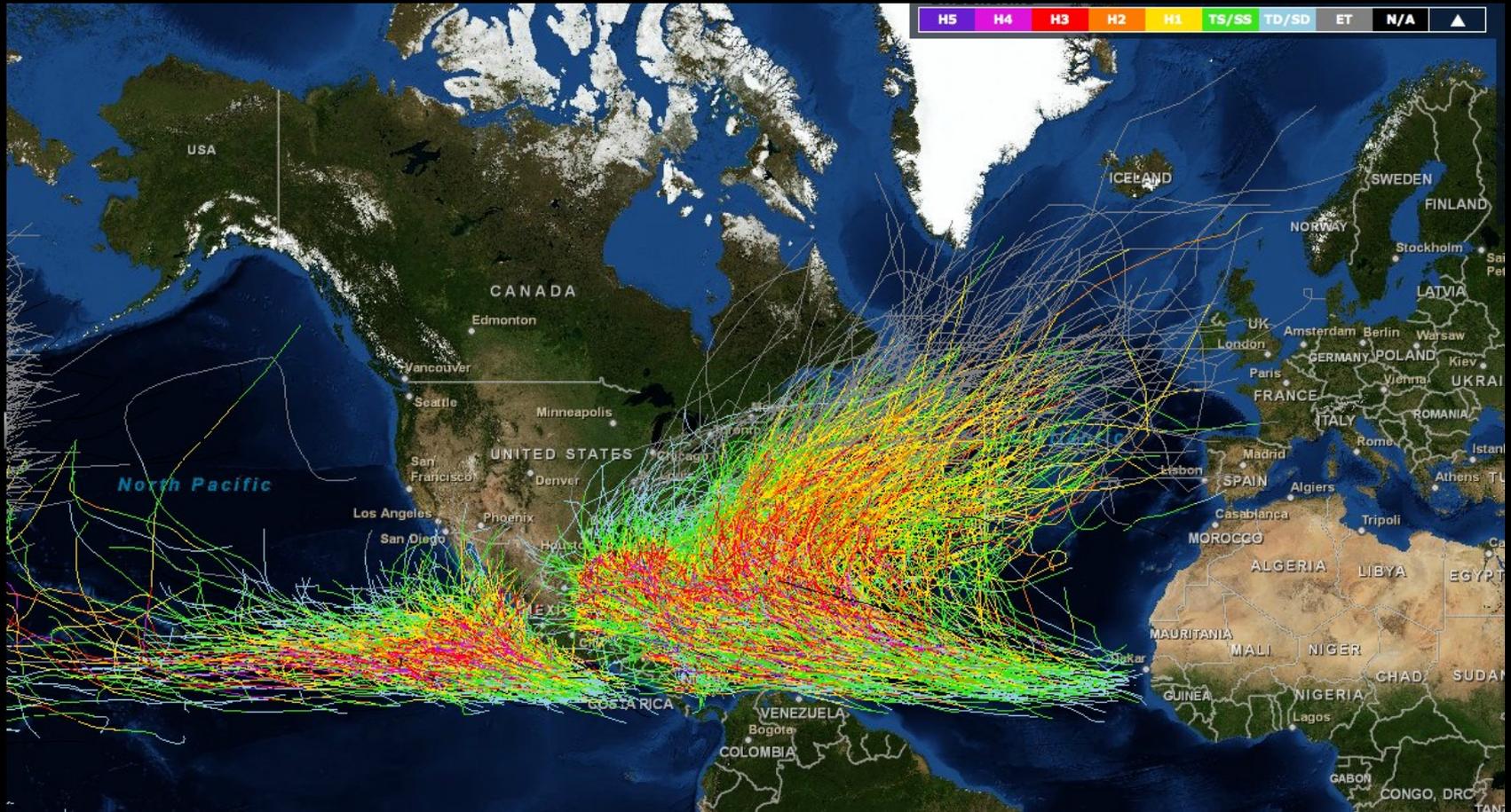
# Hurricanes?

- Annual threat of property loss and harm.
- Multi-hazard event.
- Storms of greater intensity and frequency anticipated.

# Storm Strikes on U.S.

NOAA's Full Archive 1850-2011

HURRICANE FORCE



# 2013 Forecast:

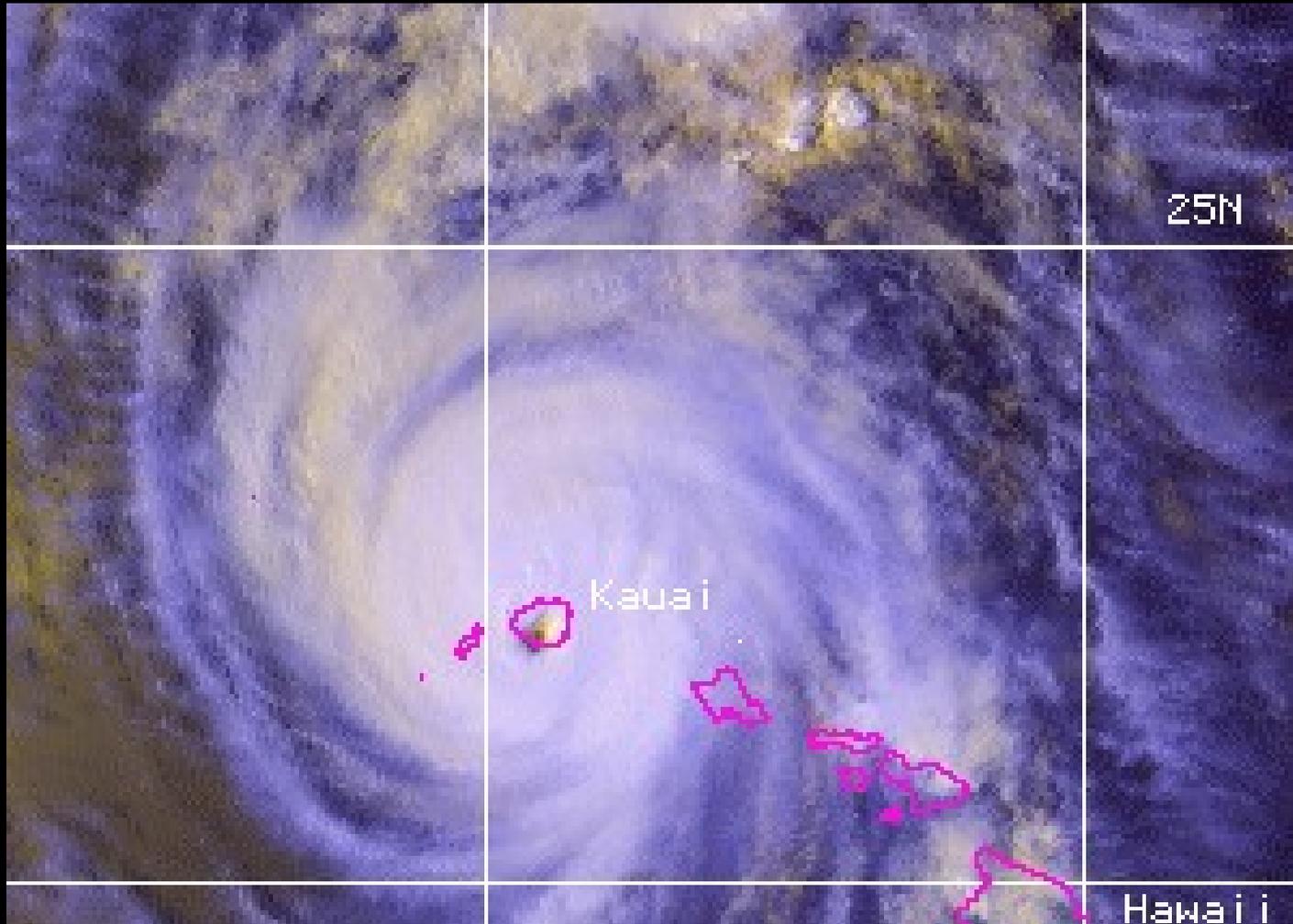
- North Atlantic Ocean warm since March.
- 16 named storms predicted.
- 9 hurricane strength storms predicted.\* (+74 mph winds)

\*

From various sources; location and dates not factored

# Hurricane Iniki

## September 11, 1992



# Resilient Building Design?



Juliet Rice Wichman Botanical Research Center, Kauai, Hawaii, 2008, Dean Sakamoto Architects LLC

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Juliet Rice Wichman Botanical Research Center, Kauai, Hawaii, 2008, Dean Sakamoto Architects LLC

# HURRIPLAN:

**Resilient Building Design  
For Coastal Communities**



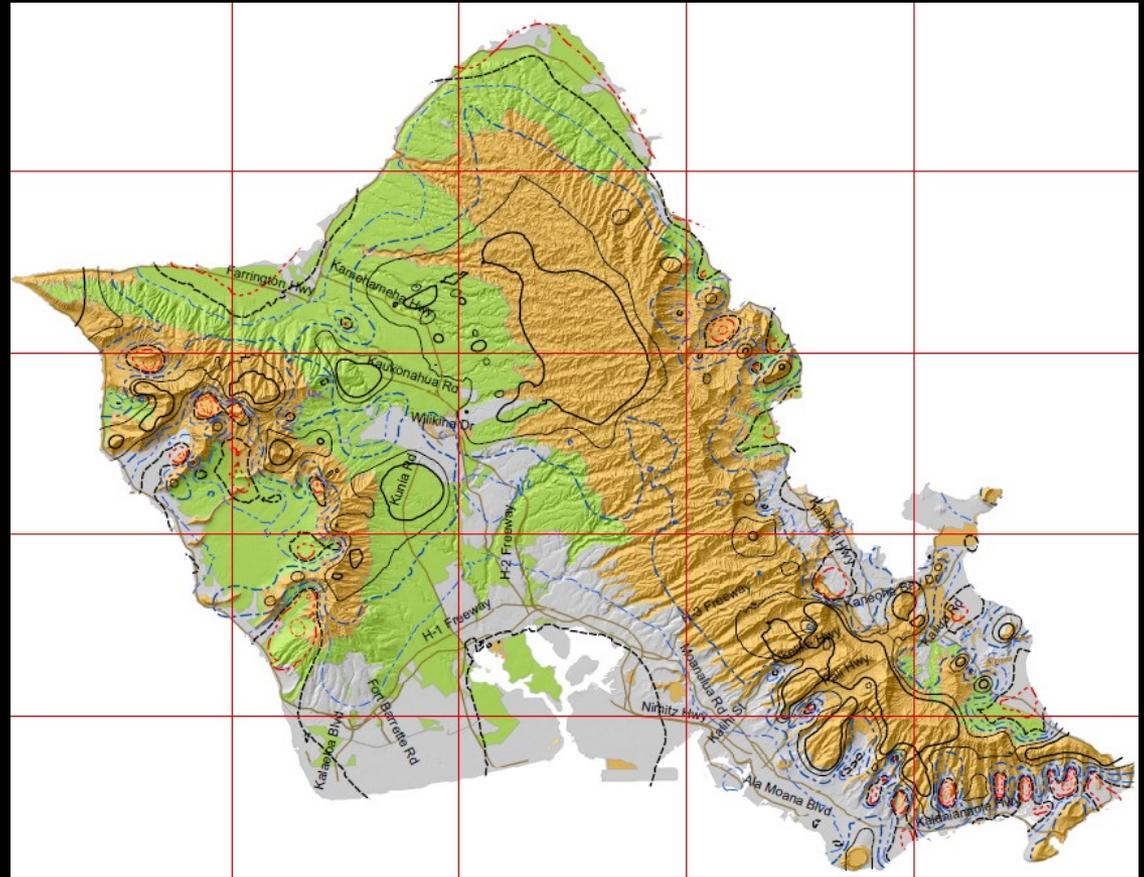
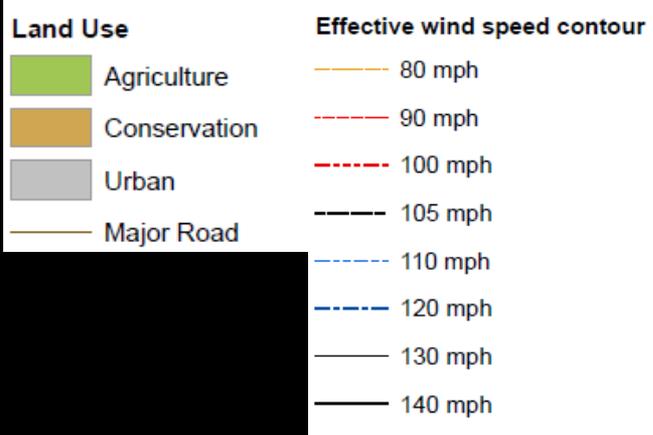
# High Wind

- Categorized by Sustained and Peak Gusts
- Hurricane winds are cyclonic but wind direction cannot be predicted
- Failure of Main Wind Force Resisting System (MWFRS) and Components/Cladding (C&C)



# Local Code Wind Maps

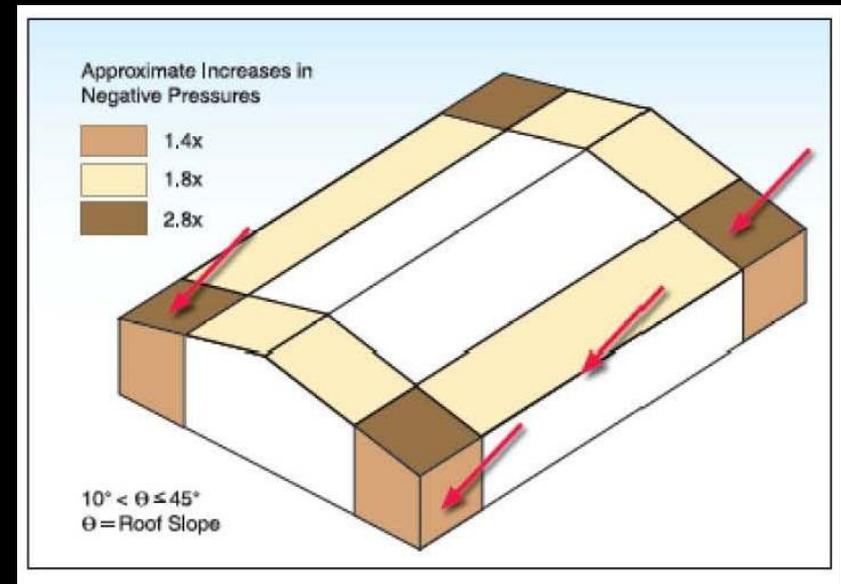
Municipalities may establish more detailed wind maps by considering its terrain conditions.



Map produced by Gary Chock.  
[http://martinchock.com/\\_library/documents/papers/hawaii-state-building-code-wind-provisions.pdf](http://martinchock.com/_library/documents/papers/hawaii-state-building-code-wind-provisions.pdf)

# High Wind Design

- MWFRS designed to resist anticipated wind force using Continuous Load Path
- C&C designed to perform under extreme localized wind pressure and debris impact
- Building location, surface roughness, geometry are factors



Corners are typically the most vulnerable parts of buildings.

# Flooding

- Storm Surge or Hurricane Tide
- Interior Flooding due to Heavy Rain
- Breaches of Sea Walls, Dams and Levees
- Base Flood Elevation (BFE) is a key term



Debris line from Iniki's Coastal Surge, NOAA 1992

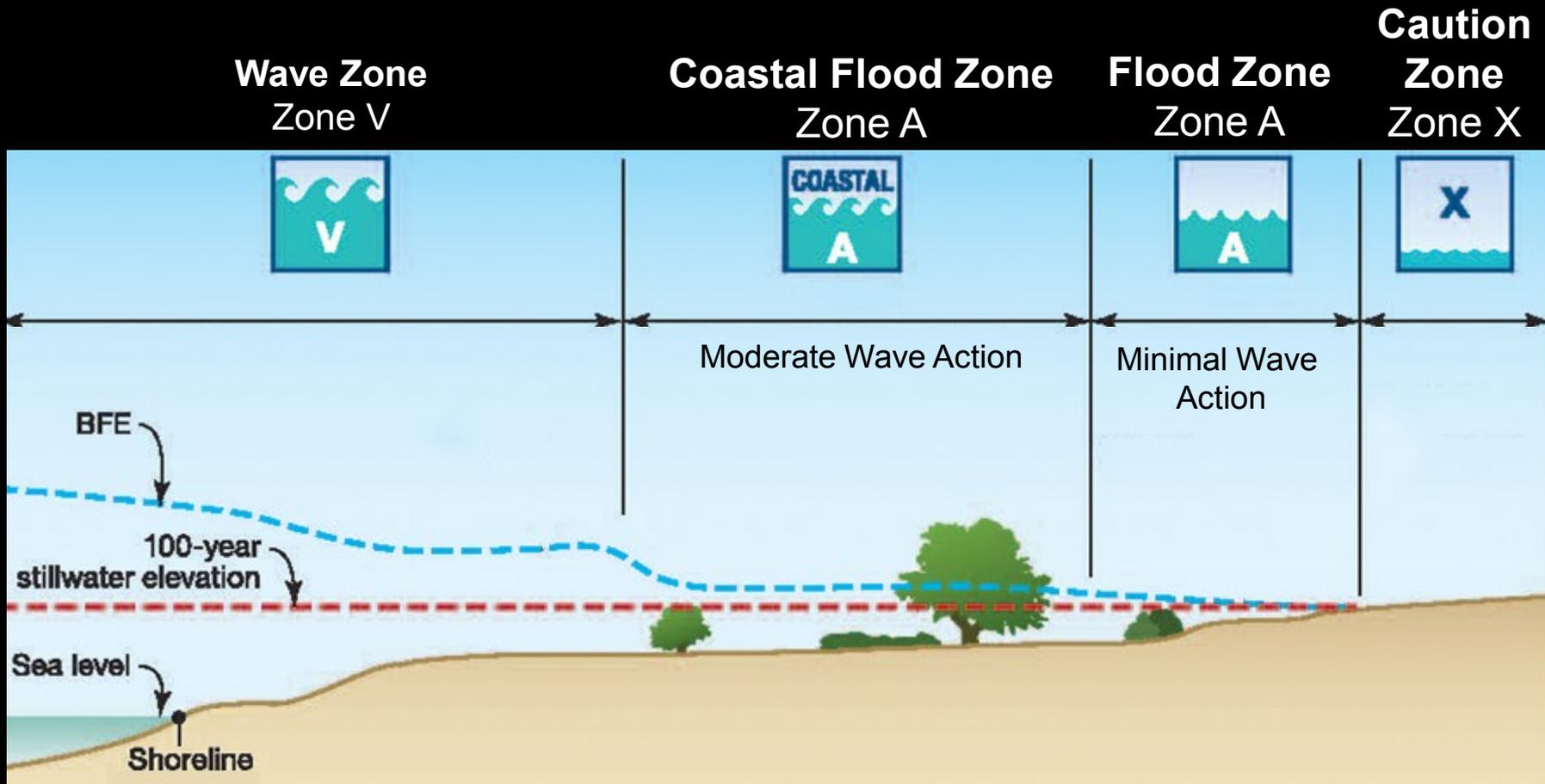
# FEMA Flood Zone Maps (FIRM)



[FEMA Map Service Center -  
https://msc.fema.gov](https://msc.fema.gov)

FIRM Map of an Area of Long Island, NY obtained from FEMA's Map Service Center  
(<https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1>)

# FEMA Flood Zones



The 4 main FEMA flood zones are governed by their relation to the BFE



**ELEVATE**

**RE-GRADE**



© Getty Images

# Best Practice Strategies

- Strive for “near absolute protection” to maintain building performance during/post events.
- **HURRIPLAN** recommends Beyond Code BEST PRACTICE Strategies.\*

**\*Use industry guidelines and your professional judgment on a project specific basis.**

# ***Mahalo!***

<https://ndptc.hawaii.edu/>

<http://www.dsarch.net/>



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