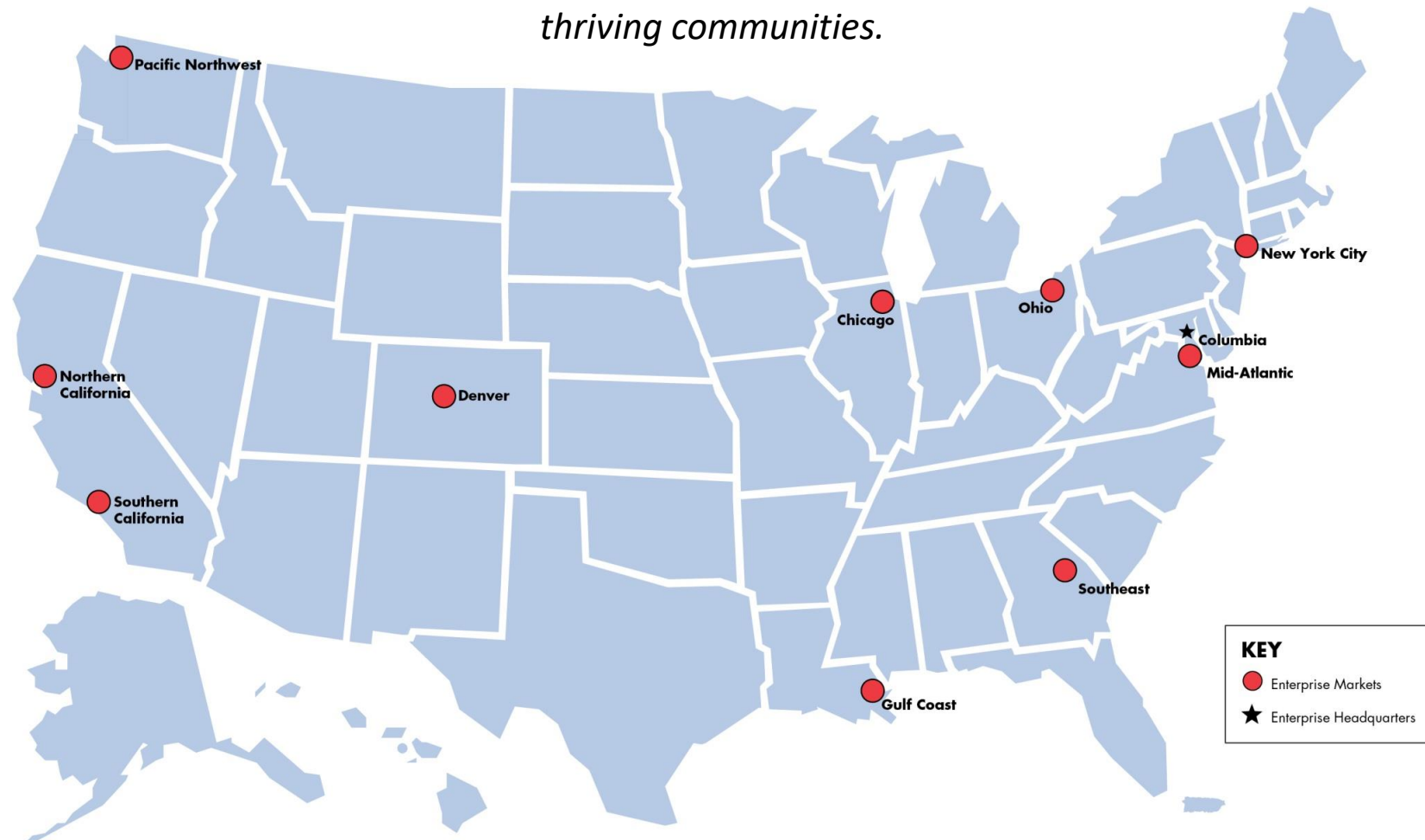


# ***Hurricane Season EERI Briefing 2020 Keep Safe***



# Enterprise: Who We Are

*Create opportunity for low- and moderate-income people through fit, affordable housing in diverse, thriving communities.*







## 15 Years of Work in Housing Resilience, Recovery, Rebuilding Disasters Impact Housing Security

Hurricane Katrina  
August 23, 2005 800K  
Homes

Super Storm Sandy  
October 22, 2012  
650K Homes

Hurricane Harvey-  
Houston  
August 17, 2017  
135K Homes

Hurricane Maria-  
Puerto Rico/USVI  
September 20, 2017  
370K Homes

Fires, California  
October 2017, 2018,  
2019 60K Plus



## We have an Affordable Housing Crisis in the United States

- For the majority of **states**, between 10% and 15% of households are **housing insecure**. California and New York have the most **housing insecurity**; 20% of households face **housing insecurity**. Island communities







# COVID-19 SHELTERING IN PLACE

---



“The house is the place where both planning and community development impact upon the family and individual. Planning for housing must therefore take into account more than the physical structure and spatial requirements; it should consider the social, economic and psychological needs of the individuals and families who will occupy the housing. And housing must be considered within the community context.”

Lucilla Fuller Marvel





# ATLANTIC HURRICANE FORECAST

**2020**

	AVERAGE	CSU FORECAST	2019
<b>TOTAL NAME STORMS</b>	<b>12</b>	<b>16</b>	<b>18</b>
<b>HURRICANES</b>	<b>6</b>	<b>8</b>	<b>6</b>
<b>MAJOR HURRICANES</b>	<b>3</b>	<b>4</b>	<b>3</b>

MAJOR HURRICANE IS CATEGORY 3 OR HIGHER



**NATIONAL  
TROPICAL  
WEATHER  
CONFERENCE**



# THE SPREAD OF ILLNESS AND DISEASE IN THE WAKE OF NATURAL DISASTERS

Building Resilient Homes helps mitigate impacts to the health and well being of residents and communities facing extreme weather and natural hazard Risks. See [Keep Safe](#) for guidance.



Untreated sewage after a flood can introduce bacteria, viruses and parasites



Heavy rain and flooding can create conditions for mosquitos and other vectors that cause malaria and dengue fever



Moisture after flooding leads to mold, which can cause asthma and other respiratory problems



Particle pollution from fires can trigger asthma attacks, heart attacks and strokes



Carbon monoxide from fires can lead to headaches, nausea, dizziness and, in high concentrations, premature death



Extreme heat can lead to cardiovascular and respiratory disorders



Earthquakes can create dust clouds that carry fungus spores, which can cause asthma













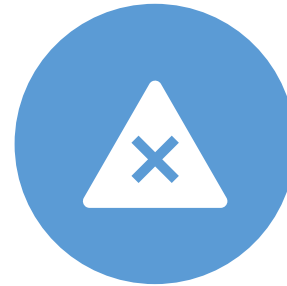
Call upon Diversity of Community Members to inform and define what resilience and mitigation planning is. Build Prototypes for peer to peer learning and sharing.



Jurisdictions identify how to leverage the Weatherization model to ensure homes are fortified in advance of storms with focus on Structural Risk (Roofs, Anchorage), Energy and Health Related Conditions.



Consider regional planning not just locality- especially in consideration of flood plain management and resource management.



Consider importance of non-profit sector in implementation of work.

# Call to Action-Promoting Climate Resilient Islands



Models: Rapido Temp to  
Perm Housing Houston,  
Texas





# OPPORTUNITY

- FEMA-BRIC
- HUD- CDBG, CDBG-DR, CDBG-MIT
- DOT
- USDOE
- Community Reinvestment Act
- ESG





# Mitigation- Investment in Community Development



Advance other community objectives



Capital improvements, infrastructure protection, open space preservation, and economic resiliency



A one-time cost for implementing a mitigation action often results in long-term savings to the community.



# Faces of Resilience



People

The extent of personal discomfort, harm, injury, or loss of life.



Physical Assets

Loss or damage to structural and architectural building components, MEP and IT equipment, utilities, landscaping, contents.



Operations

Disruption to building operations and functionality, occupancy, egress/ingress, critical systems, or lab activities.



Revenue

Loss of revenue due to business interruption, specifically in relation to tenants.



Reputation

Negative media attention or impact on industry reputation in the aftermath of an impactful shock or stress.





# MANTÉNGASE SEGURO

UNA GUÍA PARA EL DISEÑO DE VIVIENDAS  
RESILIENTES EN COMUNIDADES ISLEÑAS



# KEEP SAFE

A GUIDE FOR RESILIENT  
HOUSING DESIGN IN  
ISLAND COMMUNITIES







# KEEP SAFE

## A GUIDE FOR RESILIENT HOUSING DESIGN IN ISLAND COMMUNITIES

English

Table of Contents

- Letters Of Introduction
- Introduction
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A Safer Site: Site Fortification S
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Water Management And Storage
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Community Engagement: Prepa
- CHAPTER 8  
Putting It All Together
- Resources



# Collaboration



## Sponsors



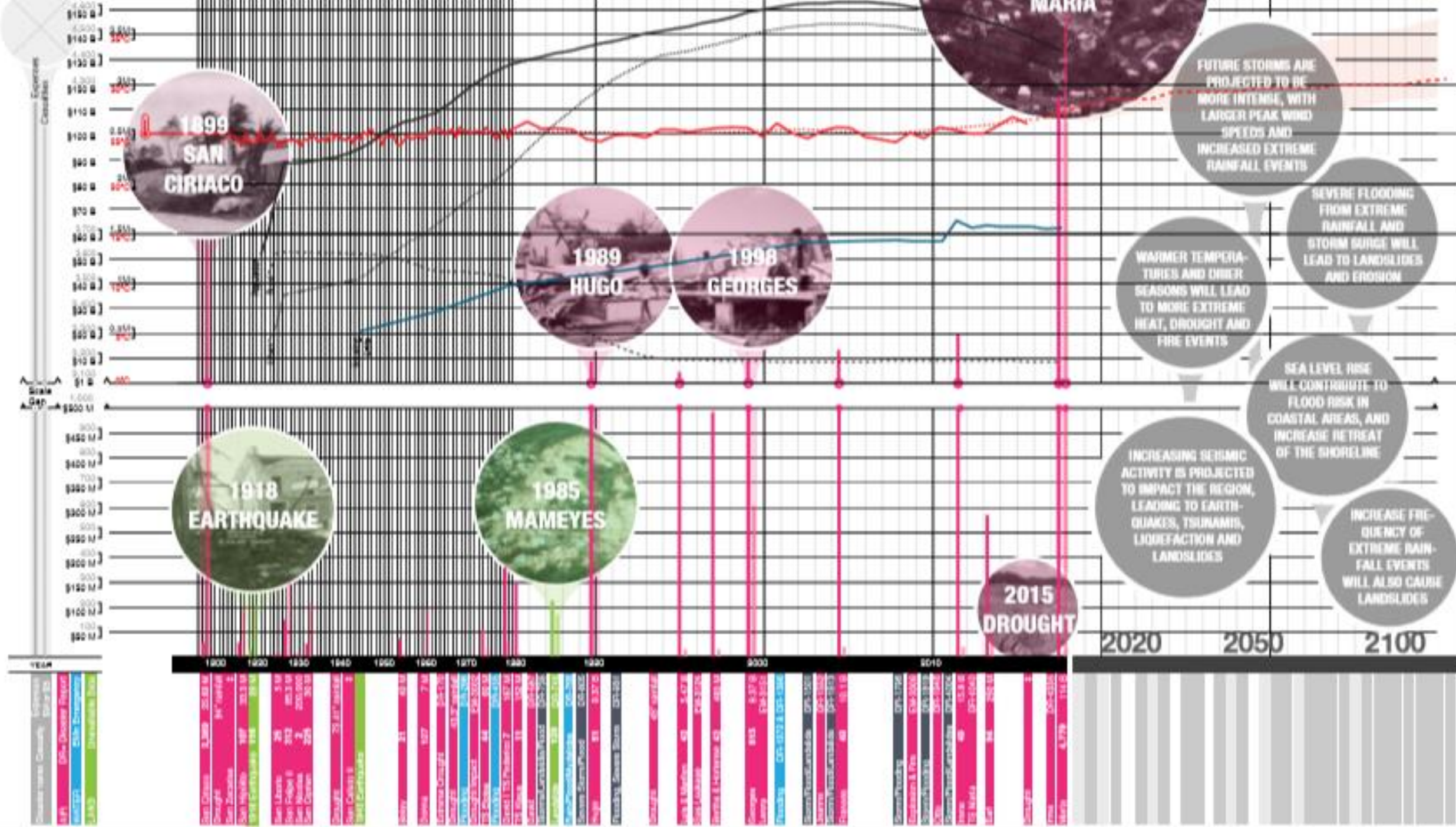
## Contributing Partners



## Funders







**1899  
SAN CIRIACO**

**1989  
HUGO**

**1998  
GEORGES**

**1918  
EARTHQUAKE**

**1985  
MAMEYES**

**2015  
DROUGHT**

**MARIA**

FUTURE STORMS ARE PROJECTED TO BE MORE INTENSE, WITH LARGER PEAK WIND SPEEDS AND INCREASED EXTREME RAINFALL EVENTS

WARMER TEMPERATURES AND DRIER SEASONS WILL LEAD TO MORE EXTREME HEAT, DROUGHT AND FIRE EVENTS

SEVERE FLOODING FROM EXTREME RAINFALL AND STORM SURGE WILL LEAD TO LANDSLIDES AND EROSION

SEA LEVEL RISE WILL CONTRIBUTE TO FLOOD RISK IN COASTAL AREAS, AND INCREASE RETREAT OF THE SHORELINE

INCREASING SEISMIC ACTIVITY IS PROJECTED TO IMPACT THE REGION, LEADING TO EARTHQUAKES, TSUNAMIS, LIQREFACTION AND LANDSLIDES

INCREASE FREQUENCY OF EXTREME RAINFALL EVENTS WILL ALSO CAUSE LANDSLIDES

2020 2050 2100



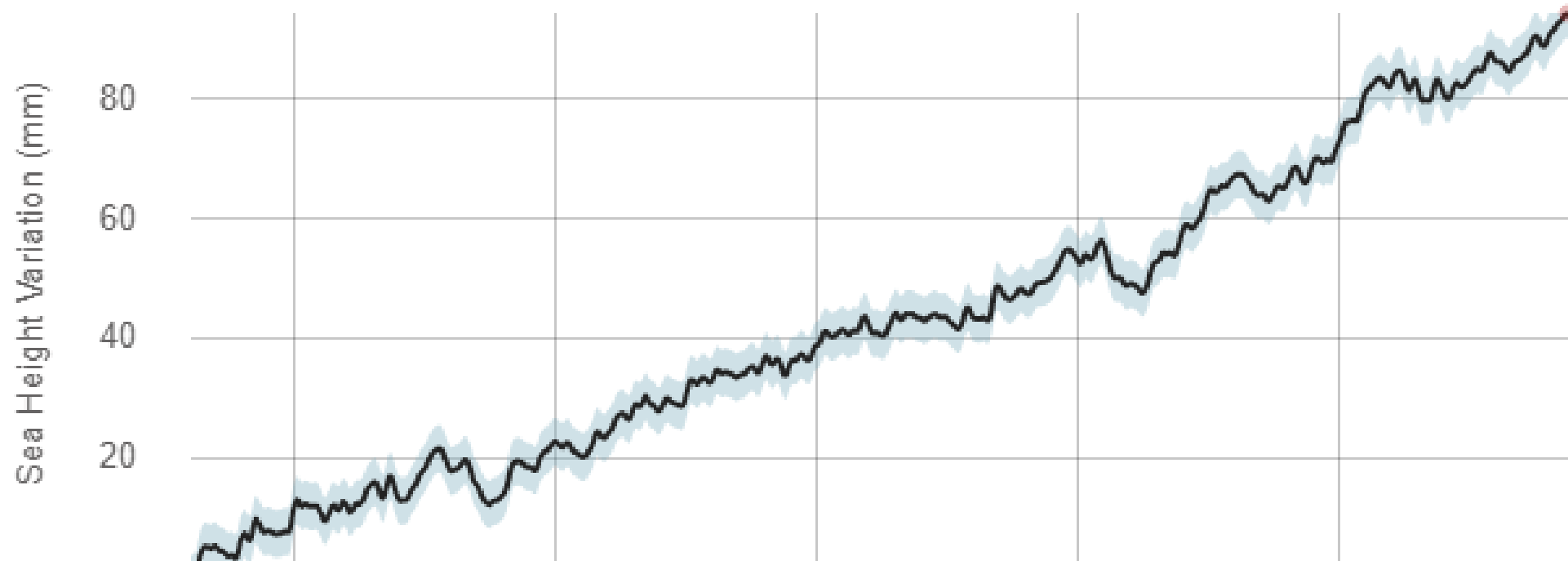
# Designing for the Future

## SATELLITE DATA: 1993-PRESENT

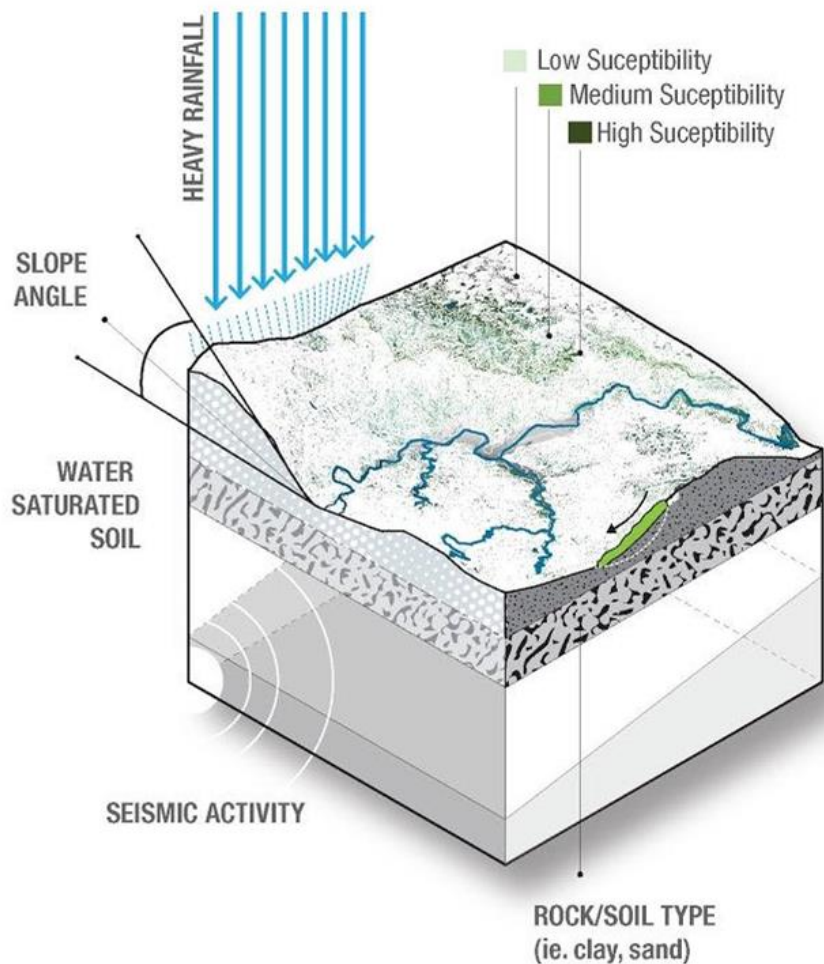
Data source: Satellite sea level observations.  
Credit: NASA Goddard Space Flight Center

RATE OF CHANGE

↑ **3.3**  
millimeters per year







## ATMOSPHERIC AIR



## GEOLOGIC LAND



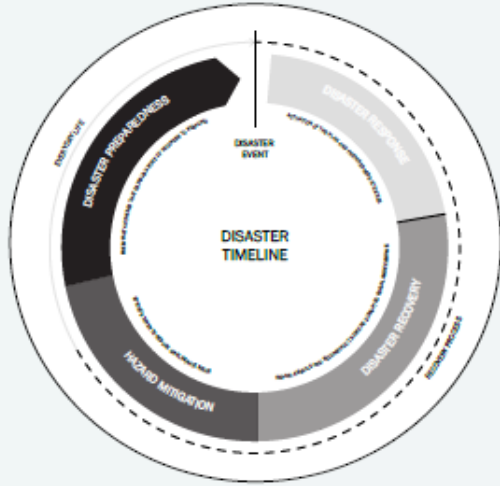
## HYDROLOGIC WATER



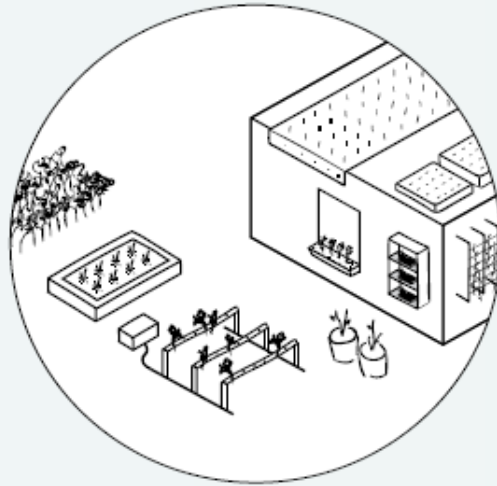


# KEEP SAFE

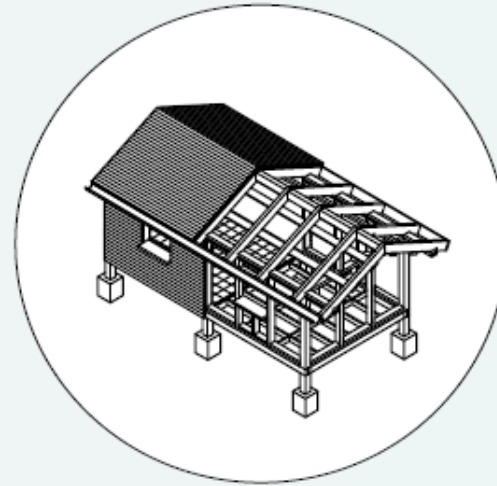
THE GUIDE IS COMPRISED OF THE FOLLOWING CHAPTERS:



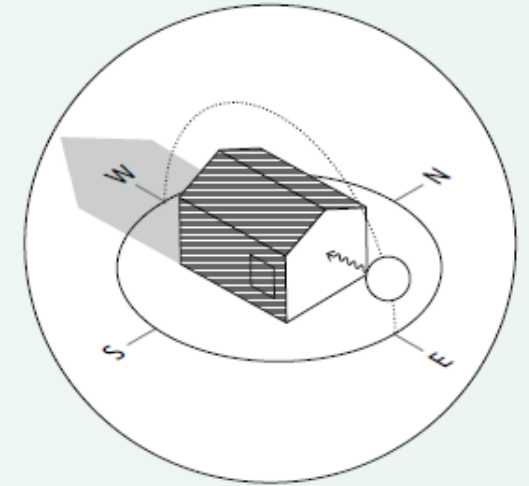
**Introduction**



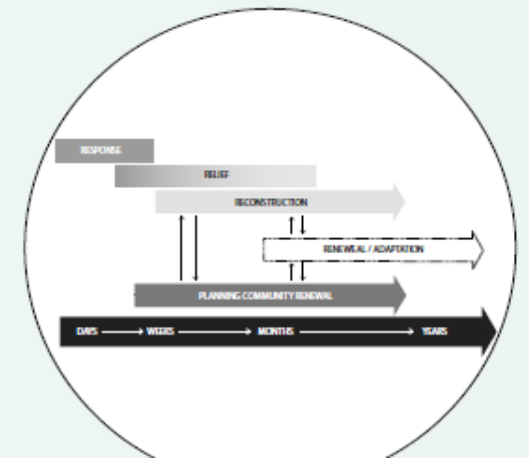
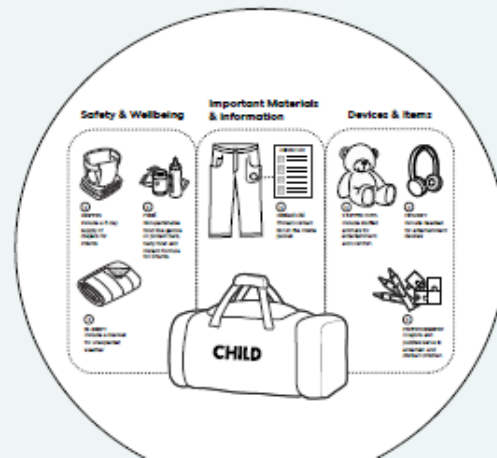
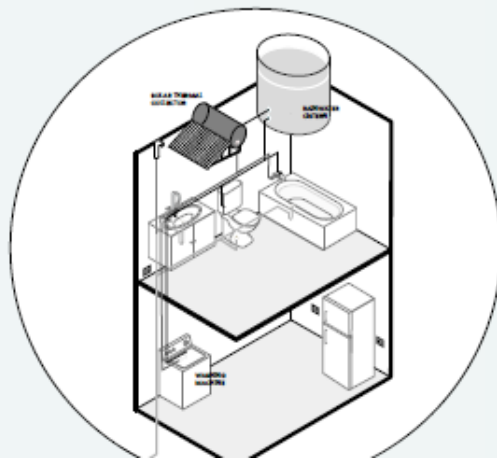
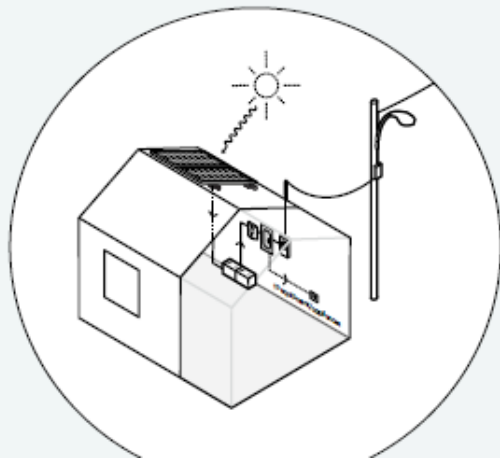
**Chapter 1: A Safer Site**



**Chapter 2: Building Protection**



**Chapter 3: Passive Habitability**





# KEEP SAFE

## PUTTING IT ALL TOGETHER

- Funding
- Contracting
- Building to Code
- Pulling Permits
- Insurance
- Design





# Who is it for?



## IS THIS GUIDE FOR ME?



### Homeowner or Building Owner

As the owner of your home, be it a townhouse or a detached building, you wield the power to make decisions regarding your structure's resiliency. You can choose to make major, permanent changes to your site and home to ensure safety before, during, and after a natural disaster.



### Community leader

The community regards you as their representative. Your communication and organizational skills enable you to serve as a liaison between governmental/external efforts during times of distress. By taking on a leadership role to bring your community together in the face of an emergency, you are catalyzing a collaborative effort towards resiliency that can persist long after the disaster hits.



### Tenant

Renting at a multifamily building may limit the actions you can take in terms of fortifying your home against natural disasters because you have limited ability to determine how the building is prepared but you can still provide the authority with suggestions and key information found in this guide to improve your home.



### Administrator

You may be an administrator of a housing program or are able to determine how to regulate a housing facility or home. This guide can help you determine ways to safeguard the building from hazards or set up a program to fund or support housing resilience.



### Property Operator

You are the legal owner of a property which you rent out and you are responsible for ensuring it is safe and has emergency plans in place. Your tenants can certainly engage in some of the preventive and prescriptive measures included in this guide.



### Construction Professional

As an architect, engineer, contractor, master builder, inspector, or other professional in the construction industry, the information included in the main corpus of this guide may seem basic to you. However, it is becoming increasingly important to bear these principles in mind.



## TYPE OF HOME

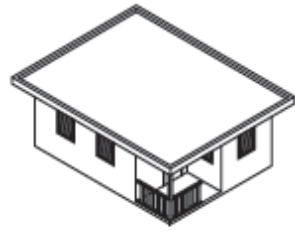


NAME

### WOODEN DETACHED

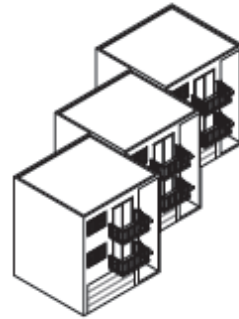
DESCRIPTION

- Wooden Structure
- Can have Zinc roof



### CONCRETE DETACHED

- Concrete/Block and rebar structure
- 1-2 stories



### TOWN HOUSES

- "Medianera" or shared wall
- One owner per vertical unit

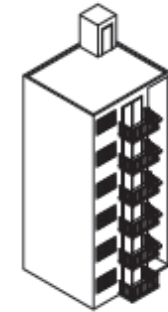


NAME

### WALK-UP

DESCRIPTION

- Multiple owner
- Up to 3 floors from ground



### HIGH RISE CONDOMINIUM

- Multiple Owner
- 3 floors and up
- Administrator oversees big decisions
- Requires elevators

## TYPE OF COMMUNITY



NAME

### INFORMAL COMMUNITY

DESCRIPTION

- Area of mixed use
- Uncertain property limits
- Organic growth
- Some units are only accessible via alleyways
- Limited outdoor space (private)



### URBAN LOTIFICATION

- Defined lots
- Planned growth
- Formal roads
- Many units share walls
- Area of mixed use



### URBANIZATION

- Defined lots with dedicated outdoor space
- Homogeneous building typologies
- Can be gated



NAME

### FINCA

DESCRIPTION

- Irregular topography
- Lotification size and form varies
- Dispersed lotification

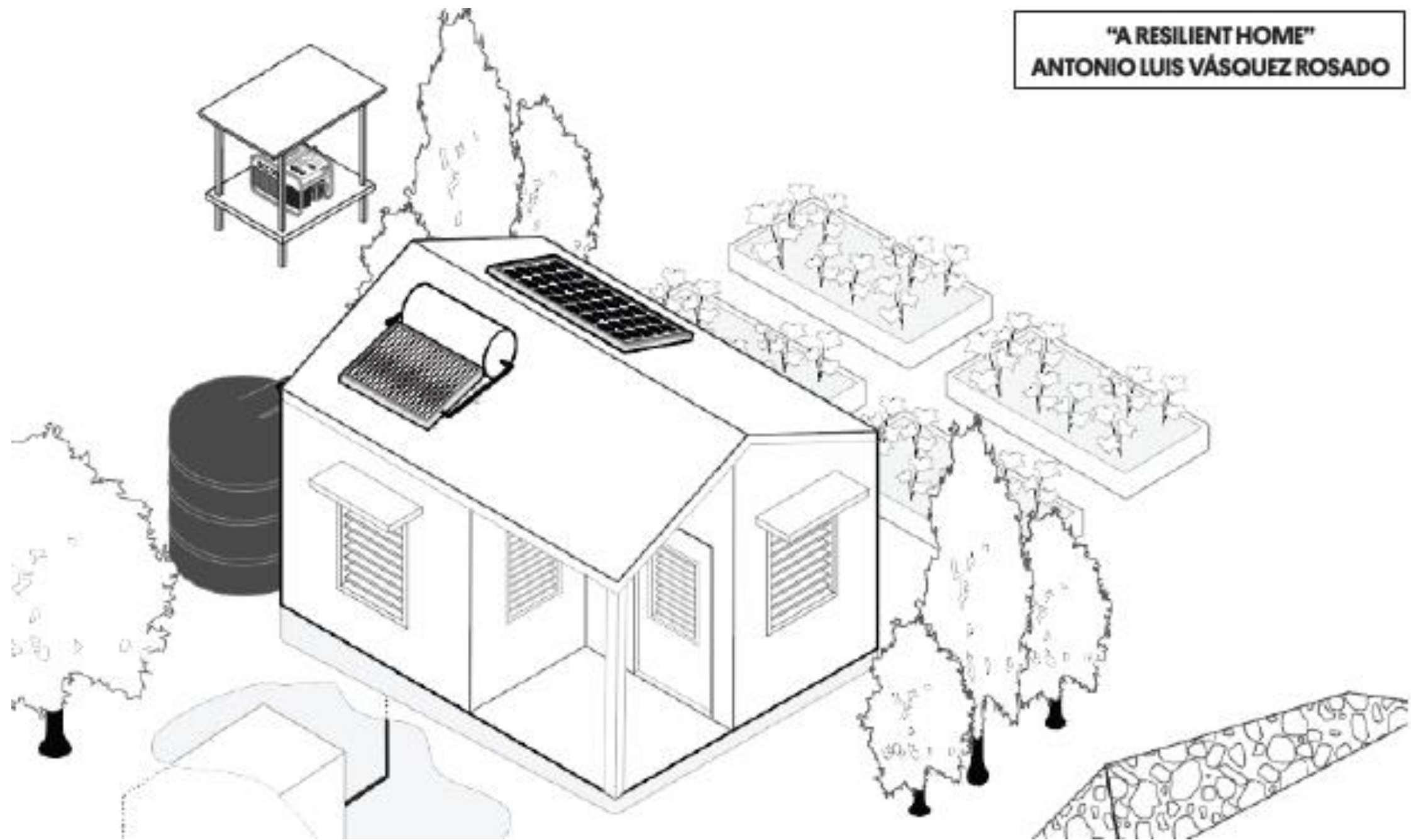


### INDEPENDENT MEGA-LOT

- Strictly defined lot
- Defined areas for parking or outdoor spaces



**"A RESILIENT HOME"**  
**ANTONIO LUIS VÁSQUEZ ROSADO**







8

- Continue to add nutrients to soil as needed.

- You can add a natural fertilizer, like homemade compost, up to once a month.
- Keep track of the rain so you do not saturate the plants with water.



9

- Till between crop cycles to oxygenate soil

- Keep track of the rain so you do not saturate the plants with water.



### C. BEGIN THE PLANTING PROCESS

#### Hydroponic Gardening

- ▶ a. Hydroponics is a method of growing plants without soil by using mineral nutrient solutions in a water solvent.
- ▶ b. The nutrients used in hydroponic systems can come from an array of different sources; these can include, but are not limited to, byproduct from fish waste, duck manure, or purchased chemical fertilizers.

- ▶ d. For all techniques, hydroponic reservoirs are built of plastic, but other materials have been used, including concrete, glass, metal, vegetable solids, and wood. Containers should exclude lip to prevent algae and fungal growth in the nutrient solution.
- ▶ e. With hydroponic farming, there are two types of watering systems: continuous flow or static. In continuous flow systems, water needs continuous circulation through the system and this requires



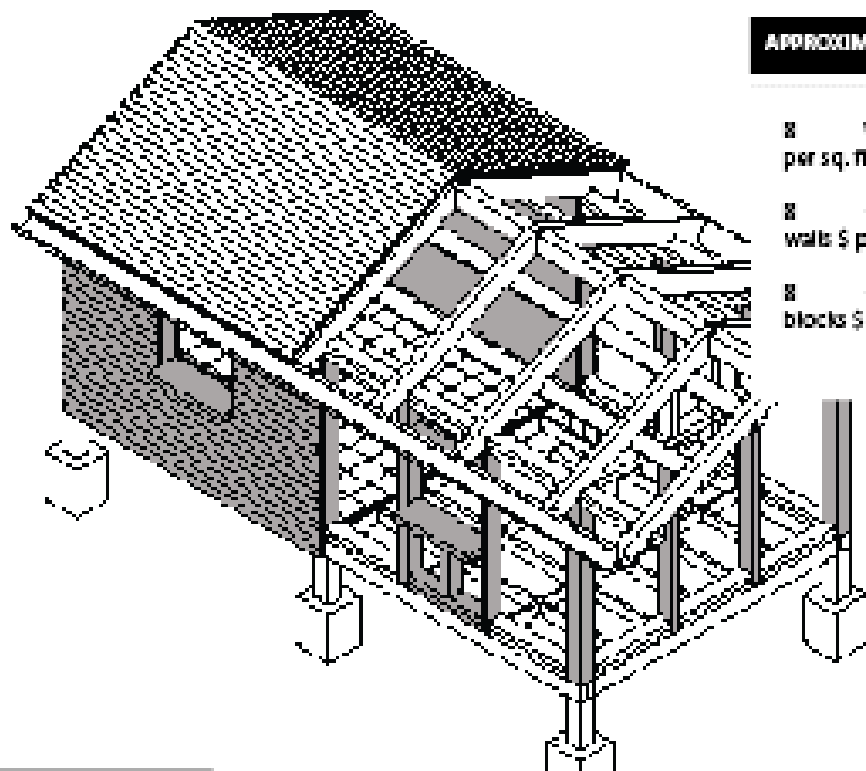
## BUILD A STRONG FOUNDATION

### STRATEGY IN ACTION

#### STEP 1 - WALL DESIGN PRINCIPLES

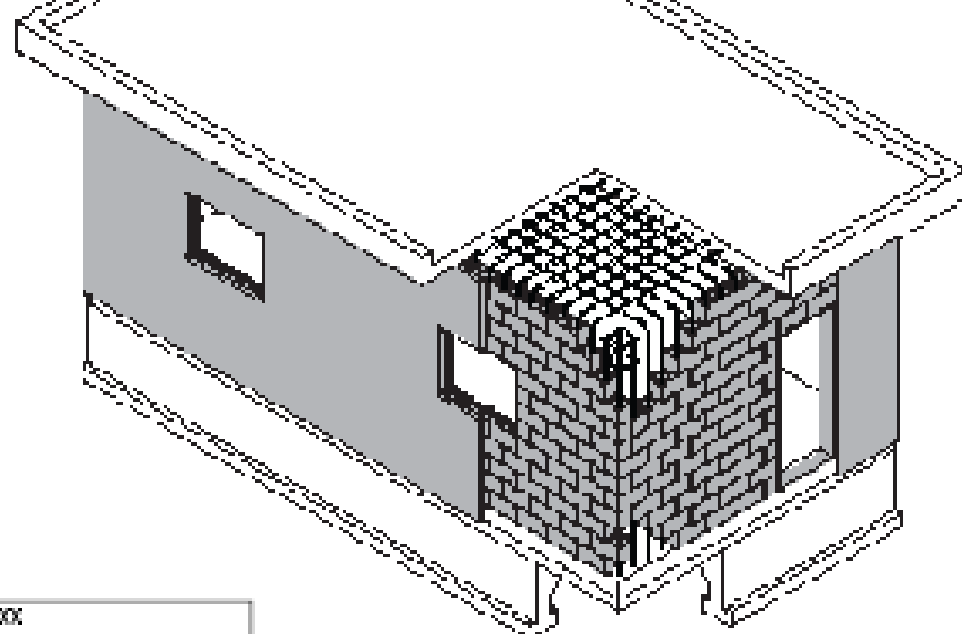
- Maintaining a continuous load path is like a chain that holds a home together from the roof to the foundation. A continuous load path is critical during an earthquake or hurricane because it holds a home together when ground forces or high winds try to pull it apart. Maintain a continuous load path by using vertical reinforcement, from the foundation to the roof, through the structural walls.

- Anchor interior partition walls into the structural frame for stability.

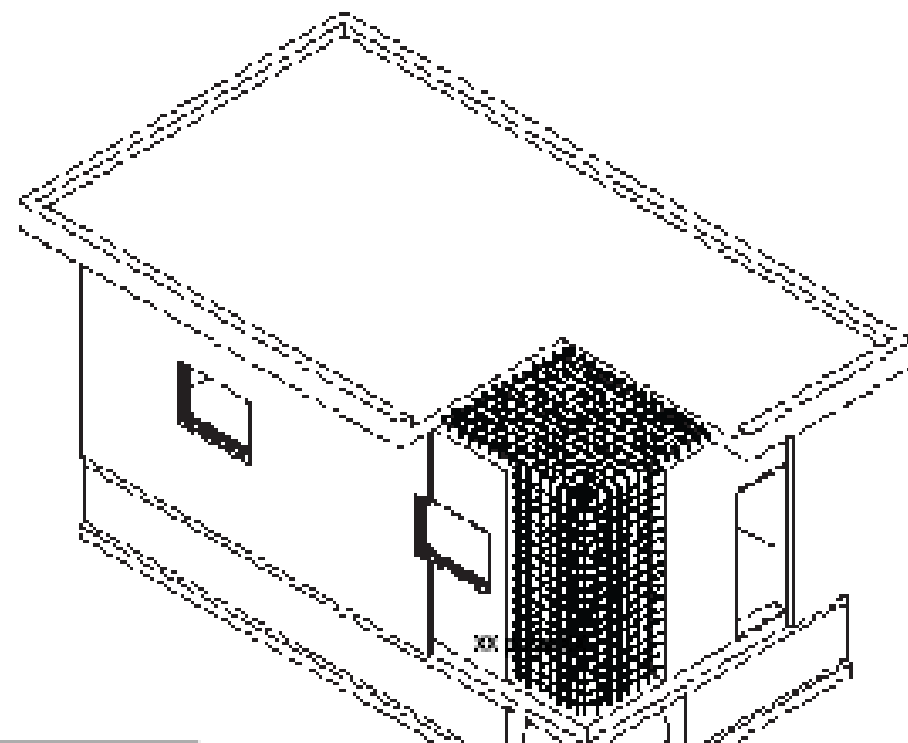


#### APPROXIMATE COST

- ⌘ Wood frame with panels \$ per sq. ft.
- ⌘ Concrete columns with fill-in walls \$ per sq. ft.
- ⌘ Cast-in-place concrete with blocks \$ per sq. ft.



VXXXXX





# ENERGY GENERATION + BACKUP

*Strategies that provide critical needs for power when a facility loses power or other services*

INTRO

[Introduction](#)

STRATEGY 15

[Reduce your Energy Use](#)

STRATEGY 16

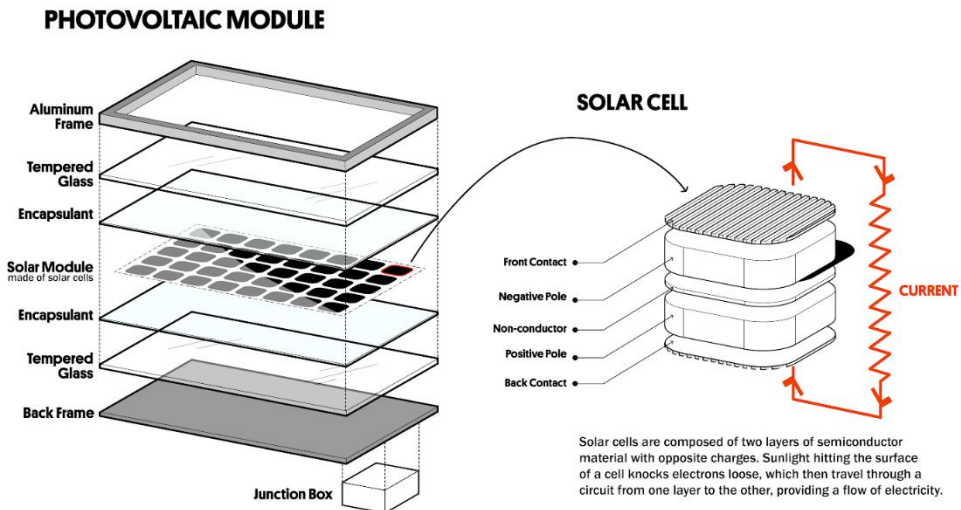
[Integrate Solar Electricity](#)

STRATEGY 17

[Integrate Solar Thermal Energy](#)

STRATEGY 18

[Install Energy Backup](#)





# WATER MANAGEMENT + STORAGE

Strategies that provide critical needs for water when a facility loses power or other services.

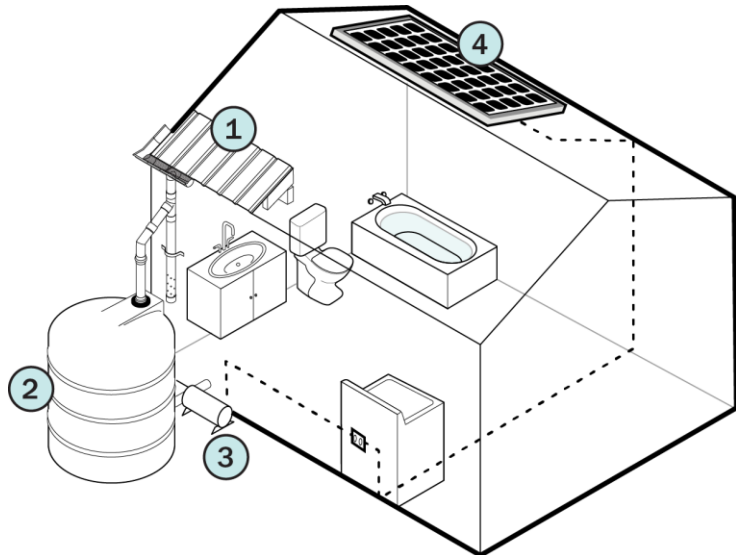
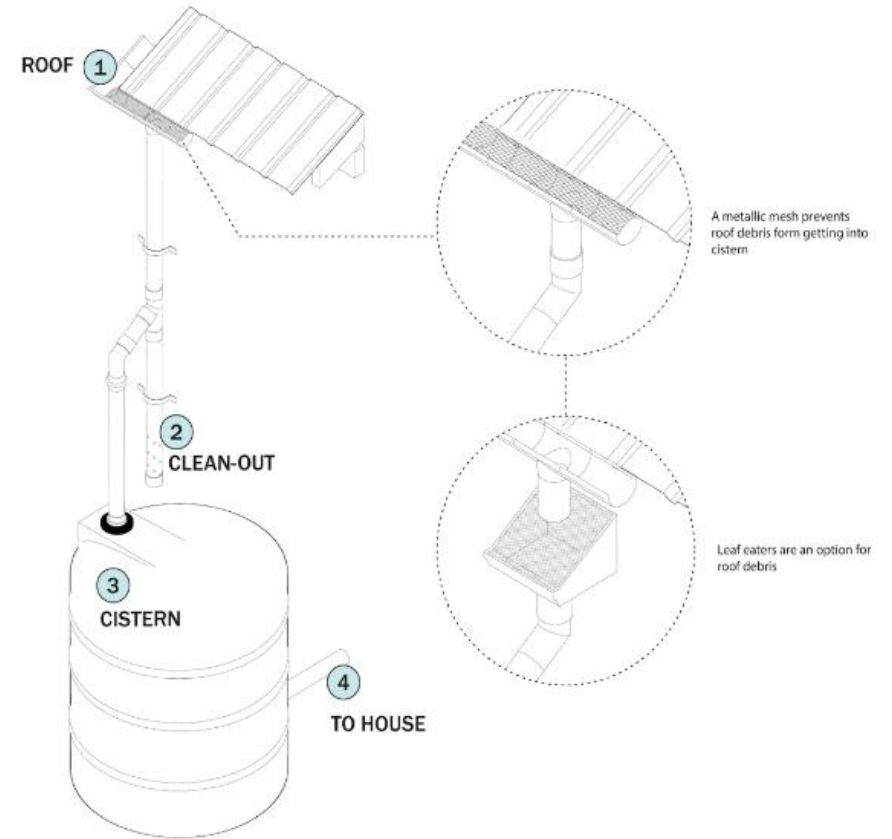
## INTRO [Introduction](#)

## STRATEGY 19 [Reduce your Water Consumption](#)

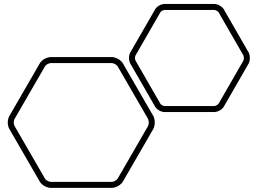
## STRATEGY 20 [Collect and Use Rainwater](#)

## STRATEGY 21 [Improve Septic Waste Disposal System](#)

## STRATEGY 22 [Prevent Wastewater Backflow in Homes](#)







# Keep Safe USVI







Creamos este recurso para ayudar a las comunidades a diseñar centros comunitarios resilientes para fortalecer la capacidad organizativa, promover la educación durante todo el año y poder enfrentar cambios climáticos, sociales y económicos. Ofrece sugerencias prácticas, incluido el desarrollo organización comunitaria, capacidad operativa y activos físicos relevantes para lograr resiliencia.

 **Ministerio de Educación** 



## COMUNIDADES UNIDAS

GUÍA PARA EL DISEÑO DE CENTROS COMUNITARIOS  
RESILIENTES EN COMUNIDADES ISLEÑAS



# Systems of a Community Resilience Center

## COMMUNICATIONS

- KP4.
- Satellite phone.
- Loudspeaker.
- Wifi/Data access for social media/ community bandwidth access for communication.
- Community-based radio station.
- Analogue telephone line.
- GoTenna mesh system- allows texting and GPS without internet.

## STRUCTURAL

A professional structural engineer should be consulted to verify the building meets code requirements for seismic movement. Depending on location, ensure the structure can withstand forces caused by storm surge produced by hurricane or tsunami events.

## ENERGY STORAGE

Design a holistic system that includes batteries for storing energy. Ensure that basic needs—like ventilation, emergency lighting, and electricity for essential equipment—is connected.

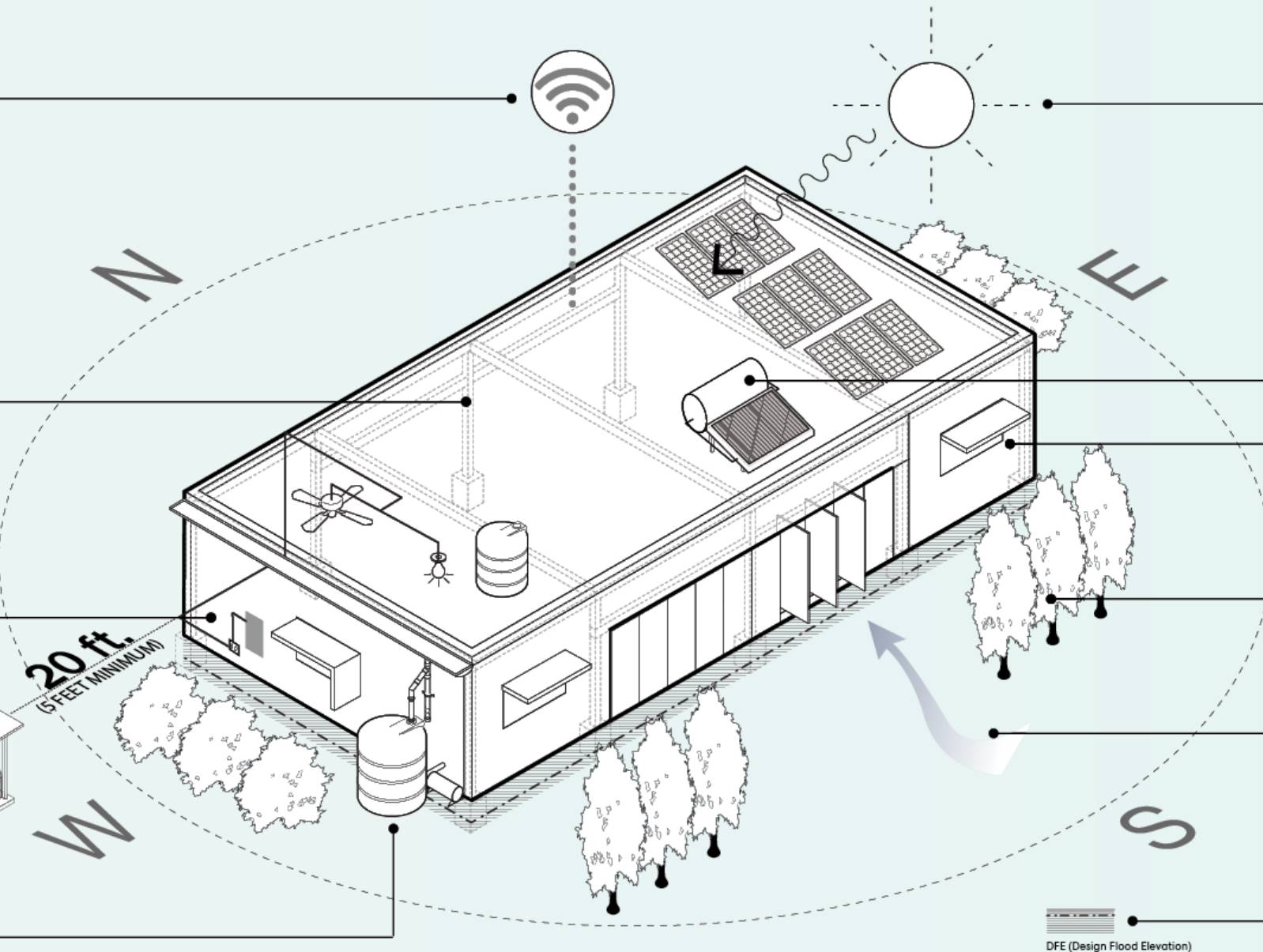
## ENERGY GENERATOR

Have a backup energy generator for emergencies. Ensure that the generator is placed outdoors, at least 20ft from the structure, and is protected from debris.

## RAINWATER COLLECTION

Install a rainwater collection system for non-potable water use, such as irrigation, flushing toilets and cleaning. If purified, water can be used for drinking.

Rainwater storage tank could be located on the roof or ground.



## SOLAR POWER

Install solar panels with batteries (some centers might also have a connection to the grid for selling power during low use or consuming power during high use), and/or other forms of renewable energy. Other recommendations for the community center or individual houses: portable solar charger for mobile phones, solar lamps, portable solar power generators, dedicated solar panels for critically ill patients (for example, requiring dialysis or respirators), solar refrigerators, or back-up diesel generator.

## SOLAR THERMAL HEATER

Use solar energy to heat up water.

## OPENINGS

Design using operable windows and doors, that allow cross breezes and ventilation. Maximize space by allowing the exterior areas to be used. Shade openings to reduce amount of sunlight and heat gain entering the building.

## VEGETATION

Use native vegetation to increase shade, mitigate excessive sunlight, reduce heat gain, and generate breeze, thereby reducing energy costs.

## VENTILATION

Design a ventilation system in which air is always circulating through the inhabited space. This ventilation system could be passive with natural breezes or mechanical with active systems, such as air conditioning.

If new construction, place the building above the Design Flood Elevation (DFE). If it is already built, ensure equipment that might get damaged with water is stored above the DFE.

DFE (Design Flood Elevation)







# Deployment Partners







## PORTFOLIO PROTECT





# KEEP SAFE

[KeepSafe@enterprisecommunity.org](mailto:KeepSafe@enterprisecommunity.org)

[Ischoeman@enterprisecommunity.org](mailto:Ischoeman@enterprisecommunity.org)