Resilience & The Evolving Standard of Care

Part 1

September 18, 2024

AIA California

California has been experiencing intensified impact from climate changes to our buildings and communities. These impacts have created both challenges and opportunities for California architects in many ways: design processes, stakeholder engagement, regulatory compliance, and standard of care.

AIACA assumes leadership in providing California architects with resources they need to strengthen their practice and to protect Health, Safety, and Welfare of Californians.

Learning Objectives

	Recognize and distinguish how industry practice is changing in response to worsening climate conditions (Industry Standard of Care), and how courts view the responsibilities of design firms in designing to account for future climate risks (Legal Standard of Care).
	Understand the five steps in the Tool Kit methodology used to create mitigation strategies for high-performance buildings that include Sustainability and Net Zero Carbon Design components.
	Know the impact of choices made in a project from Scope to Project Integration.
	Identify opportunities and provide examples for clients that embrace resilience goals and risks that may come with ignoring shocks and stresses.
	Understand the role and use of the REDi™ Rating System.

Attendees will earn **1.5 AIA LU/HSW** for attending this presentation live.
AIA CA will submit you for AIA credit.

AIA Continuing Education Provider

Housekeeping Reminders

Resources will be made available on our website

Today's session qualifies for 1.5 AIA HSW/LU & 1.5hrs of ZNCD

Use the Q&A to ask questions for today's presenters

Cultivate a positive learning environment

ARUP

Sustainable Development is Everything.

Moderator: Tian Feng, FAIA

Agency Architect for the San Francisco Bay Area Rapid Transit District (BART)

AIACA & Resilient Design Committee

January 2, 2022, A wave of king tide overtopping embankment at San Francisco Embarcadero. Photo by Tian Feng

Since 1967, **AIA California** has been in the forefront of shaping and designing buildings and communities for the Health, Safety, and Welfare of Californians.

Intensified climate hazards not only impact our environment but also our practice of architecture. They demand architects to be equipped with ability for applying resilient design concept in their practice – a professional competence issue; they also demand architects to be knowledgeable about climate hazards' impact to their client's human and property wellbeing – a standard of care issue.

Resilience & The Evolving Standard of Care

Introduction

By AIACA staff and Moderator

Practice Resources – **AIA & HKS Resilient Design Toolkit**

Presented by HKS

Resilience Design Tools – **REDi™ Rating System**

Presented by ARUP

Trends & Case Studies - **An Evolving Standard of Care for Design Firms**

Presented by Victor Insurance Managers LLC

Discussion

Moderated by Tian Feng, FAIA, FCSI

Presenters

Sammy Shams, AIA – Sustainable Design Leader, HKS

Amanda S. Barton, AIA, RID – Project Designer, HKS

Josephine Hsu, AIA – Architect, HKS

Andreanna Tzortzis, SE, PE – Associate Structural Engineer, ARUP

Ana Moura-Cook, PE – ARUP Alum

Yvonne Castillo, Esq. – Sr. Vice President, Director of Risk Management & Global ESG Chair, Victor Insurance

Resilience and the Evolving Standard of Care

Session 01 –

Integrating Resilience Design Into Your Architectural Projects

Wednesday, September 18, 2024

12:00 Noon – 1:30 PM PST

Learning Units [1.5 Credit Hour]

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Questions related to specific products and services may be addressed at the conclusion of this presentation.

Speakers

Sammy Shams, AIA,
Sustainable Design Leader,
HKS

Amanda Barton, AIA, RID
Project Designer,
HKS

Josephine Hsu, Assoc. AIA
Architect,
HKS

Ana Moura-Cook, PE
Arup Alumna

Andreanna Tzortzis, SE, PE
Associate Structural Engineer,
Arup

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3. Know the impact of choices made in a project from Scope to Project Integration.
4. Identify opportunities and provide examples for clients that embrace resilience goals and risks that may come with ignoring shocks and stresses.
5. Understand the role and use of the REDi Rating System.

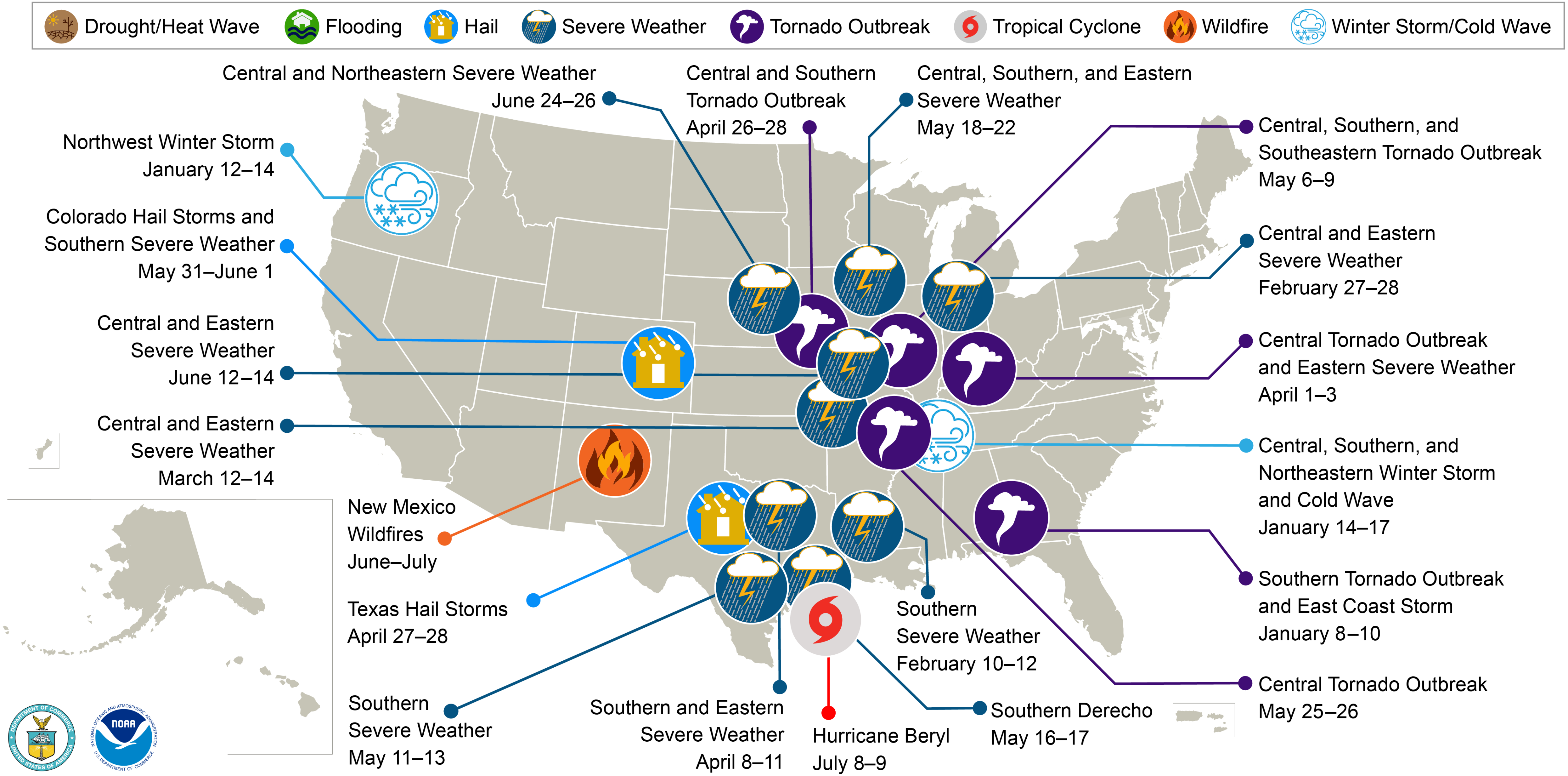
Agenda

- Resilience Overview
- Resilience Design Toolkit
    - Step 01: Resilience Scope Assessment
    - Step 02: Team Alignment & Project Planning
    - Step 03: Identify Hazards
    - Step 04: Integrate Resilience
    - Step 05: Evaluate + Nurture
- REDi™ Resilience-Based Design Guideline
- Best Practices & Closing Thoughts

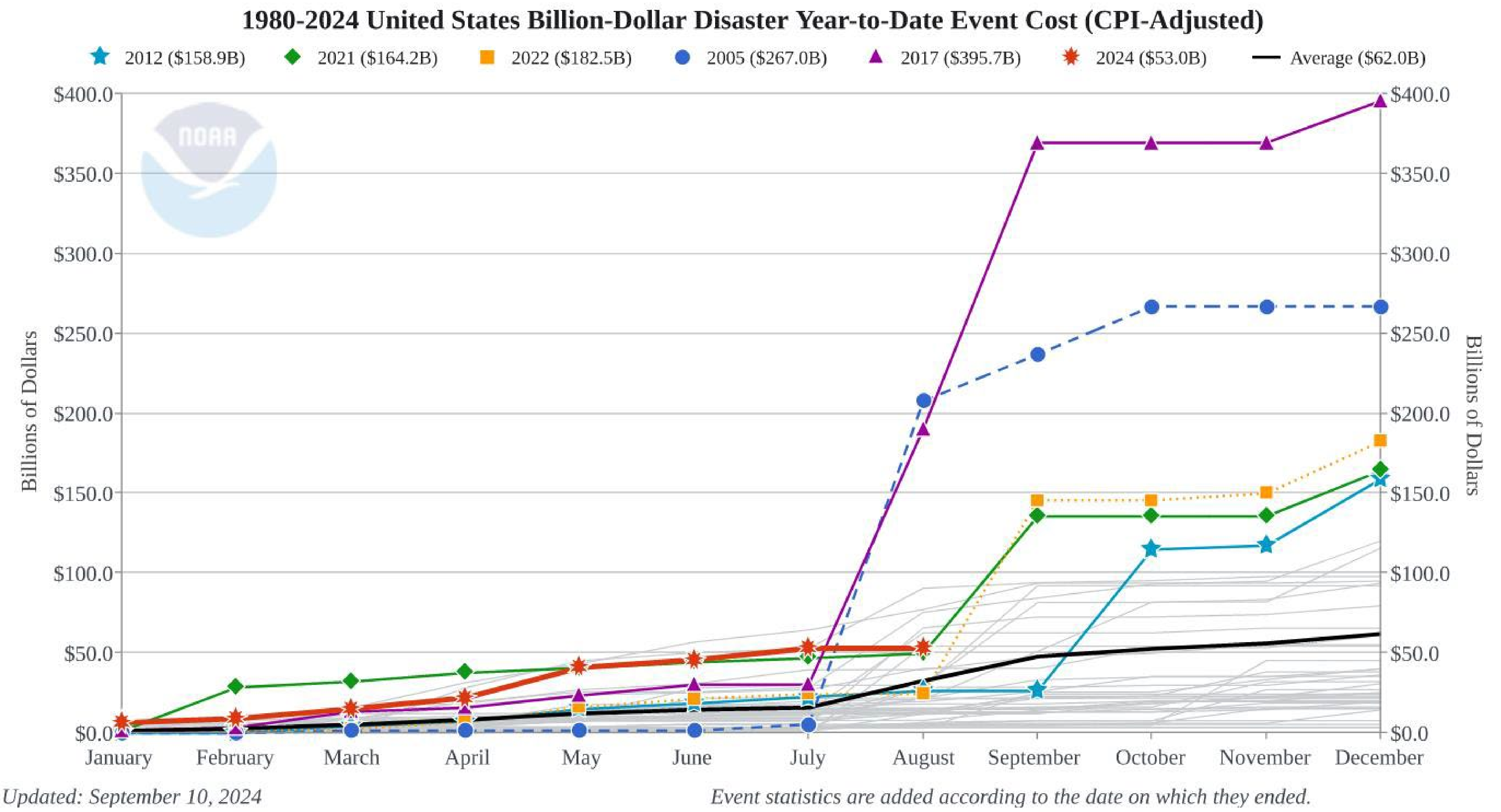
Resilience Overview

Why Resilience?

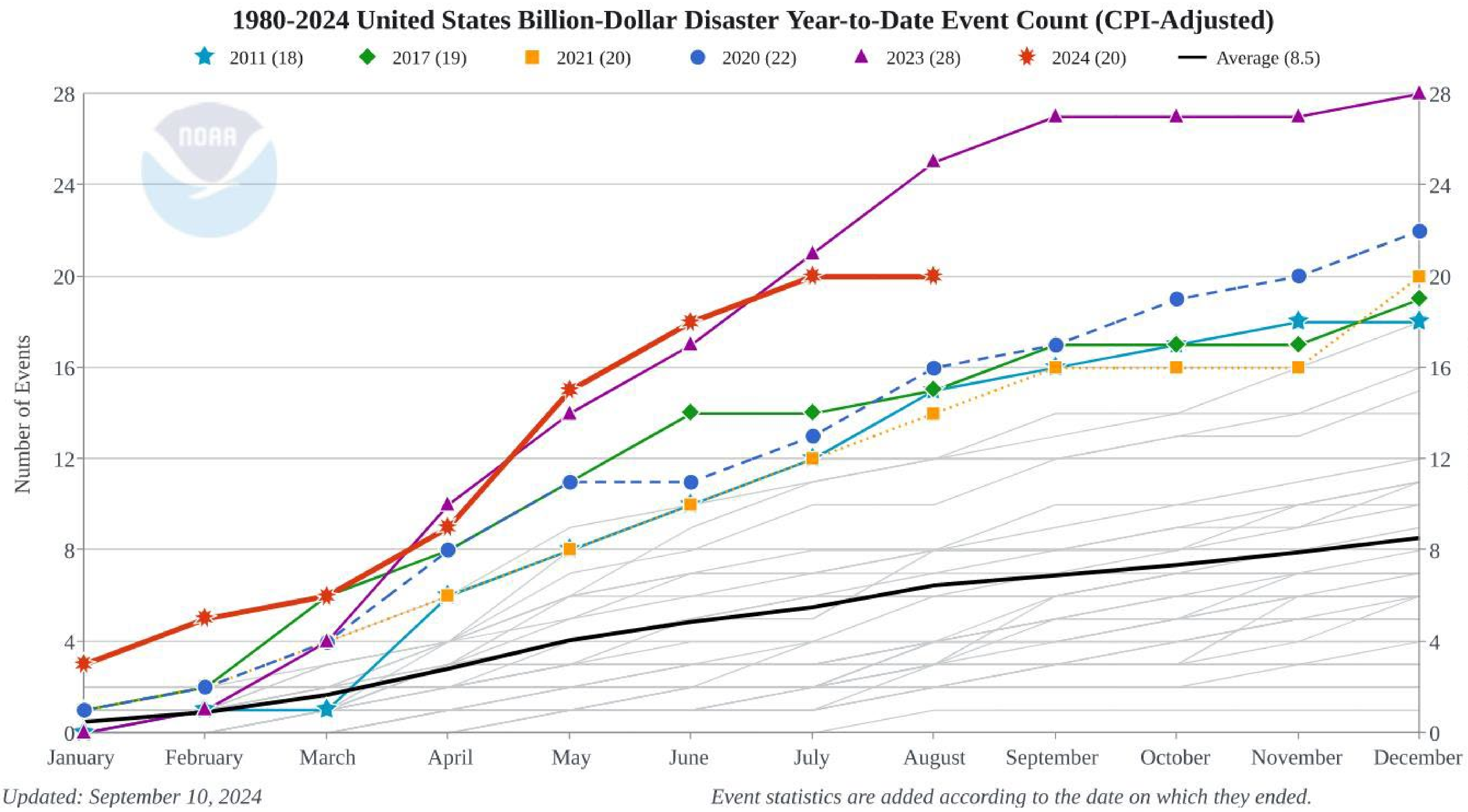
U.S. 2024 Billion-Dollar Weather and Climate Disasters



*This map denotes the approximate location for each of the **20 separate billion-dollar weather and climate disasters that impacted the United States through August 2024.***

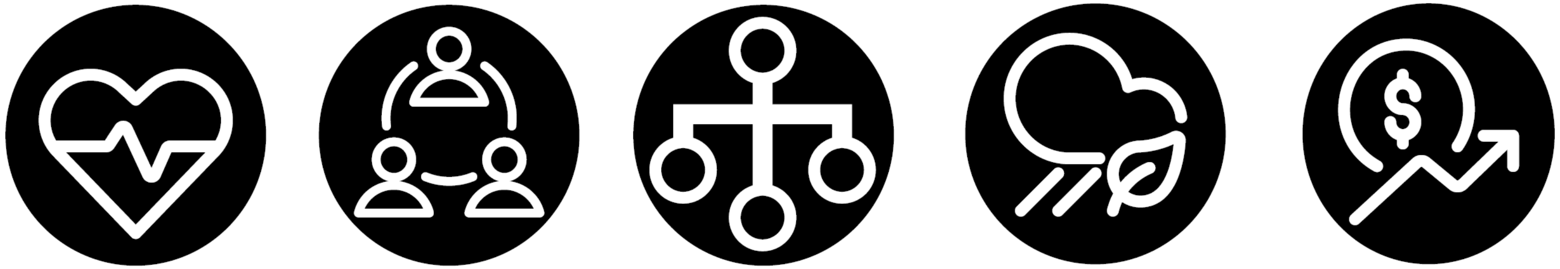


1980-2024 United States Billion-Dollar Disaster Year-to-Date Event Cost (CPI-Adjusted)
2012 ($158.9B)
2021 ($164.2B)
2022 ($182.5B)
2005 ($267.0B)
2017 ($395.7B)
2024 ($53.0B)
Average ($62.0B)
$400.0
$350.0
$300.0
$250.0
$200.0
$150.0
$100.0
$50.0
$0.0
Billions of Dollars
January
February
March
April
May
June
July
August
September
October
November
December
Updated: September 10, 2024
Event statistics are added according to the date on which they ended.



1980-2024 United States Billion-Dollar Disaster Year-to-Date Event Count (CPI-Adjusted)
2011 (18)
2017 (19)
2021 (20)
2020 (22)
2023 (28)
2024 (20)
Average (8.5)
Number of Events
0
4
8
12
16
20
24
28
January
February
March
April
May
June
July
August
September
October
November
December
Updated: September 10, 2024
Event statistics are added according to the date on which they ended.

5-Forms of Resilience



Health Resilience
refers to the physical, mental, and social health of individuals of a place.

Social Resilience
health of a community to maintain cultural and historical traditions that can define a sense of a place.

Infrastructure Resilience
focuses on the physical infrastructure of a place.

Environmental Resilience
includes climate and weather impacts on an ecosystem as well as all the native flora and fauna species of a place.

Economic Resilience
Ability to prepare, endure, and operate through adversity.

Sustainable design follows an additive model

The gains from each sustainable design choice are not explicitly dependent on all other choices.

Resilient design follows a weak-link model

All systems work together to maintain the building's essential functions across all aspects.

Sustainability

- Reduced Energy & Water Demand
- Renewable Energy
- Passive Building Systems
- Restore and protect site ecosystems
- Support community culture, customs, and needs

- Utility Grid Independence
- Habitat Protection
- Carbon Reduction

Resilience

- Multiple Energy & Water Sources
- Passive Survivability
- Leverage strengths of natural ecosystems
- Support Community connections and infrastructure

Mexico City Beach, FL after Hurricane Michael (Cat. 5) in 2018.

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Resilience Design Toolkit

Introduction

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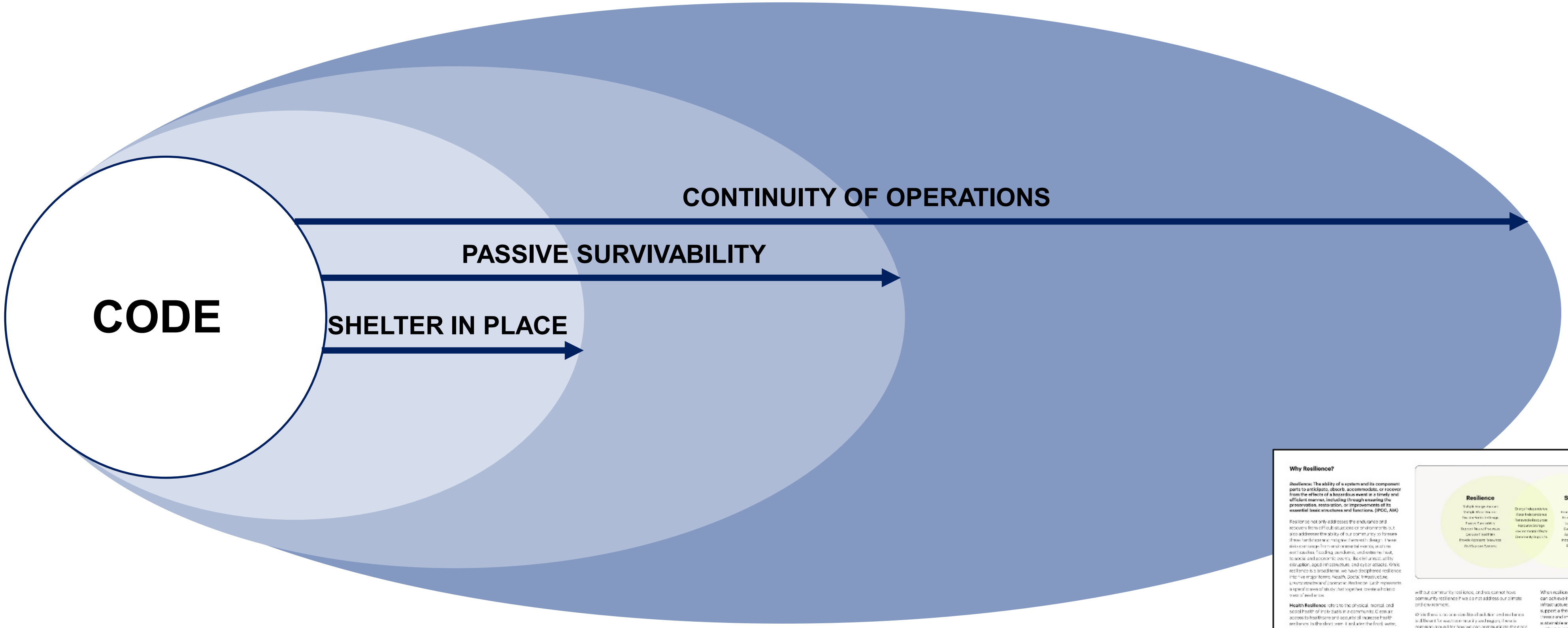
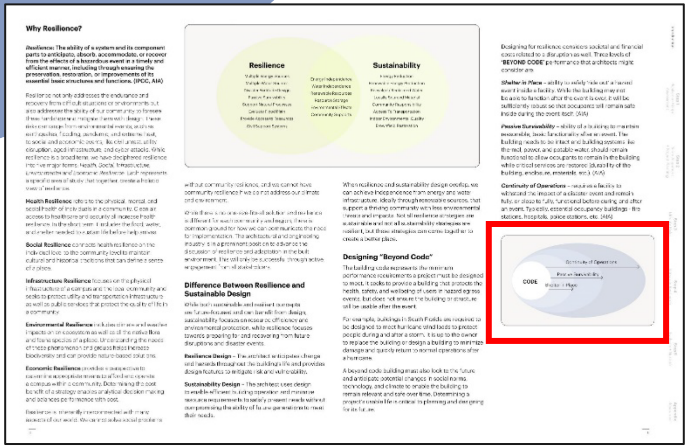
Designing Beyond Code





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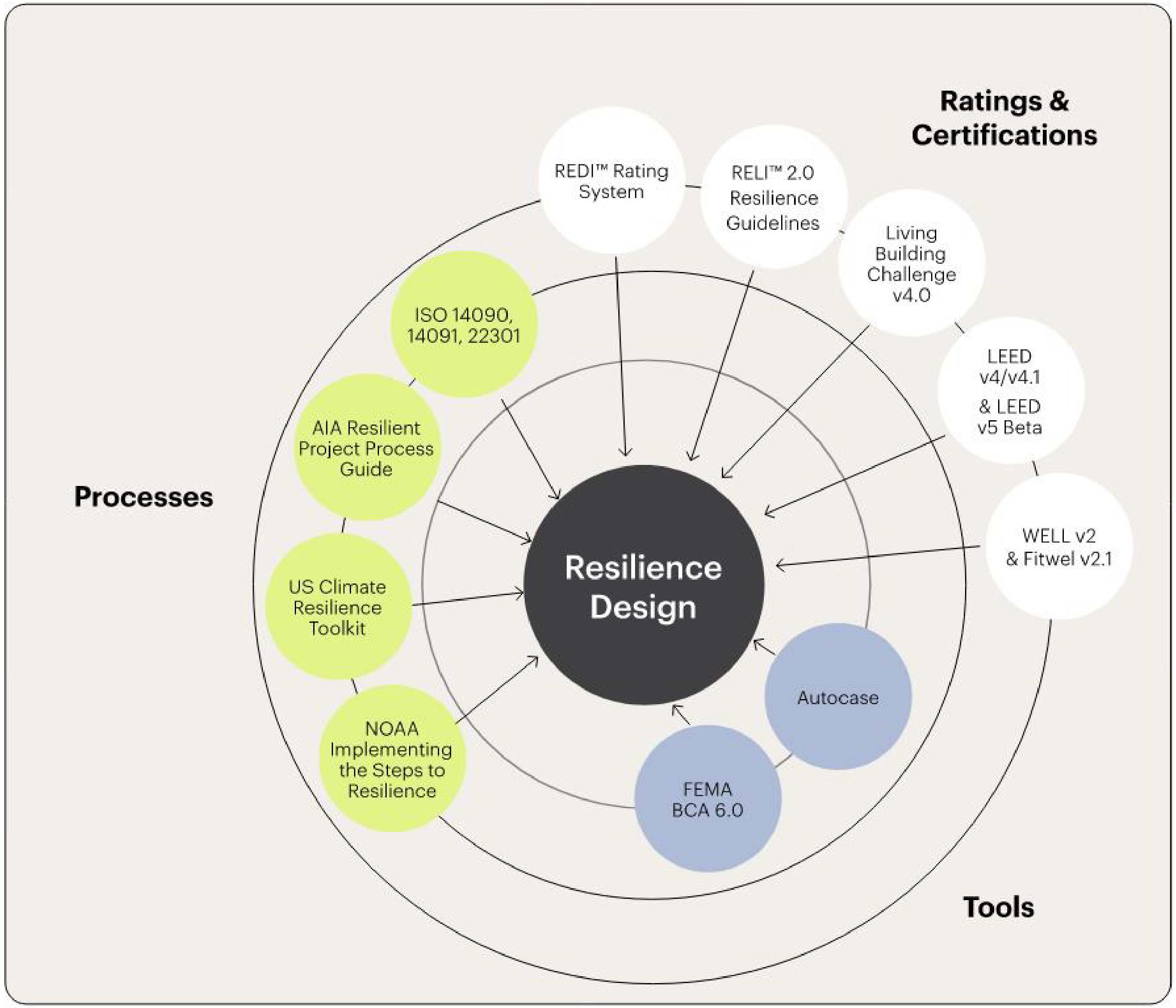
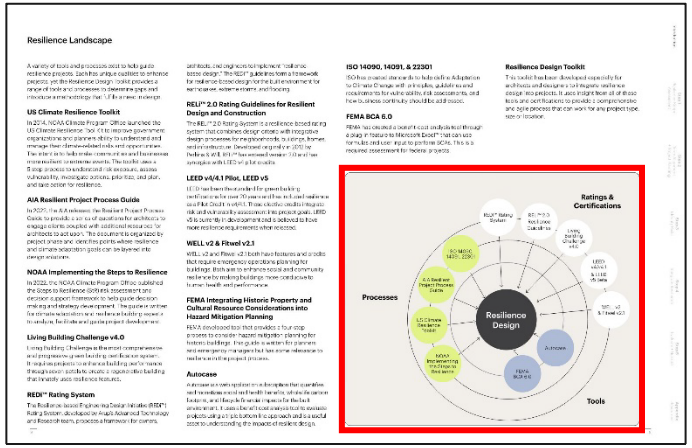
Resilience Design Landscape





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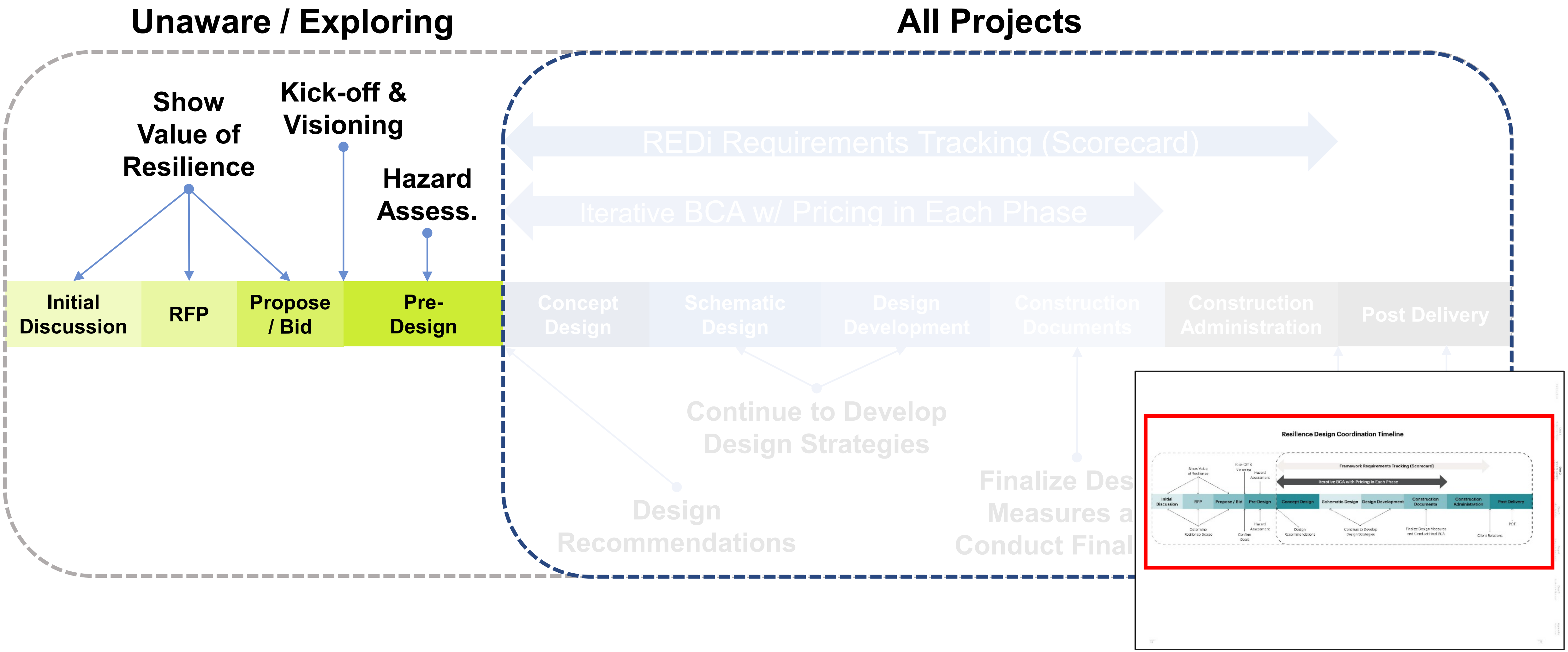
Resilience Design Coordination Timeline



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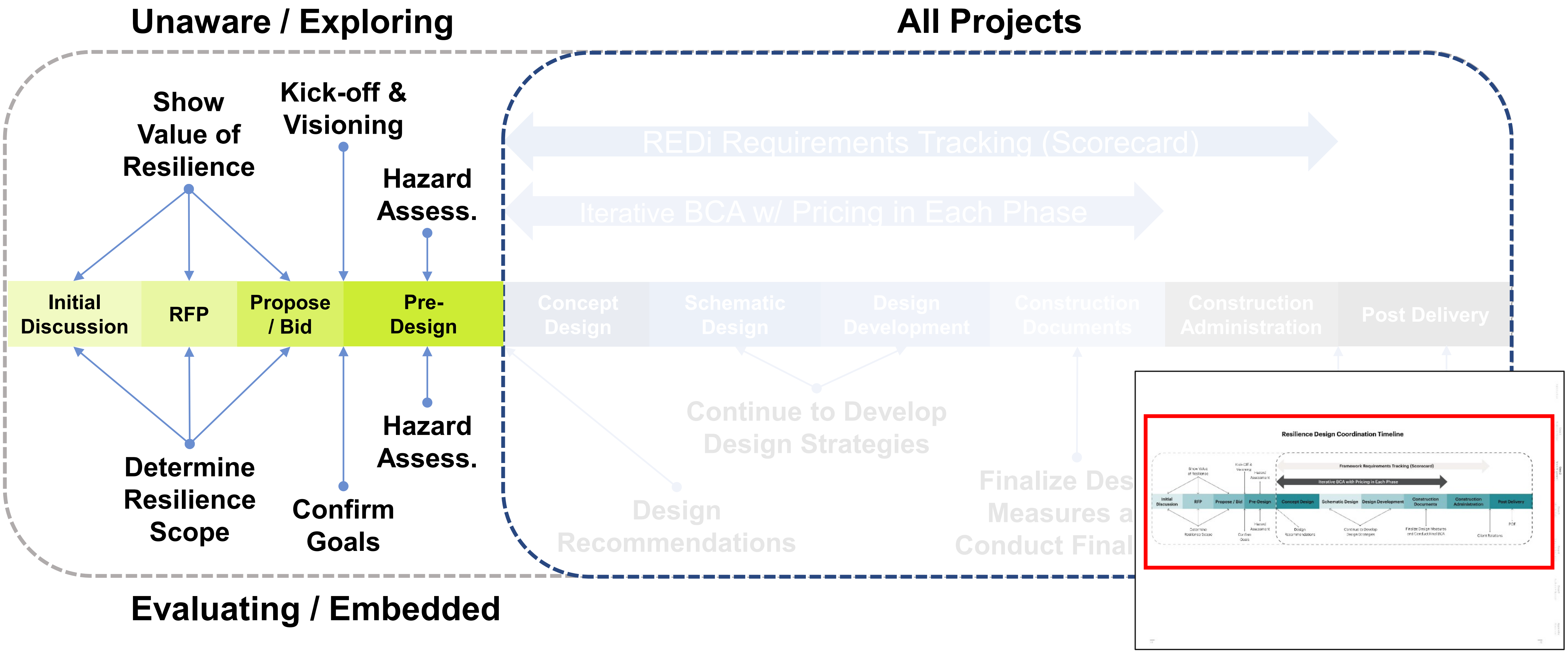
Resilience Design Coordination Timeline



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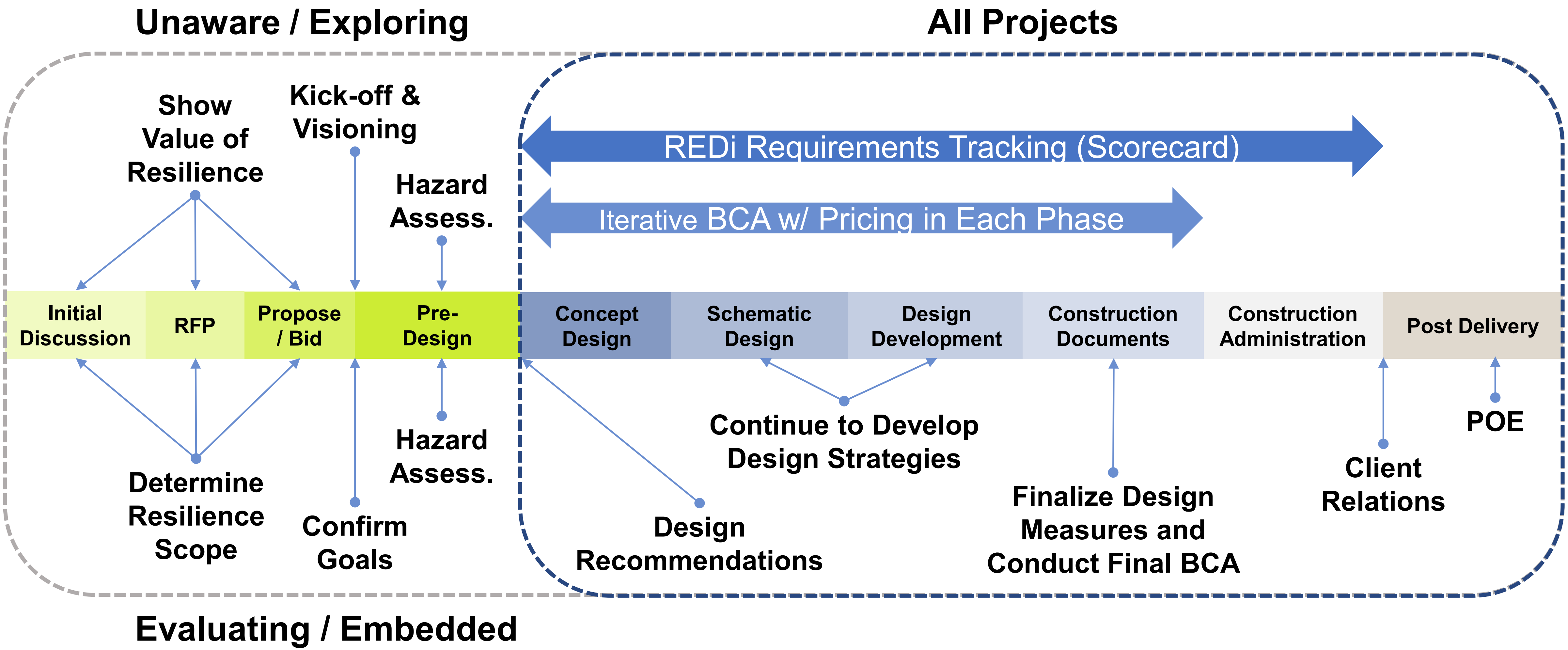
Resilience Design Coordination Timeline



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Resilience Design Toolkit – 5 Steps

Pursuit ▶ Planning ▶ Pre-Concept ▶ Design ▶ Post-Construction

1. Resilience Scope

Determine the client's understanding of resilience and the owner's project requirements. Develop an appropriate resilience scope for the project.

Perform:

Identify Client Understanding of Resilience

Assess Resilience Scope

2. Team Alignment + Planning

Develop a plan to integrate resilience in the project by identifying appropriate talent and process by creating a resilience design work plan.

Perform:

Create Resilience Design Workplan

Assemble Project Team

Resilience Design

Kick-off, Visioning, and Work Sessions

3. Identify Hazards

After the plan is set, identify project hazards, then assess risk & vulnerability. Discuss results with project team and stakeholders.

Perform:

Hazard Study

Risk & Vulnerability Assessment

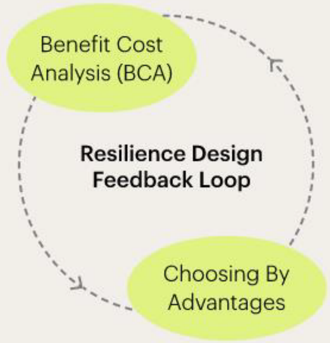
Determine Critical Hazards

Employ:

AIA Principles of Design Excellence Framework

4. Integrate Resilience Design

Mitigate project risk & vulnerability by integrating resilience design measures. Assess viability & feasibility of specific strategies through a Benefit Cost Analysis.



5. Evaluate + Nurture

Project close out and delivery. Assess building resilience performance and develop a case study after first year of operation.

Perform:

Post Occupancy Evaluation

Create:

Case Study & Apply Lessons Learned

Step 01

Resilience Scope Assessment

Step 01 – Resilience Scope Assessment

Private Conversations	Embedded in an RFP/RFQ	Added to an Existing Project	Stakeholder Meeting

Client Characteristics

Unaware	Unaware of resilience as an issue Resilience may have not been mentioned in an RFP/RFQ or come up in conversation. Opportunity to lead with knowledge May not have an appetite for resilience
Exploring	Aware of resilience as a concern but may not know what it is totally about or how it is performed Needs guidance in understanding on how hazards might put their project at risk Could be an opportunity to lead with knowledge Need to understand client's position on resilience
Evaluating	Client has a position on resilience and understands base concepts Client has an idea on what they want in the project Project team needs to build confidence in the client that they can provide resilience design services
Embedded	Client is familiar with resilient design and knows what the final deliverable should be Project team should determine the capabilities of the team and ability to provide desired services for the client

Resilience Conversations

Private Conversation

Word-of-mouth work and leads are effective ways to maintain a business. Speaking at conferences and participating in your community are also effective methods to advertise, lead with knowledge, and reinforce firm values for business development. Architects often become trusted voices to clients. If a client is curious about resilience and wants to know more about how resilience design can be beneficial for their project, the architect should be able to provide a confident response.

Embedded in RFP/RFQ

Architects typically receive an RFP for potential new work. Usually, the scope of work is clearly defined and presented so that the architect can assemble the appropriate team and fee. In the wake of recent disasters, resilience design requirements are becoming more common. The Resilience Design Toolkit aims to equip architects with knowledge and strategies to confidently respond to RFP/RFQs with resilience design requirements.

Added to an Existing Project

Scope will develop and may change through the life of the project. Architects may also uncover a previously unknown hazard during a project. These should be brought to the client's attention with care and effective solutions discussed with the project team. A project change directive from the client could request a resilience design add service. To better serve the client, architects will need to be knowledgeable about resilience design.

Community Meeting

Community meetings can be an essential part of a project development and approval process especially for public projects. Community meetings may not be required for private projects, but community interests should be considered in design. We can learn what is important to a community from comments and statements provided at community meetings. Resilience may arise in public feedback and could impact how the client team addresses requests for resilience design.

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Example RFP

Activities:

- Define organizational and decision-making structure
- Establish project team
- Verify clinical, education, sustainability, and research goals
- Review and analyze historic volume, and utilization
- Review and analyze current state of the Strategic Plan and fully understand its goals and objectives
- Confirm schedule including milestones and deliverables

Deliverables:

- Current state summary

Project Phase: Basis of Plan/Design

Activities:

- Lead steering committee meetings
- Tour facilities
- Consult with service line leadership on willingness/opportunities to explore campus decanting strategies
- Confirm Critical Success Factors
- Confirm current care model and best practices
- Complete site investigation
- Interview with key staff members
- Review and refine scenarios for future inpatient and relevant outpatient volumes and utilization for programs
- Prioritize drivers/key considerations to reach critical success factors
- Define scenarios for optimal program sites of service on both the main campus and greenfield campus location. Off-campus ambulatory (OCCs) sites only need service and volume definition, no facility master planning.
- Define resiliency goals
- Confirm zoning requirements and identify any constraints
- Review owner-supplied code and regulatory deficiency list and incorporate corrections into master plan

Deliverables:

- Reports resulting from the activities above

Project Background

- **Confidential Client**
- **Healthcare Master Planning**
- **Main Campus and smaller Outpatient facilities**
- **5–10-year planning horizon**
- **Exploring Resilience**

Deciphering Resilience Scope

1. **Identify resilience scope in RFP**
2. **Ask questions**
3. **Compile information**
4. **Develop a proposal response**

Example Scope of Work

	SCOPE	TASK	DELIVERABLES
Resilience Assessment	• Review Current State of campuses and policies • Determine potential hazards, risks and vulnerabilities • Develop a plan to mitigate risk and vulnerabilities	1. Current State Analysis 2. Assess Potential Hazards, Risk & Vulnerabilities 3. Determine Resilience Goals 4. Identify Strategies to Achieve Goals	• Stakeholder Goal Setting Session • Risk & Vulnerability Assessment Report for each campus • Comprehensive Resilience Plan providing strategies to mitigate risk for each campus

Step 02

Team Alignment & Project Planning

What Does This Mean For My Project?

Task 01 – Determine the Resilience Scope

Detect Resilience Scope from Client

- Private Conversations
- RFP/RFQ
- Added Scope
- Stakeholder Meetings

Define & Refine Resilience Scope

+

Task 02 – Assemble the Team

Determine

- Who to include?
- What is their task?
- How much fee needed?

Deliverables

Work Plan

Job Cost

Manage Client Expectations

Step 02 – Team Alignment & Project Planning

Owner

Architect / Interior Design

Construction Manager

MEP Eng.

Geo/Tech.

Civil Eng. / Landscape

General Contractor

Structural Eng.

Sub. Contractors

Cost Estimator

+

Specialty Consultants

ESG

Ecological Systems

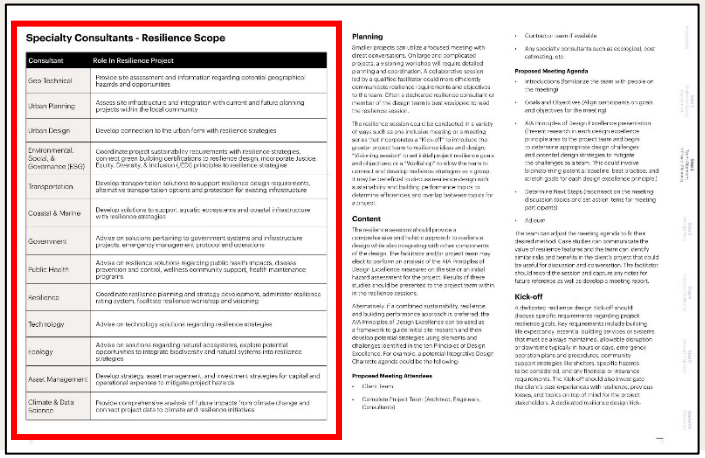
Transportation

Asset Management

Coastal & Marine

Resilience Assessor

Climate & Data Science



Specialty Consultants - Resilience Scope

Consultant	Role In Resilience Project
Geo Technical	Provide site assessment and information regarding potential geographical hazards and opportunities
Urban Planning	Assess site infrastructure and integration with current and future planning projects within the local community
Urban Design	Develop connection to the urban form with resilience strategies
Environmental, Social, & Governance (ESG)	Coordinate project sustainability requirements with resilience strategies, connect green building certifications to resilience design, incorporate Justice, Equity, Diversity, & Inclusion (JEDI) principles to resilience strategies
Transportation	Develop transportation solutions to support resilience design requirements, alternative transportation options and protection for existing infrastructure
Coastal & Marine	Develop solutions to support aquatic ecosystems and coastal infrastructure with resilience strategies
Government	Advise on solutions pertaining to government systems and infrastructure projects, emergency management, protocol and operations
Public Health	Advise on resilience solutions regarding public health impacts, disease prevention and control, wellness community support, health maintenance programs
Resilience	Coordinate resilience planning and strategy development, administer resilience rating system, facilitate resilience workshop and visioning
Technology	Advise on technology solutions regarding resilience strategies
Ecology	Advise on solutions regarding natural ecosystems, explore potential opportunities to integrate biodiversity and natural systems into resilience strategies
Asset Management	Develop strategy, asset management, and investment strategies for capital and operational expenses to mitigate project hazards
Climate & Data Science	Provide comprehensive analysis of future impacts from climate change and connect project data to climate and resilience initiatives

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Building the Team

Typical Project Team - Resilience Scope

Consultant	Role In Resilience Project
Architecture	Coordinate resilient strategies with building design features, integrate BCA into design strategy development
Civil Engineering	Develop site infrastructure and stormwater design with resilience strategies
Landscape Architecture	Design site solutions to accommodate resilience features and promote biodiversity
Mechanical, Electrical, Plumbing, Fire Protection Engineering	Develop building system design with resilience requirements, plan for power, potable water and process water emergency and back-up systems for the desired self-sufficiency period, support resilience design strategies and future retrofit opportunities, conduct project energy models and assess project performance
Structural Engineering	Design building structure to accommodate potential seismic, wind and other structural hazards, design site structures and coordinate infrastructure design
Interior Design	Design interior spaces to support resilient features and requirements
Contractor	Provide feedback on what is feasible in construction
Cost Estimating	Provide cost estimates for design components and strategies
Facility Management	Provide feedback for building operations and incorporate design strategies in building operation

Specialty Consultants - Resilience Scope

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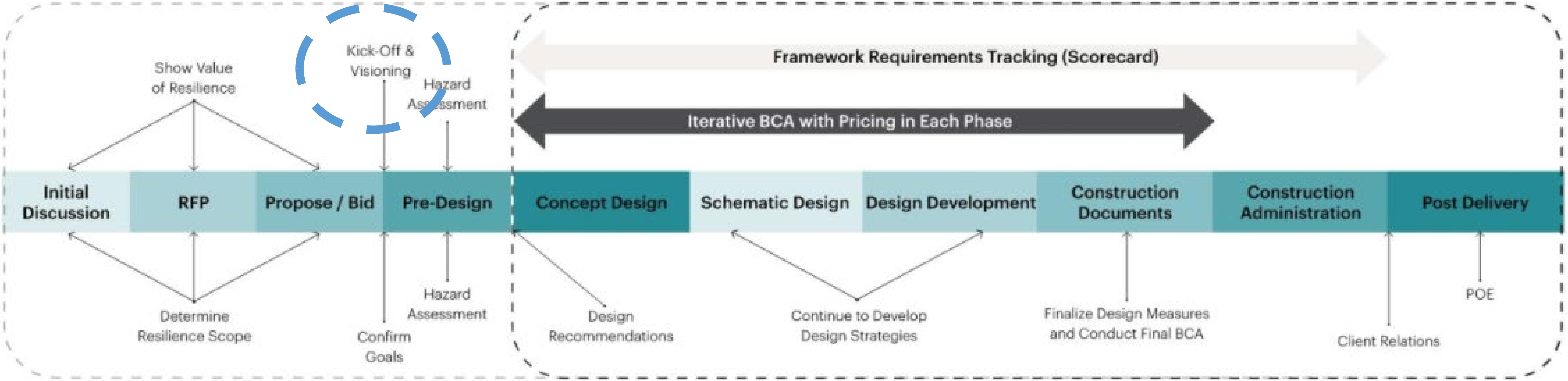
Aligning the Team

Meeting types	Time	Accomplishments
Kick-off	1-2 hours	Discuss Resilience Goals
Visioning	1-2 hours	Develop a Resilience Plan
Workshop	1-2 hours or Series of Meetings	Team Collaboration and Development of Resilience Strategies



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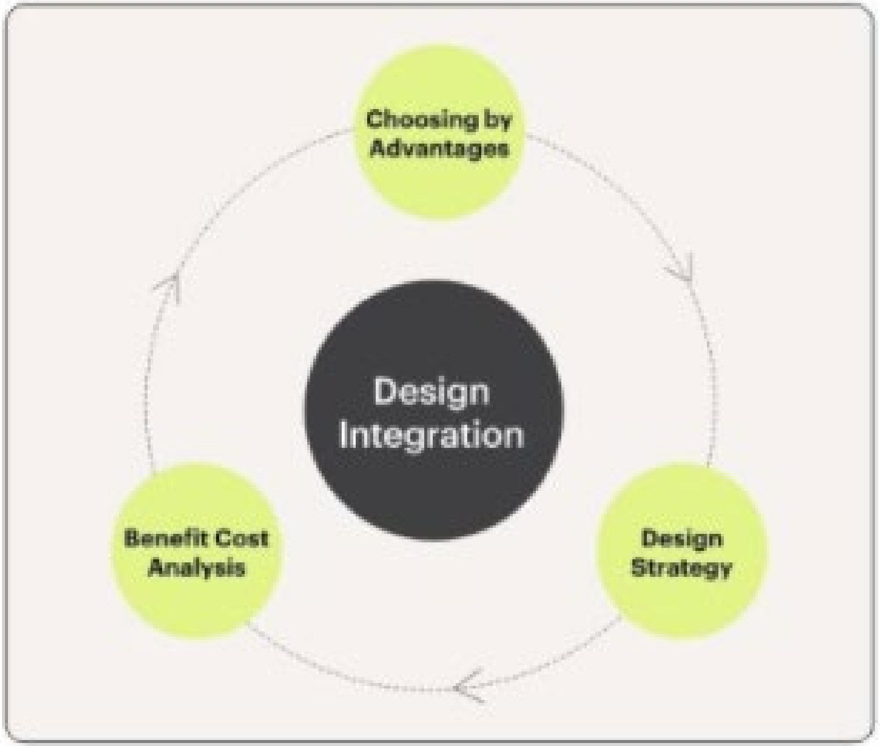
Project Planning - Workplan & Job Cost Budget

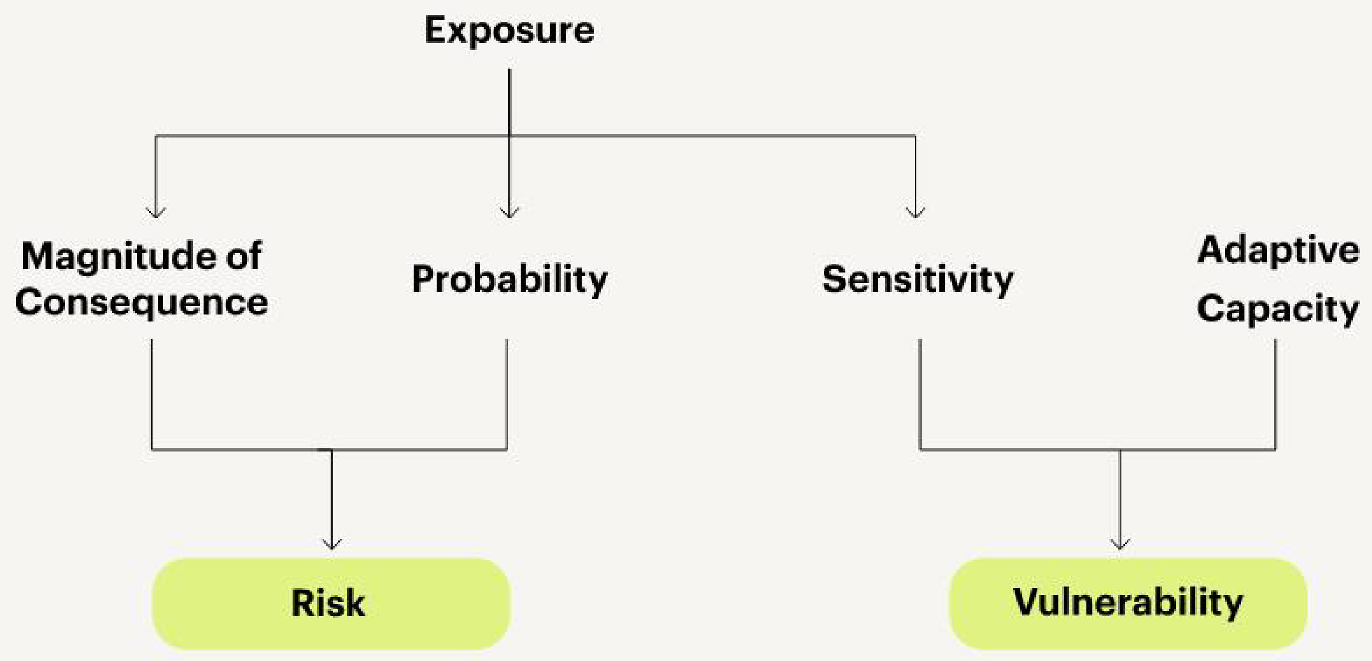


Injecting what we learned about the hazards into our iterative design process enables us to envision a more resilient future.

Step 03

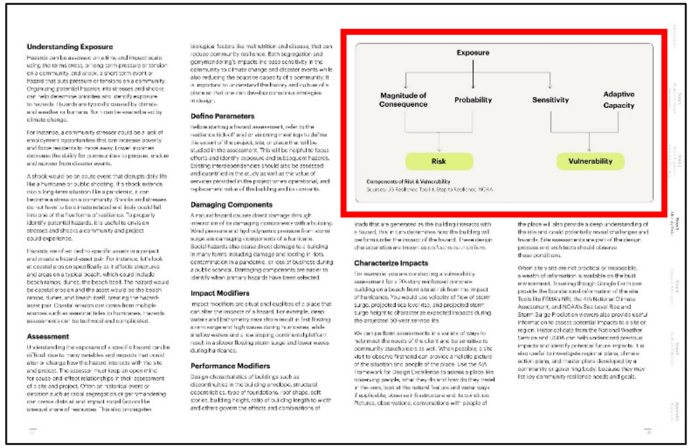
Identify Hazards

Step 03 – Hazard Assessment and Identifying Risk/ Vulnerability



Components of Risk & Vulnerability

Sources: US Resilience Toolkit, Step to Resilience, NOAA



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Step 03 – Identify Hazards

Avalanche

	A large mass of snow traveling down an inclined slope
Causes	Snowstorms, heavy snowfall, human activity, vibration, steep slopes, warm temperatures
Concerns	Recreational activity, property damage, burial
Damaging Components	Velocity, weight

Coastal Flooding

	Sea water flooding of coastal, low lying regions
Causes	Waves, tides, storm surge, heavy rainfall, sea level rise
Concerns	Reoccurring minor flooding, property / infrastructure damage, water contamination
Damaging Components	Depth of water, flood inundation duration, velocity of surge

Cold Wave

	A rapid fall in temperature within a 24-hour period affecting much larger areas than blizzards, ice storms, and other winter hazards
Causes	Winter temperatures, polar vortexes, shift in jet stream
Concerns	Pipes bursting, livestock harm, ice and frost, fuel and electric demands, dangerous roads, agriculture harm
Damaging Components	Rapid freezing, ice on roads, winter weather

Earthquake

	A sudden and violent shaking of the ground, due to tectonic movement
Causes	Volcanic Activity, Tectonic Movement, Geological Faults, Landslides, Explosions
Concerns	Structural Damage, Tsunami, Rockfalls, Liquefaction
Damaging Components	Landslides/Mudslides, Avalanches, Shaking Vertical/Horizontal Displacement, Compromised Adjacent Structures with Fall Risk

Hail

	Pellets of frozen rain
Causes	Strong updrafts, cold upper region of thunderstorm
Concerns	Vehicle/ roofing/ window/ gutter damage, agriculture, bodily harm
Damaging Components	Size of hail stone, frequency, amount in a given storm

Heat Wave

	A period of time where there are abnormally high temperatures compared to the average
Causes	Trapped air circulation, high pressure system, heated, stagnant air
Concerns	Lack of awareness, outdoor work related tasks/jobs, health issues
Damaging Components	High heat, extreme exertion on body, drought conditions

Ice Storms

	A storm of freezing rain that leaves a coating of ice
Causes	Freezing rain, near freezing temperatures
Concerns	Road conditions, weight on trees/roofs, utility damages
Damaging Components	Weight of ice, slick conditions for roads, freezing

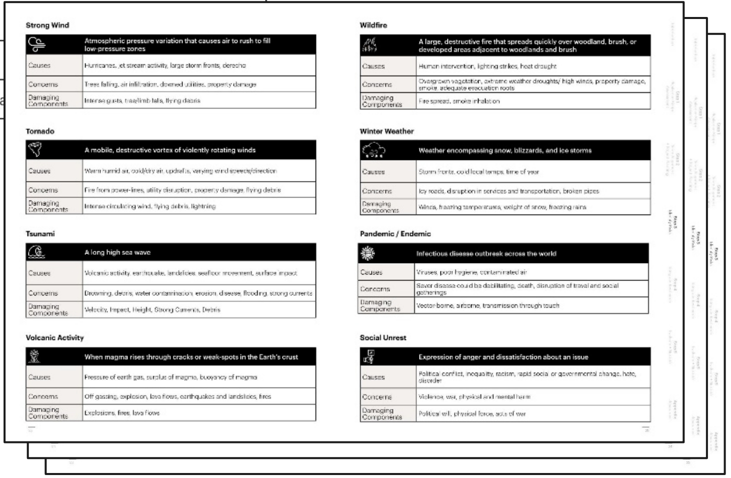
Landslide

	The sliding down of a mass of earth or rock from a mountain or cliff
Causes	Disturbances on slopes, rapidly accumulated water, destruction of vegetation
Concerns	Disruption of Utilities, Road Blockage, Rapidly Moving Water and Debris
Damaging Components	Mass and Velocity of Debris, Rockfalls

Lightning

	An electrical discharge caused by imbalances between storm clouds and the ground
Causes	Electrical imbalances, thunderstorms
Concerns	Fires, utility interruption
Damaging Components	Fires, direct strikes to humans, electrical ma

+ 10 more Hazards in the FEMA National Risk Index



Strong Wind

	Atmospheric pressure variation that causes air to rush to fill low-pressure zones
Causes	Hurricanes, jet stream activity, large storm fronts, derecho
Concerns	Trees falling, air infiltration, downed utilities, property damage
Damaging Components	Intense gusts, tree/limb falls, flying debris

Tornado

	A mobile, destructive vortex of violently rotating winds
Causes	Warm humid air, cold/dry air, updrafts, varying wind speeds/direction
Concerns	Fire from power-lines, utility disruption, property damage, flying debris
Damaging Components	Intense circulating wind, flying debris, lightning

Tsunami

	A long high sea wave
Causes	Volcanic activity, earthquake, landslides, seafloor movement, surface impact
Concerns	Drowning, debris, water contamination, erosion, disease, flooding, strong currents
Damaging Components	Velocity, Impact, Height, Strong Currents, Debris

Volcanic Activity

	When magma rises through cracks or weak-spots in the Earth's crust
Causes	Pressure of earth gas, surplus of magma, buoyancy of magma
Concerns	Off gassing, explosion, lava flows, earthquakes and landslides, fires
Damaging Components	Explosions, fires, lava flows

Wildfire

	A large, destructive fire that spreads quickly over woodland, brush, or developed areas adjacent to woodlands and brush
Causes	Human intervention, lighting strikes, heat drought
Concerns	Overgrown vegetation, extreme weather droughts/ high winds, property damage, smoke, adequate evacuation roots
Damaging Components	Fire spread, smoke inhalation

Winter Weather

	Weather encompassing snow, blizzards, and ice storms
Causes	Storm fronts, cold local temps, time of year
Concerns	Icy roads, disruption in services and transportation, broken pipes
Damaging Components	Winds, freezing temperatures, weight of snow, freezing rains

Pandemic / Endemic

	Infectious disease outbreak across the world
Causes	Viruses, poor hygiene, contaminated air
Concerns	Sever disease could be debilitating, death, disruption of travel and social gatherings
Damaging Components	Vector borne, airborne, transmission through touch

Social Unrest

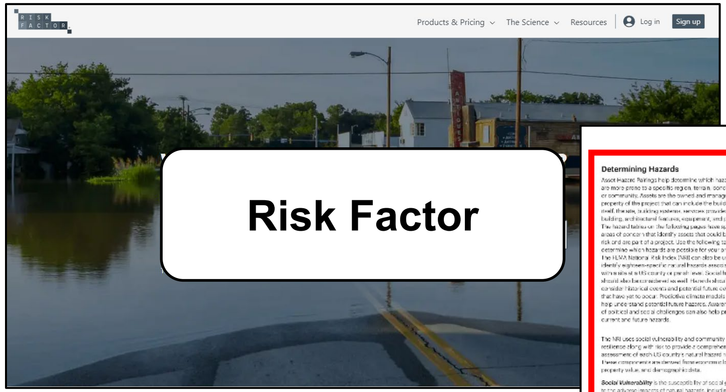
	Expression of anger and dissatisfaction about an issue
Causes	Political conflict, inequality, racism, rapid social or governmental change, hate, disorder
Concerns	Violence, war, physical and mental harm
Damaging Components	Political will, physical force, acts of war

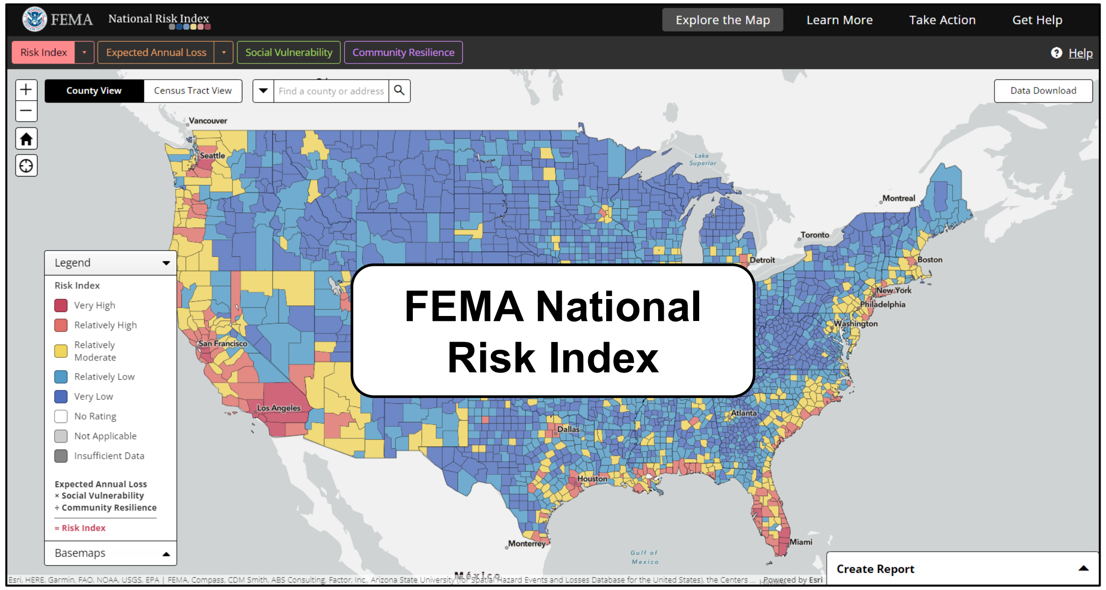
Earthquake

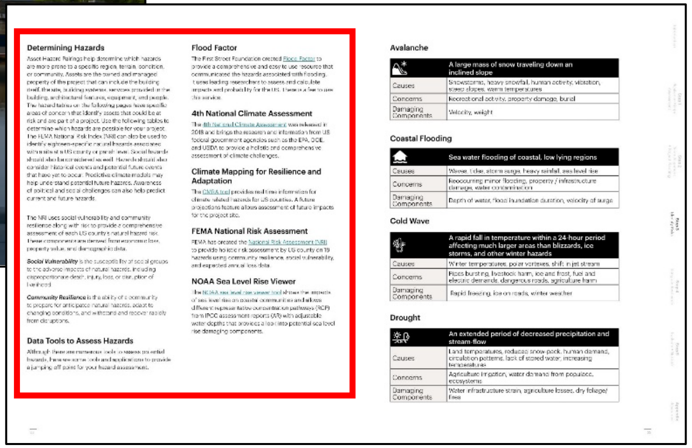
	A sudden and violent shaking of the ground, due to tectonic movement
Causes	Volcanic Activity, Tectonic Movement, Geological Faults, Landslides, Explosions
Concerns	Structural Damage, Tsunami, Rockfalls, Liquefaction
Damaging Components	Landslides/Mudslides, Avalanches, Shaking Vertical/Horizontal Displacement, Compromised Adjacent Structures with Fall Risk

Pages 23-25

Step 03 – Industry Tools







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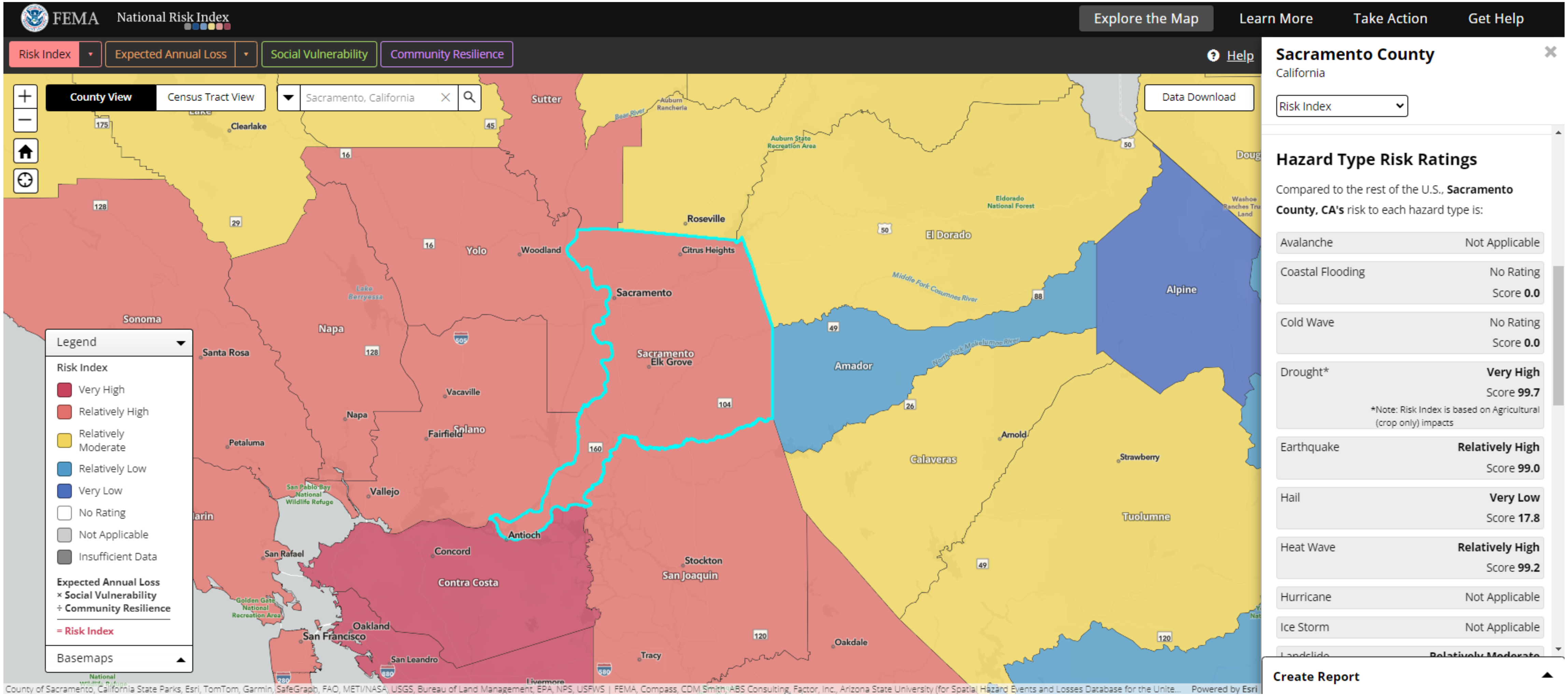
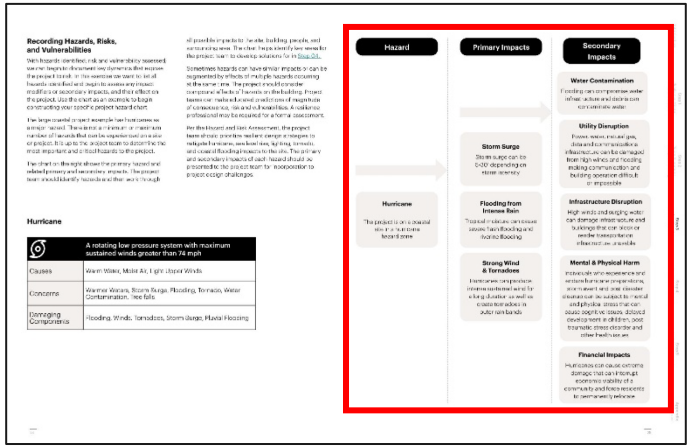
Step 03 – FEMA National Risk Index



AIA HKS ARUP

Step 03 – Determine Critical Impacts

Hazard	Primary Impacts	Secondary Impacts
Earthquake	Shaking, Vertical / Horizontal Displacement	Utility Disruption
	Fault Rupture	Infrastructure Disruption
	Liquefaction	Building Damage
	Landslides	Mental & Physical Harm
	Tsunami	Financial Impacts



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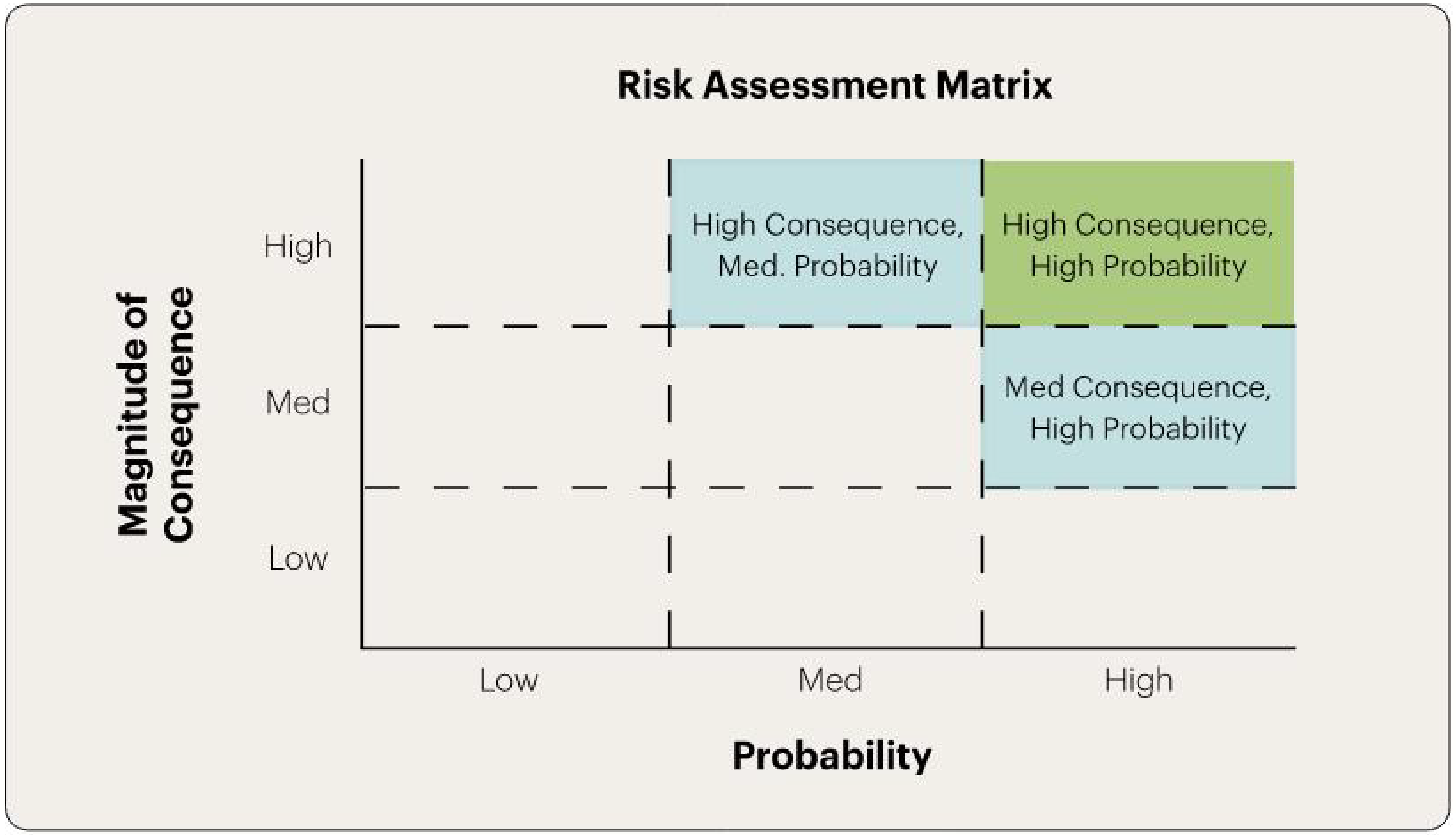
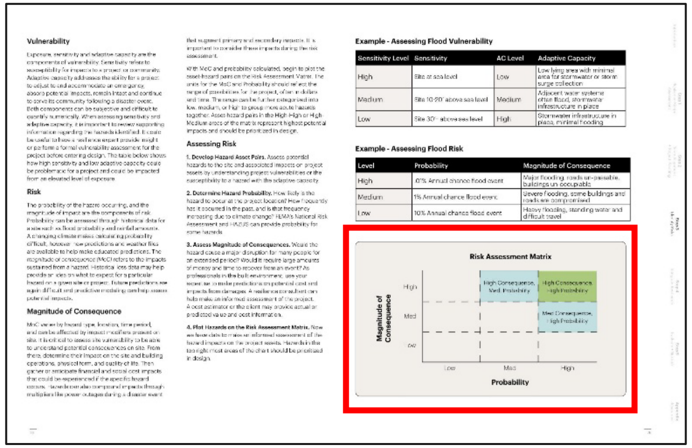
Step 03 – Magnitude of Consequence





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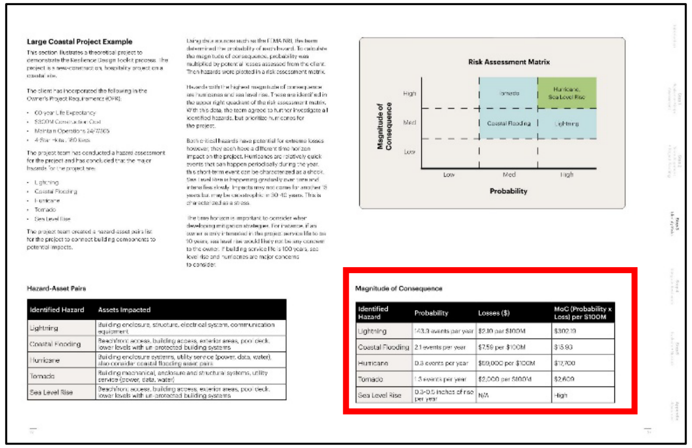
Step 03 – Determine Magnitude of Consequence

Hazard mapping chart helps determine risk from identified hazards.

Critical Hazard	**Probability (Annualized Frequency)** per year	**Exposure Value**	**Magnitude of Consequence** (Expected Annual Loss)
Earthquake	0.654% Chance	$263B	$1 per $3,150
Drought	55.3	$318B	$1 per $10.27
Heat Wave	2.3	$263B	$1 per $1.27B
Wildfire	0.254%	$166B	$1 per $91,200
Landslide	0	$15B	$1 per $1.48M

Probability vs. Frequency. It is impossible to know exactly how many storms or hazardous events will occur in any given year. We use annualized frequency to assess probability of a hazard occurring.



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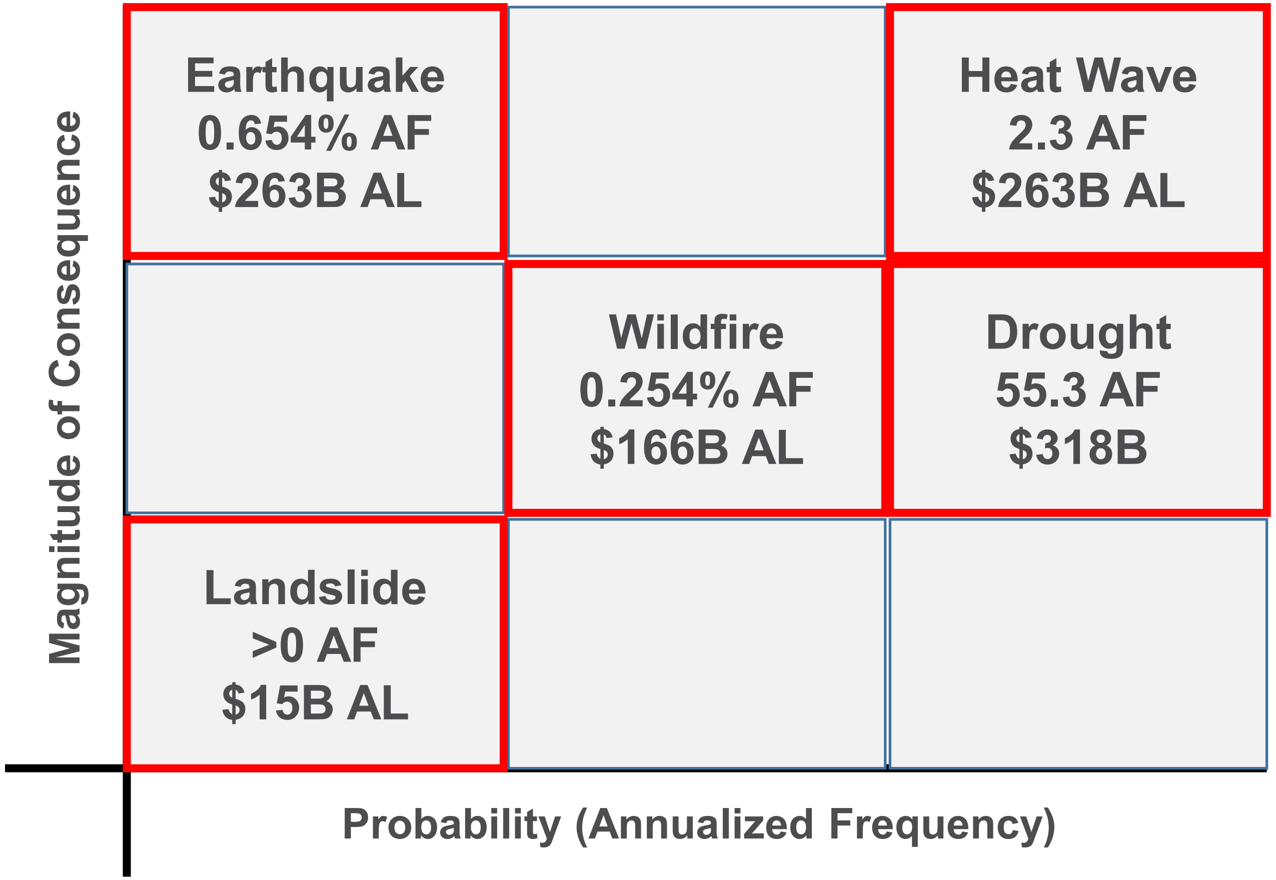
Step 03 – Plotting Magnitude of Consequence

Critical Hazards

Earthquake
Drought
Heat Wave
Wildfire
Land Slide

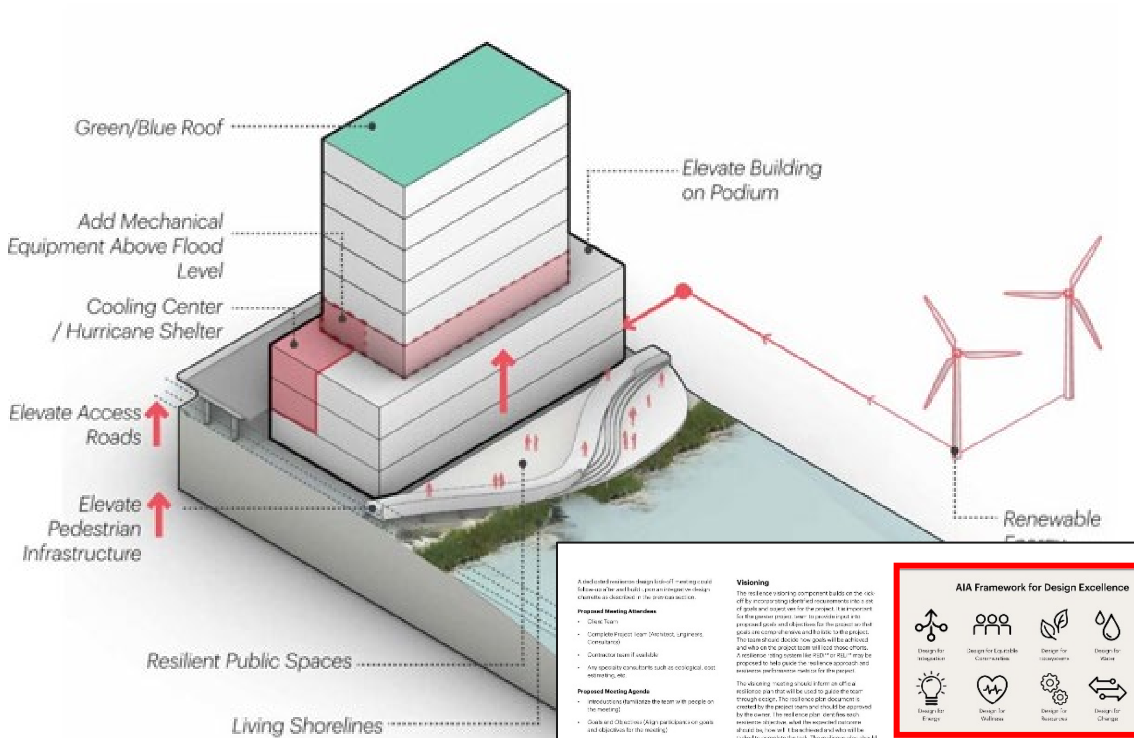
Others to consider:
Pandemic / Health Emergency
Social Unrest

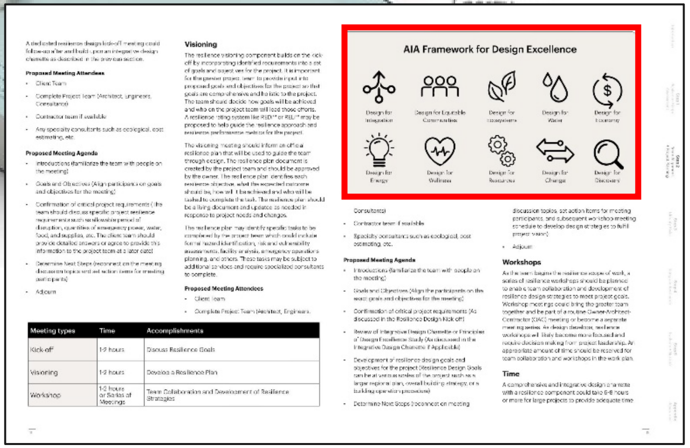


Step 04

Integrate Resilience

Step 04 – Knowledge of Place in Design





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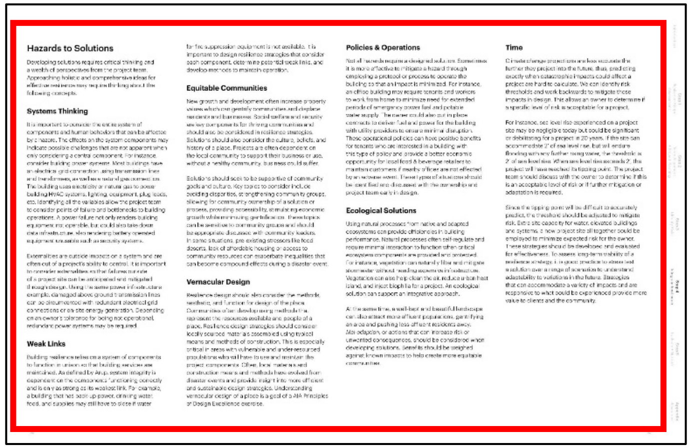
Step 04 – When Developing Solutions….

7 Topics to Consider

- Systems Thinking
- Vernacular Design
- Weak Links
- Policies & Operations
- Equitable Communities
- Ecological Solutions
- Time


Hazards to Solutions

Systems Thinking

Weak Links

Equitable Communities

Vernacular Design

Policies & Operations

Ecological Solutions

Time

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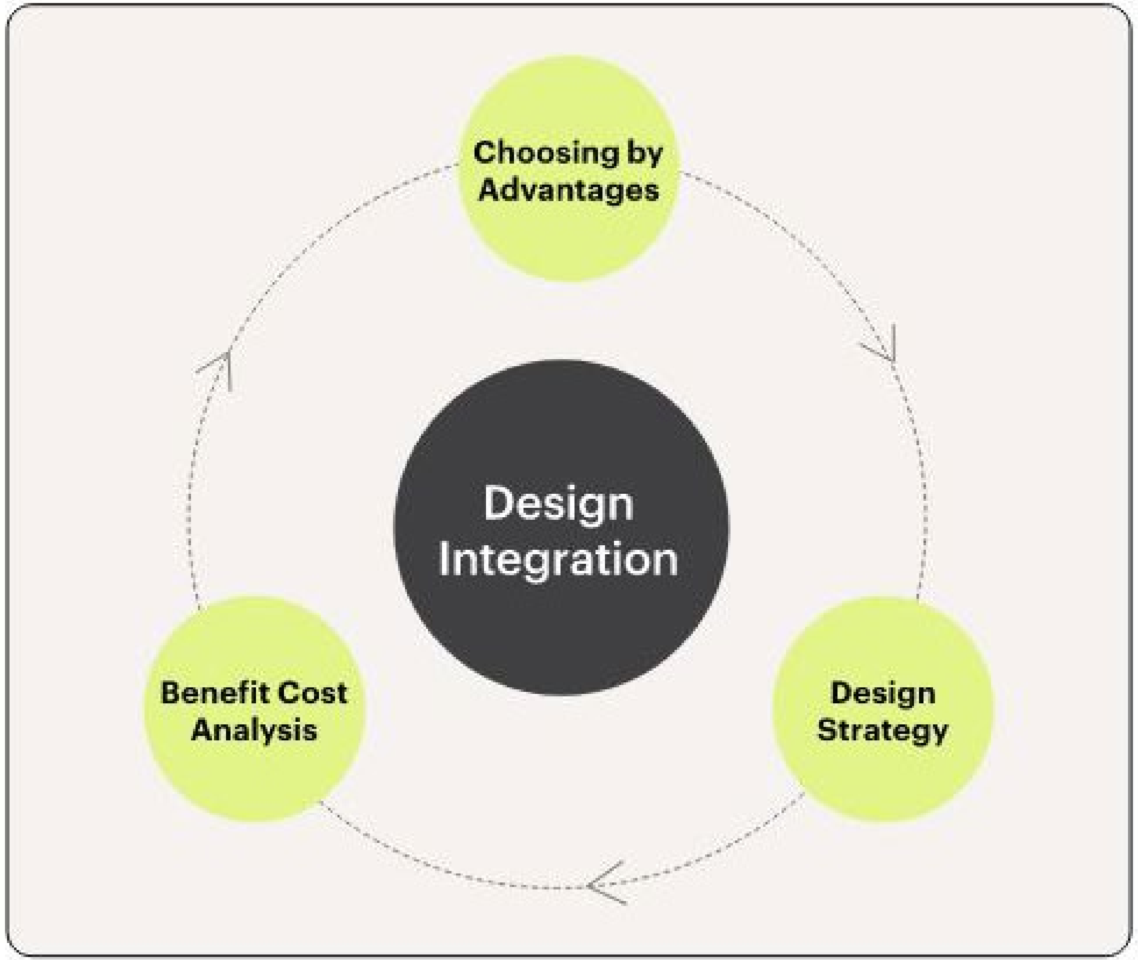
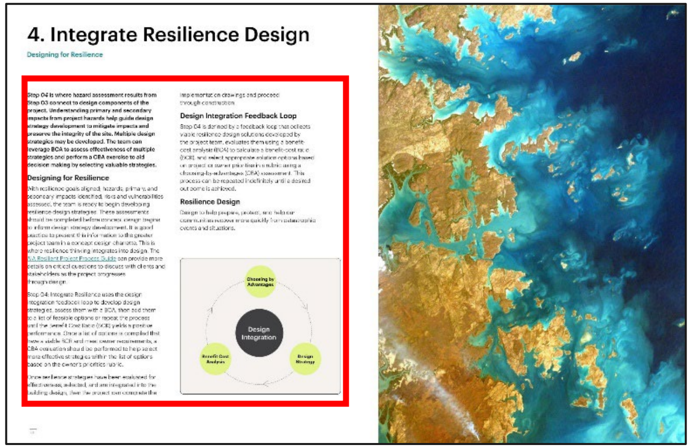
Step 04 – Resilience Design Feedback Loop





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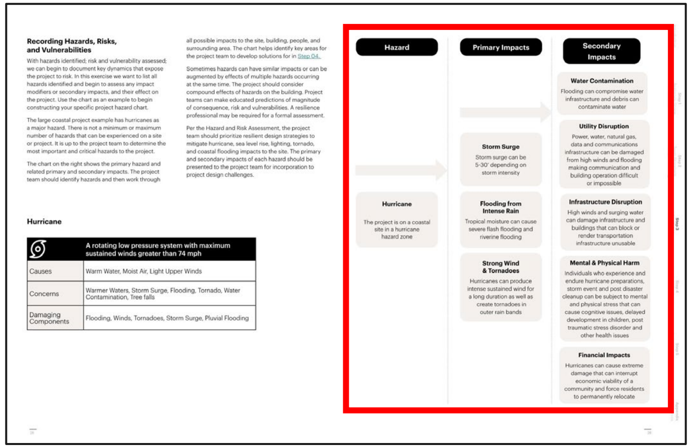
From Step 03 – Determine Critical Impacts

Hazard	Primary Impacts	Secondary Impacts
Hurricane	Storm Surge	Water Contamination
	Pluvial Flooding	Utility Disruption
	Strong Winds & Tornadoes	Infrastructure Disruption
		Mental & Physical Harm
		Financial Impacts



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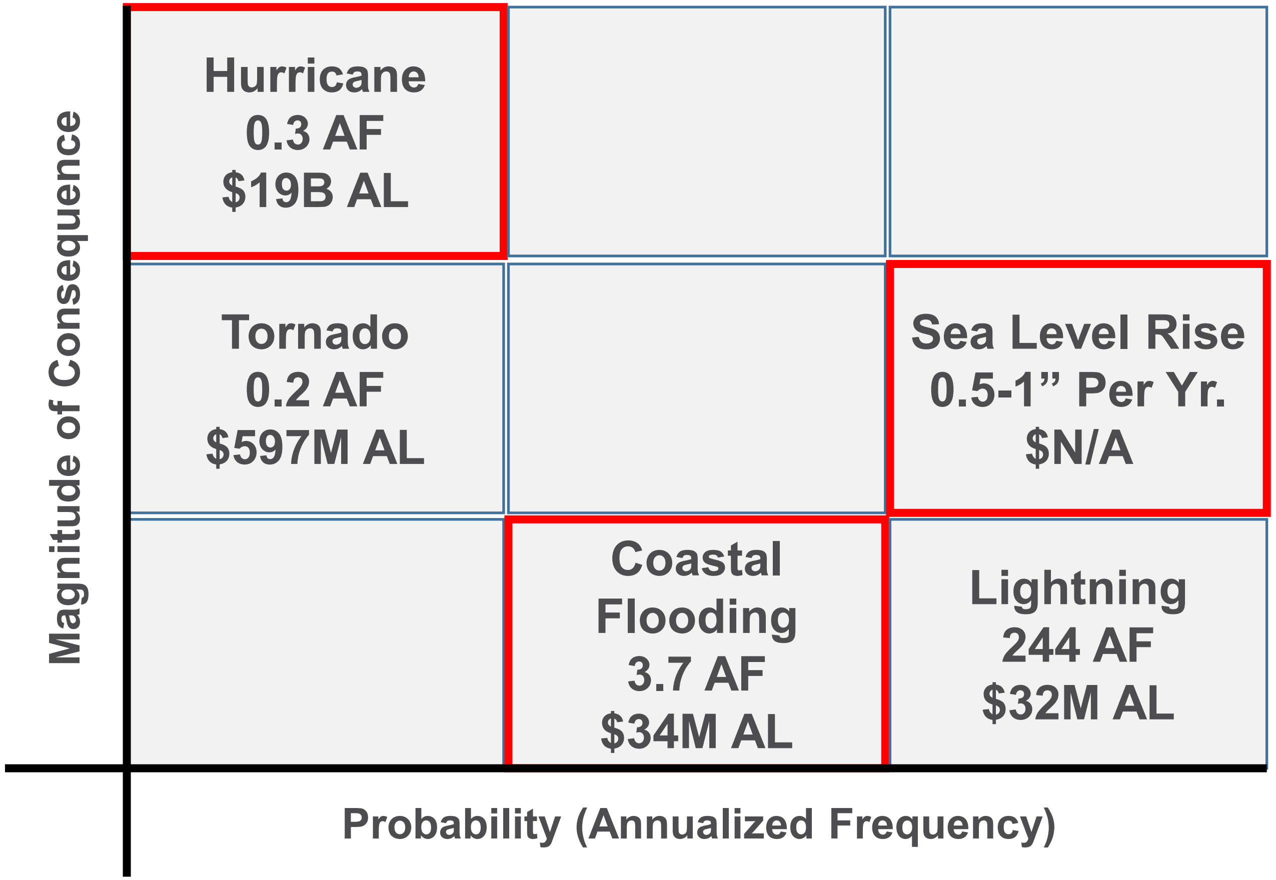
From Step 03 – Plotting Magnitude of Consequence

Critical Hazards

Hurricane
Tornado
Coastal Flooding
Lightning
Sea Level Rise

Others to consider:
Pandemic / Health Emergency
Social Unrest



Step 04 – Benefit Cost Analysis

Key Building Components to Consider

Enclosure	Roofs, opaque wall, glazing, curtain wall, seismic joints
Mechanical / HVAC	Air handlers, cooling towers, chillers, roof top units, fan units, dehumidification systems, exhaust, and intakes
Electrical / Data	Lighting, emergency power, process loads, electrical gear, renewable energy systems, transformers, vertical circulation, low voltage, data, communications
Plumbing	Water supply fixtures, wastewater systems, filtration systems, pool pumps, cisterns, potable water storage systems
Site	Landscape areas, pool deck, building entry, loading dock, waste collection, amenity lawns, building connections

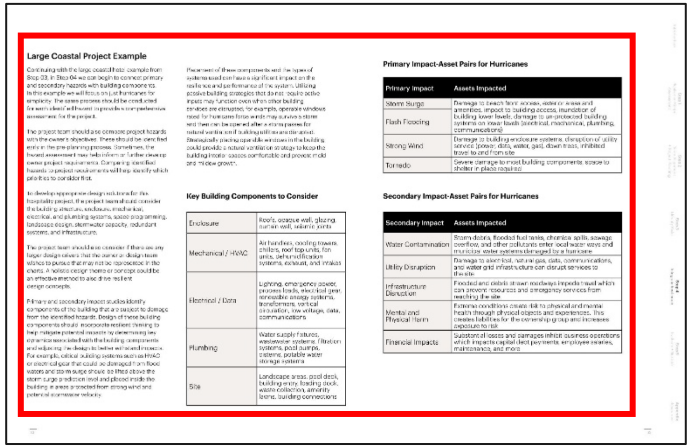
Primary Impact-Asset Pairs for Hurricanes

Primary Impact	Assets Impacted
Storm Surge Flash Flooding	Damage to beach front access, exterior areas and amenities, impact to building access, inundation of building lower levels, damage to un-protected building systems on lower levels (electrical, mechanical, plumbing, communications)
Strong Wind	Damage to building enclosure systems, disruption of utility service (power, data, water, gas), down trees, inhibited travel to and from site
Tornado	Severe damage to most building components, space to shelter in place required

Secondary Impact-Asset Pairs for Hurricanes

Secondary Impact	Assets Impacted
Water Contamination	Storm debris, flooded fuel tanks, chemical spills, sewage overflow, and other pollutants enter local water ways and municipal water systems damaged by a hurricane
Utility Disruption	Damage to electrical, natural gas, data, communications, and water grid infrastructure can disrupt services to the site
Infrastructure Disruption	Flooded and debris strewn roadways impede travel which can prevent resources and emergency services from reaching the site
Mental and Physical Harm	Extreme conditions create risk to physical and mental health through physical objects and experiences. This creates liabilities for the ownership group and increases exposure to risk
Financial Impacts	Substantial losses and damages inhibit business operations which impacts capital debt payments, employee salaries, maintenance, and more

Sanibel Island, FL after Hurricane Ian (Cat. 4) 2022.


Large Coastal Project Example

Primary Impact-Asset Pairs for Hurricanes

Key Building Components to Consider

Secondary Impact-Asset Pairs for Hurricanes

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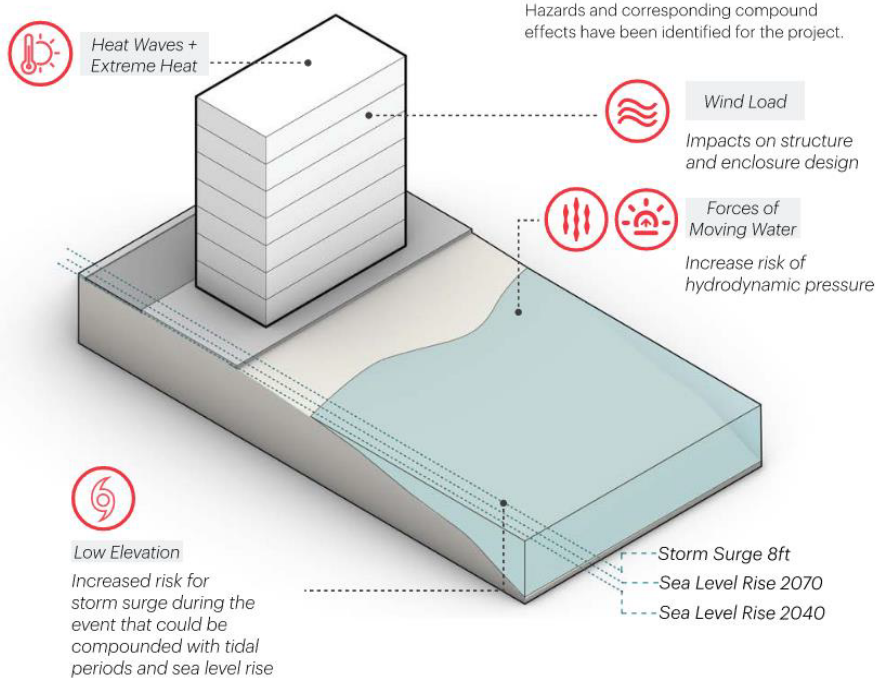
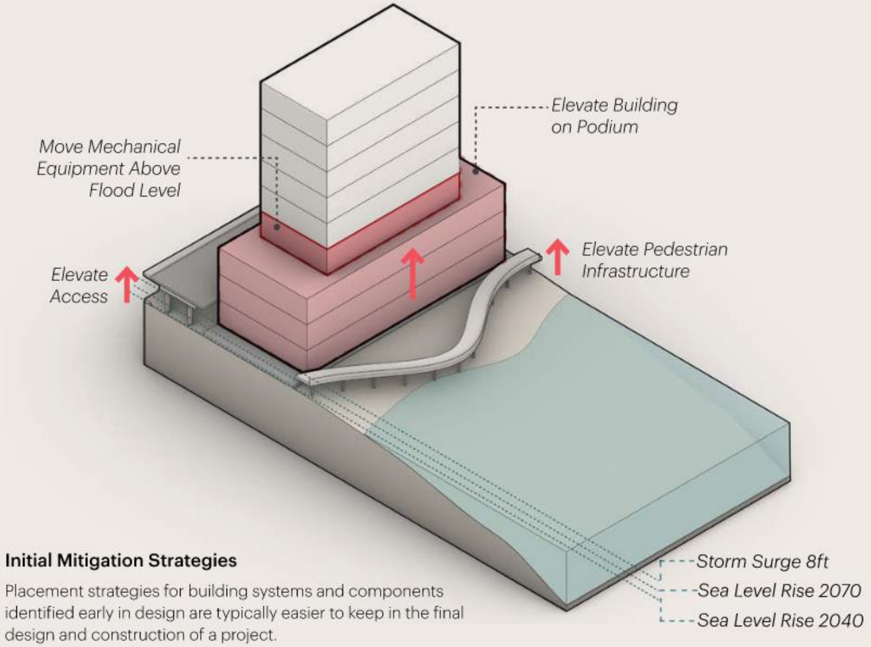
AIA HKS ARUP

Hazards Identified

Hazards and corresponding compound effects have been identified for the project.





Initial Mitigation Strategies

Placement strategies for building systems and components identified early in design are typically easier to keep in the final design and construction of a project.

Resilience Design

When designing for resilience, sometimes the best way to start is to just jump headfirst with an idea to see where it goes. In the process, considerations and supplementary ideas will help shape design. There is not one correct way to put a building together and this is where it is up to the design and project team to take the information provided and make the process theirs.

It is beneficial to incorporate the AIA Framework for Design Excellence into the design process to help coordinate design concepts with the ten measures. This will help maintain a thorough assessment of the design and help provide documentation needed for AIA award submissions. The hospitality project example uses the AIA Framework for Design Excellence to illustrate how the ten measures could be incorporated into design solutions.

Design for Water

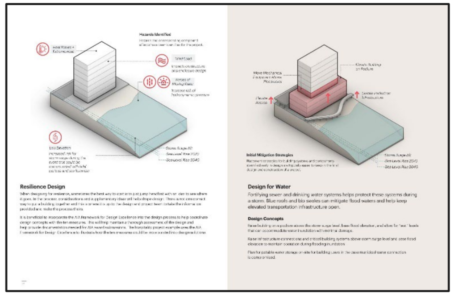
Fortifying sewer and drinking water systems helps protect these systems during a storm. Blue roofs and bio swales can mitigate flood waters and help keep elevated transportation infrastructure open.

Design Concepts

Raise building on a podium above the storm surge level, base flood elevation, and allow for "wet" levels that can accommodate water inundation with minimal damage.

Raise infrastructure connections and critical building systems above storm surge level and base flood elevation to maintain operation during flooding inundation.

Plan for potable water storage on-site for building users in the case municipal water connection is compromised.



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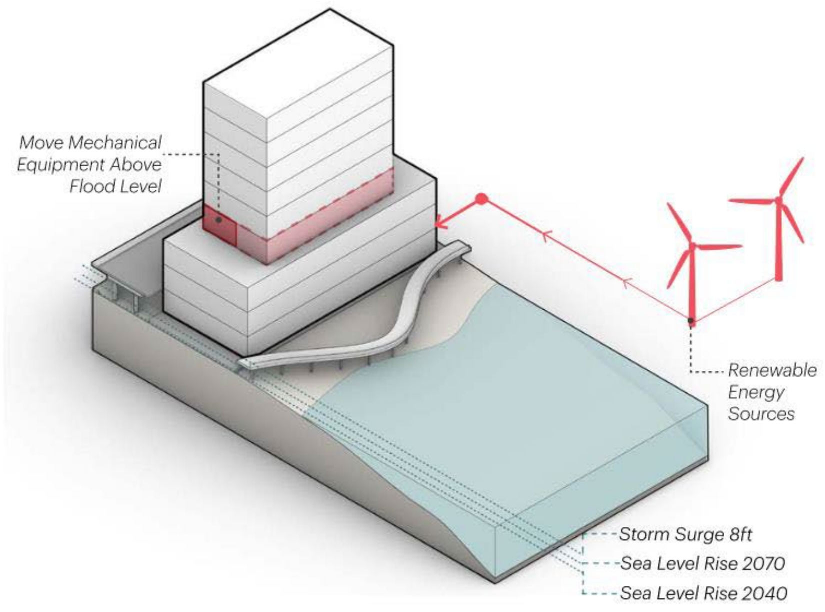
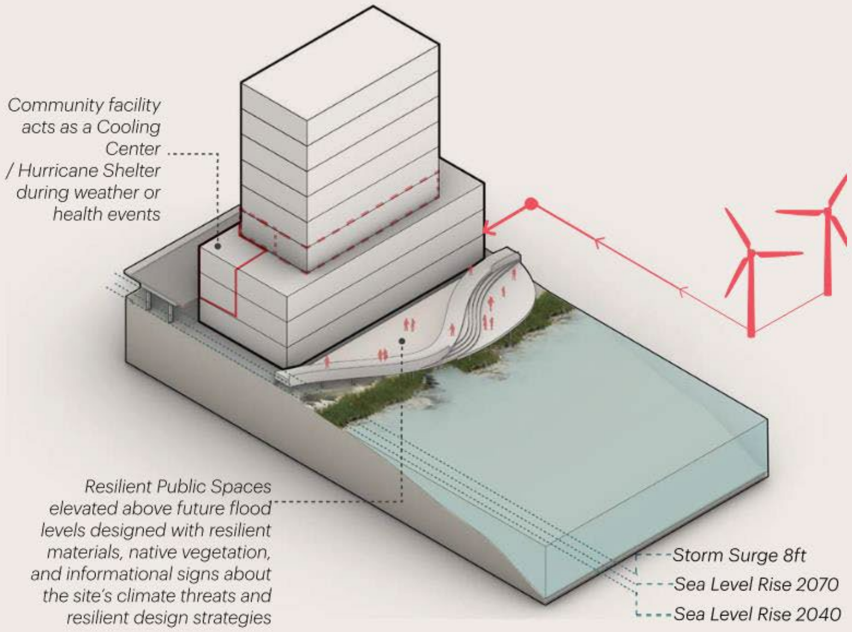




Design for Energy

Redundant and elevated power, data and communication systems protect building components and mitigate risks for storm surge. This is especially critical for essential buildings like hospitals and residences.

Design Concepts

Redundant and protected energy systems (Raised equipment floors from flood level).

Flexible power systems.

Micro-grid power delivery.

Reducing energy consumption by cool paving/roofs (by reflecting more solar energy and enhancing water evaporation) not only cools the pavement surface and surrounding air but can also reduce stormwater runoff and improve nighttime visibility. Can reduce ambient temperatures by 80 degrees and reflects 85-90% of radiation on site.

Design for Equitable Communities & Wellness

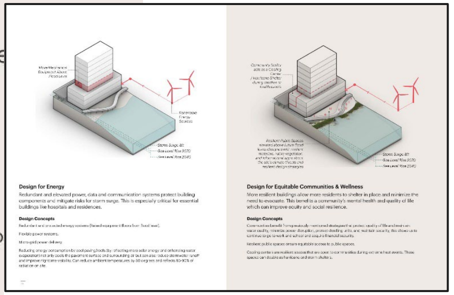
More resilient buildings allow more residents to shelter in place and minimize the need to evacuate. This benefits a community's mental health and quality of life which can improve equity and social resilience.

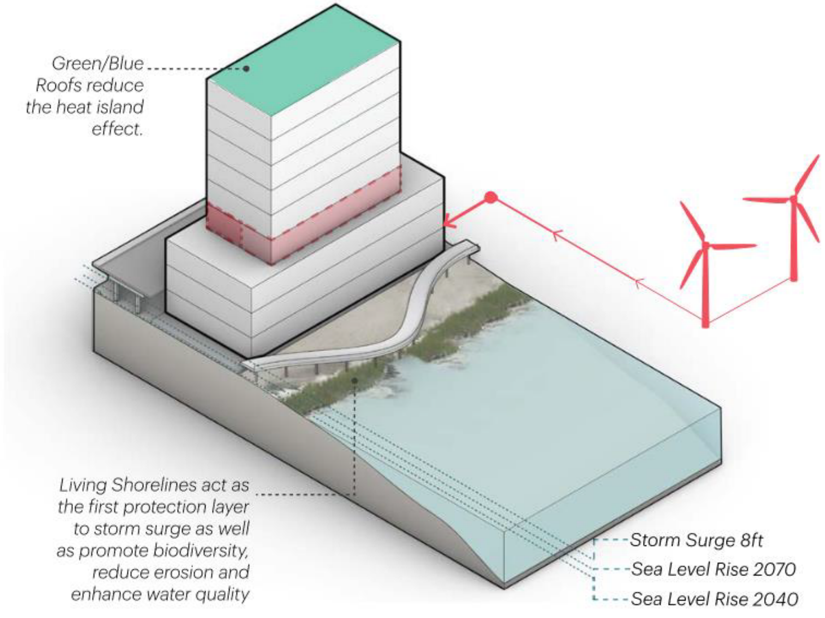
Design Concepts

Communities benefit from previously mentioned strategies that protect quality of life and maintain water quality, minimize power disruption, protect dwelling units, and maintain security, this allows us to continue to go to work and school and acquire financial security.

Resilient public spaces ensure equitable access to public spaces.

Cooling centers are resilient spaces that are open to communities during extreme heat events. These spaces can double as hurricane and storm shelters.





Design for Ecosystems

Natural solutions can often provide more effective solutions to environmental concerns. Vegetative buffers on the coast can mitigate storm surge and flooding while promoting biodiversity that can be an asset to the ecology of a place as well an aesthetic asset for communities.

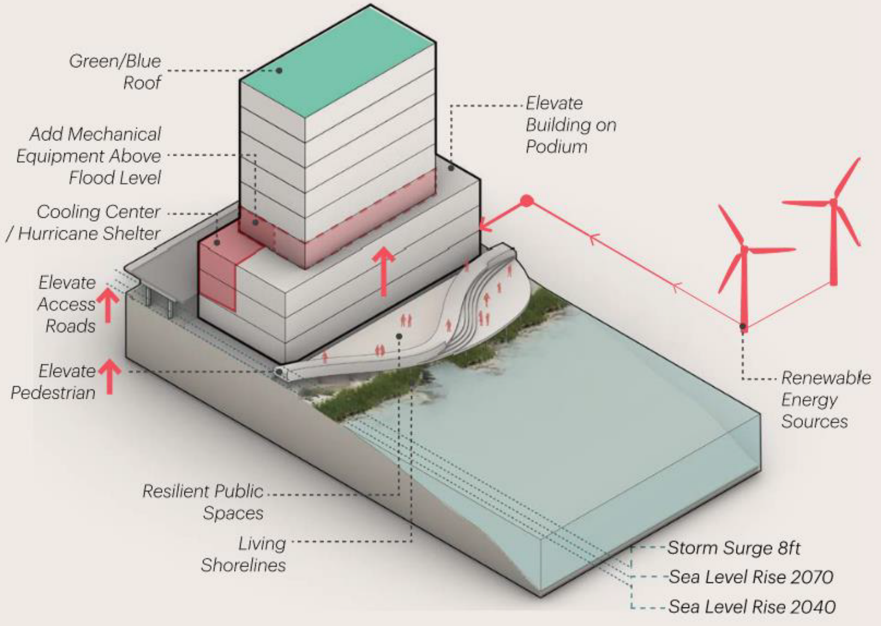
Design Concepts

Living shorelines and vegetated coastal buffers better resist erosion and promote biodiversity on land and under the water.

Vegetated landscapes better control storm water, clean pollutants from run-off water, promote biodiversity, reduce urban heat island, and promote biophilia which helps promote healing and control stress.

Resilience Design Strategies

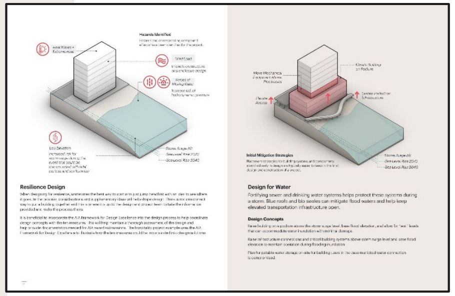
The diagram above collects the previously developed resilience design strategies together for evaluation.



Resilience Design Assessment

The diagram above collects the developed resilience design strategies together for evaluation. In your project you may have multiple ideas to satisfy design objectives or mitigate hazards. A value engineering process may also jeopardize the ability to keep some concepts in the design. Resilience design strategies naturally require a systems approach that help us think about several different types of building systems, concepts, and features to create an integrative and holistic design idea. A building design solution that touches many parts of the building is harder to value engineer or remove from the project. For example, if solar brise soleil reduce visual glare, shrink the size of mechanical equipment, and can be used as hurricane shutters for windows, it may be harder for the project to remove them to save cost. The existence of the brise soleil help reduce cost of other items in the project.

When a more objective analysis is needed to determine if an option is viable to keep in a project or to help decide between multiple different ideas, a BCA can be used. The next section introduces the concept of a BCA and performs one for the hospitality project example.



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Step 04 – Benefit Cost Analysis

Benefit Cost Analysis (BCA) Steps

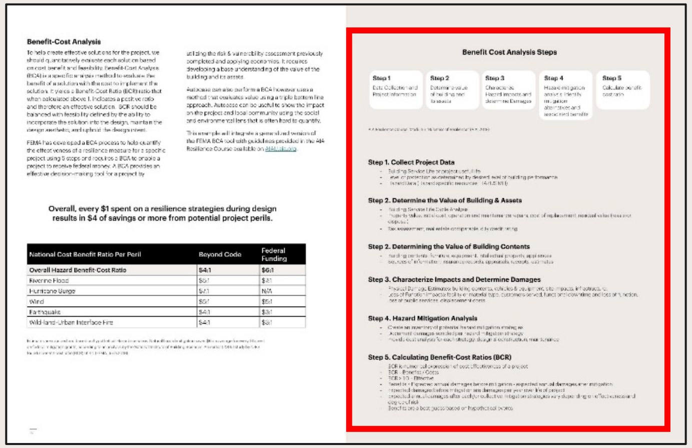
Step 1
Data Collection and Project Information

Step 2
Determine value of building and its assets

Step 3
Characterize Hazard Impacts and determine Damages

Step 4
Identify mitigation alternatives and associated benefits

Step 5
Calculate Benefit Cost Ratio (BCR)



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AIA Resilience Course, Module 7 “Business of Resilience” (AIA 2018)

Step 04 – Benefit Cost Analysis

Damages from Potential Hazards > **Cost for Resilience Strategies**

$$\frac{\text{Damages}}{\text{Cost of Resilience Strategies}}$$

Benefit Cost Ratio (BCR) >1.0 → **The Resilience Strategy Should be Considered**

Step 04 – Benefit Cost Analysis

Step 1: Project Data

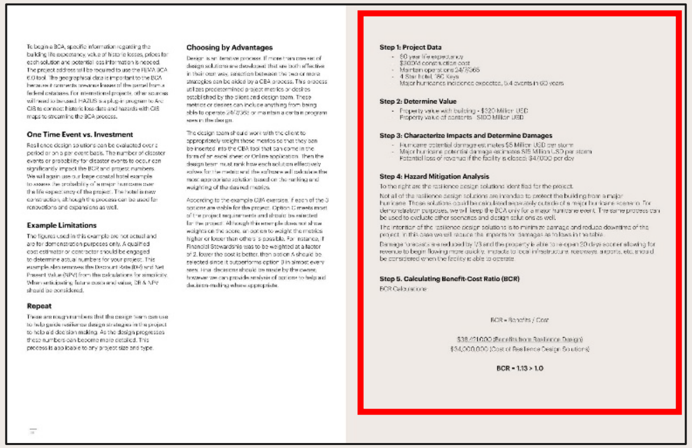
- 60 year life expectancy
- $300M construction cost
- Maintain operations 24/7/365
- 4-Star hotel, 180 Keys
- Major hurricanes incidence expected, 5.4 events in 60 years

Step 2: Determine Value

- Property value with building - $320 Million USD
- Property value of contents - $100 Million USD

Step 3: Characterize Impacts and Determine Damages

- Hurricane potential damage estimates $5 Million USD per storm
- Major hurricane potential damage estimates $15 Million USD per storm
- Potential loss of revenue if the facility is closed: $47,000 per day



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Resilience Design Solutions

Solution	Cost
Living Shoreline	$3,000,000
Elevated Building above BFE & Storm Surge Line	$4,000,000
Back-up Power Systems for 7-days	$15,000,000
Back-up Water Systems for 7-days	$8,000,000
Resource Storage for 7-days	$500,000
Green / Blue Roofs	$1,500,000
Elevated Pedestrian Space	$2,000,000
Renewable Energy Systems	$7,000,000
Native & Adaptive Species Landscape Design	$1,500,000
Total for Resilience Design Solutions	**$58,500,000**

Resilience Design Solutions for a Major Hurricane

Solution	Cost
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Step 4: Hazard Mitigation Analysis

To the right are the resilience design solutions identified for the project.

Not all of the resilience design solutions are intended to protect the building from a major hurricane. Those solutions could be calculated separately outside of a major hurricane scenario. For demonstration purposes, we will keep the BCA only for a major hurricane event. The same process can be used to evaluate other scenarios and design solutions as well.

The intention of the resilience design solutions is to minimize damage and reduce downtime of the project. In this case we will reduce the impacts for damages as follows in the table.

Damage forecasts are reduced by 1/3 and the property is able to re-open 20 days sooner allowing for revenue to begin flowing more quickly. Impacts to local infrastructure, roadways, airports, etc. should be considered when the facility is able to operate.

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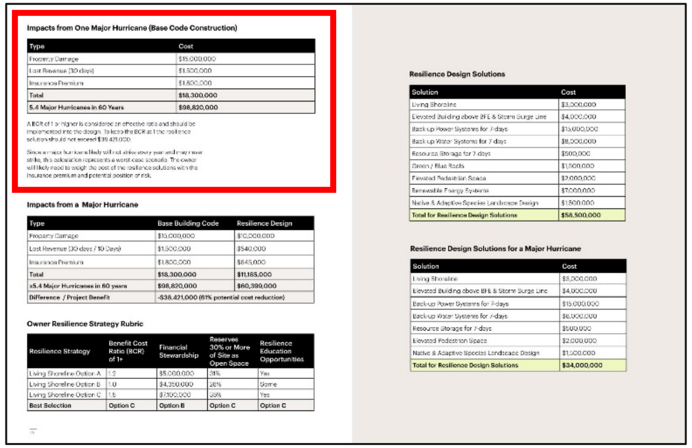
Step 04 – BCA to CBA

Impacts from One Major Hurricane (Base Code Construction)

Type	Cost
Property Damage	$15,000,000
Lost Revenue (30 days)	$1,500,000
Insurance Premium	$1,800,000
Total	**$18,300,000**
5.4 Major Hurricanes in 60 Years	**$98,820,000**

A BCR of 1 or higher is considered an effective ratio and should be implemented into the design. To keep the BCR at 1 the resilience solution should not exceed $38,421,000.

Since a major hurricane likely will not strike every year and may never strike, this calculation represents a worst-case scenario. The owner will likely need to weigh the cost of the resilience solutions with the insurance premium and potential position of risk.



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Step 04 – BCA to CBA

Impacts from a Major Hurricane

Type	Base Building Code	Resilience Design
Property Damage	$15,000,000	$10,000,000
Lost Revenue (30 days / 10 Days)	$1,500,000	$540,000
Insurance Premium	$1,800,000	$645,000
Total	**$18,300,000**	**$11,185,000**
x5.4 Major Hurricanes in 60 years	**$98,820,000**	**$60,399,000**
Difference / Project Benefit	**-$38,421,000 (61% potential cost reduction)**	

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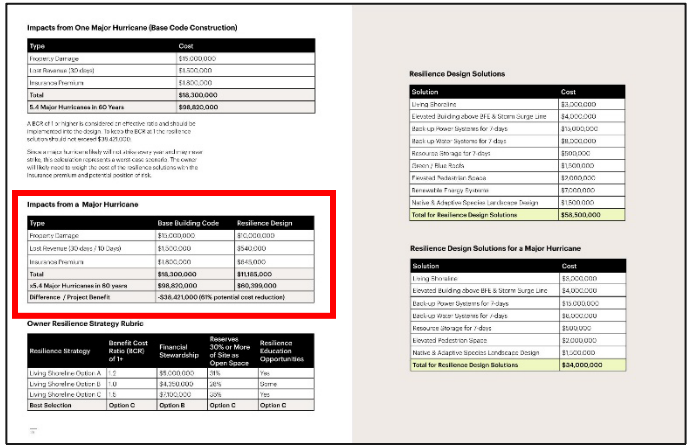

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Impacts from a Major Hurricane

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x5.4 Major Hurricanes in 60 years	**$98,820,000**	**$60,399,000**
Difference / Project Benefit	**-$38,421,000 (61% potential cost reduction)**	

Owner Resilience Strategy Rubric

Resilience Strategy	Benefit Cost Ratio (BCR) of 1+	Financial Stewardship	Reserves 30% or More of Site as Open Space	Resilience Education Opportunities
Living Shoreline Option A	1.2	$5,000,000	31%	Yes
Living Shoreline Option B	1.0	$4,350,000	28%	Some
Living Shoreline Option C	1.5	$7,100,000	35%	Yes
Best Selection	**Option C**	**Option B**	**Option C**	**Option C**

Resilience Design Solutions

Solution	Cost
Living Shoreline	$3,000,000
Elevated Building above BFE & Storm Surge Line	$4,000,000
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Elevated Pedestrian Space	$2,000,000
Renewable Energy Systems	$7,000,000
Native & Adaptive Species Landscape Design	$1,500,000
Total for Resilience Design Solutions	**$58,500,000**

Resilience Design Solutions for a Major Hurricane

Solution	Cost
Living Shoreline	$3,000,000
Elevated Building above BFE & Storm Surge Line	$4,000,000
Back-up Power Systems for 7-days	$15,000,000
Back-up Water Systems for 7-days	$8,000,000
Resource Storage for 7-days	$500,000
Elevated Pedestrian Space	$2,000,000
Native & Adaptive Species Landscape Design	$1,500,000
Total for Resilience Design Solutions	**$34,000,000**

Page 39

Step 04 – BCA to CBA

Resilience Design Solutions

Solution	Cost
Living Shoreline	$3,000,000
Elevated Building above BFE & Storm Surge Line	$4,000,000
Back-up Power Systems for 7-days	$15,000,000
Back-up Water Systems for 7-days	$8,000,000
Resource Storage for 7-days	$500,000
Green / Blue Roofs	$1,500,000
Elevated Pedestrian Space	$2,000,000
Renewable Energy Systems	$7,000,000
Native & Adaptive Species Landscape Design	$1,500,000
Total for Resilience Design Solutions	**$58,500,000**

Resilience Design Solutions for a Major Hurricane

Solution	Cost
Living Shoreline	$3,000,000
Elevated Building above BFE & Storm Surge Line	$4,000,000
Back-up Power Systems for 7-days	$15,000,000
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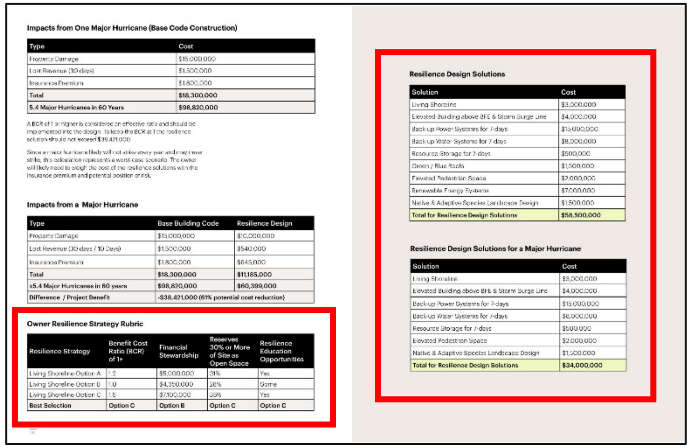
Resource Storage for 7-days	$500,000
Elevated Pedestrian Space	$2,000,000
Native & Adaptive Species Landscape Design	$1,500,000
Total for Resilience Design Solutions	**$34,000,000**

Owner Resilience Strategy Rubric

Resilience Strategy	Benefit Cost Ratio (BCR) of 1+	Financial Stewardship	Reserves 30% or More of Site as Open Space	Resilience Education Opportunities
Living Shoreline Option A	1.2	$5,000,000	31%	Yes
Living Shoreline Option B	1.0	$4,350,000	28%	Some
Living Shoreline Option C	1.5	$7,100,000	35%	Yes
Best Selection	**Option C**	**Option B**	**Option C**	**Option C**

Option C Should Be Selected



Page 39

Step 04 – BCA to CBA

Impacts from a Major Hurricane

Type	Base Building Code	Resilience Design
Property Damage	$15,000,000	$10,000,000
Lost Revenue (30 days / 10 Days)	$1,500,000	$540,000
Insurance Premium	$1,800,000	$645,000
Total	**$18,300,000**	**$11,185,000**
x5.4 Major Hurricanes in 60 years	**$98,820,000**	**$60,399,000**
Difference / Project Benefit	**-$38,421,000 (61% potential cost reduction)**	

A BCR of 1 or higher is considered an effective ratio and should be implemented into the design. To keep the BCR at 1 the resilience solution should not exceed $38,421,000.

Since a major hurricane likely will not strike every year and may never strike, this calculation represents a worst-case scenario. The owner will likely need to weigh the cost of the resilience solutions with the insurance premium and potential position of risk.

Resilience Design Solutions for a Major Hurricane

Solution	Cost
Living Shoreline	$3,000,000
Elevated Building above BFE & Storm Surge Line	$4,000,000
Back-up Power Systems for 7-days	$15,000,000
Back-up Water Systems for 7-days	$8,000,000
Resource Storage for 7-days	$500,000
Elevated Pedestrian Space	$2,000,000
Native & Adaptive Species Landscape Design	$1,500,000
Total for Resilience Design Solutions	**$34,000,000**

$$\frac{\text{Damages}}{\text{Cost of Resilience Strategies}}$$

Benefit Cost Ratio (BCR) >1.0

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Step 04 – BCA to CBA

Impacts from a Major Hurricane

Type	Base Building Code	Resilience Design
Property Damage	$15,000,000	$10,000,000
Lost Revenue (30 days / 10 Days)	$1,500,000	$540,000
Insurance Premium	$1,800,000	$645,000
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Resilience Design Solutions for a Major Hurricane

Solution	Cost
Living Shoreline	$3,000,000
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Native & Adaptive Species Landscape Design	$1,500,000
Total for Resilience Design Solutions	**$34,000,000**

$$\frac{\$38{,}421{,}000}{\$34{,}000{,}000}$$

Benefit Cost Ratio = 1.13 >1.0

Resilience Strategy Adds Value

Step 05

Evaluate & Nurture

5. Evaluate + Nurture

A Resilient Building

Step 05 - Evaluate + Nurture is where the relationship with the client and the performance of the project come together, hopefully in a positive form. We should always seek to know failures and successes of our past projects so that we can learn and perform better on the next project.

Post Construction

Successfully achieving the project's resilience goals presents post occupancy opportunities. After the certificate of occupancy has been earned and the contract requirements have been fulfilled, the project likely is considered complete. This is a perfect time to follow up on Return-on-Investment (ROI) of the project as appropriate with the client and stakeholders. This could be assessed more comprehensively through a Post-Occupancy Evaluation (POE). Lessons learned in the POE may be useful content for a project case study or other publication that describes both failures and successes.

It is incredibly valuable to be able to assess project performance so that we can determine which design strategies functioned as intended or were not worth the investment. The comprehensive yet highly specific design strategies that could be developed for resilience design may be unique to the project and site. Design elements could be used in subsequent projects and a database of successful and not so successful strategies can help provide direction in the future.

Case studies are a great vehicle for documenting project work and the resilience design strategies included in the design. Developing a case study template that is clear and direct helps make project work highly sharable and can also be used for marketing and business development.

Clear and tangible building operations and maintenance manuals are critical for the building to function as designed and maintain its resilience features. Building operations manuals are developed and building operations staff are trained on how to properly operate the building. This is typically performed by commissioning agents and MEP engineers on the project. These training manuals should have sections on building resilience systems.

Through this process, it also provides an opportunity to remain in a trusted position with the client. Maintaining a relationship with a client and their organization may provide opportunities for future work and the ability to follow-up on past projects.

Post Occupancy Evaluation

Within the first year of operation, it is best practice to engage the owner with the opportunity to perform a post occupancy evaluation (POE) for the project.

"Post occupancy evaluation" is a term widely accepted and used across the industry for evaluating design after it has been put into service. The depth of analysis and tools used can vary quite widely in a POE.

POE is an evaluation conducted during the operations phase of a project after completion of design and construction. The scope of POE can differ dramatically by project type, client interest, and the skills and experience of the design team. A POE is executed to answer crucial questions about a building's performance. It can address questions such as:

Does the building perform as it was designed?

Does the building meet the users' needs?

What corrective measures can be implemented to improve performance?

How can building features be designed more effectively in the future?

Quantitative and qualitative measurements taken in a POE study ultimately allow designers and clients to review the effectiveness of design features and building performance.

When

It's important to give the operations team sufficient opportunity to calibrate the building after it is fully occupied, which typically occurs 10-18 months after project completion. Also, work teams, managers and individuals need to adapt to their new spaces, discover what works and doesn't work for them, and run through all processes.

You should start thinking about a POE at the very beginning of the project. A similar evaluation can also be provided prior to the start of a project to document a baseline condition, identify issues or concerns to be addressed with the new design, or help the owner and design team identify project goals and priorities.

Who

Simple tutorials can be provided to help project team members gather quantitative data. When it comes to interviews, surveys, and other qualitative responses, careful consideration in phrasing questions or input prompts will help collect unbiased and more useful responses. In identifying user groups and respondents to the POE, the first consideration is the type of information or feedback desired. Typical stakeholders could include building engineers and facility mangers, residents, team leaders, tenants, specialized work groups, students, faculty, nurses, patients, managers, staff, and executives. There are external tools and resources available to help define a more customized POE to address specific concerns or client needs.

Why

The POE provides validation of design strategies and/or construction implementation, and helps track to meet initial goals. Evidence from previous projects, including examples and impacts, makes it even easier to justify or bolster design solutions on future projects.

For the client, the POE proves the value of design and performance enhancements (daylight, biophilia, acoustic control, lighting, individual control, thermal comfort, etc.). The end user gains better understanding of the physical space they occupy and the design considerations.

A POE could also be used to demonstrate to an owner the impact of higher quality design features, including higher quality materials.

Follow-up After a Disaster

Inevitably when a disaster occurs, we should all lend a helping hand where we can. After the situation has stabilized, a discussion with an owner may be welcomed on how the building or project endured the disaster event and how the project team can help navigate issues with the building. This may help reveal how the owner has perceived resilience design features which may provide both objective and subjective responses. Having a relationship with the owner can help make these conversations more fluid and may reveal feedback on resilience performance. Sometimes the conversation may not be welcomed, it is up to the project team to assess the situation.

Other Ways to be Involved

The AIA Disaster Assistance Committee provides organization and training for architects to help their communities after a disaster event. The Safety Assessment Program (SAP) uses the California Office of Emergency Services training program for structure assessments after earthquakes, flooding, and extreme windstorms. Architects and Engineers can complete the training and be placed on a list of volunteers to help with damage assessments after a disaster event. This program can provide firsthand experience of the potential damage and hazards, relief process, and protocols that can affect communities, which can help with resilient design development.

Safety Assessment Program (SAP)

The Safety Assessment Program

NOVEMBER 29, 2023

The AIA Safety Assessment Program (SAP) Training teaches architects, engineers, building officials, and inspectors how to assess homes, buildings, and infrastructure for safety after a disaster.

Cal OES
GOVERNOR'S OFFICE
OF EMERGENCY SERVICES

Safety Assessment Program (SAP) Training

Evaluate buildings after disasters to help people get back into their homes and businesses

- Get certified to do rapid safety assessments
- Based on CalOES's SAP program
- 2 half-day sessions | 6 LU HSW
- Sessions:
    - September 25-26, 2024
    - December 10-11, 2024

REDi™ Design Guidelines

Resilience-based Design Initiative

Mission

REDi aims to transform the way resilience is measured and implemented in the built environment, and to **lower the barrier to entry** for owners, developers, architects, and engineers to achieve resilience. Ultimately, REDi defines **best practice for resilience-based design**.

Resilience-driven Design

REDi™ Design Guides

https://www.redi.arup.com/

REDi™ is a suite of design guides to **enable resilient design in the built environment**.

Each REDi™ guide is a set of **prescriptive guidelines for owners, engineers, and architects** to implement resilience-based design to achieve beyond-code resilience objectives.

AIA HKS ARUP

Resilience In Practice

Current industry approach	Best practice
Individual Resilience Choices	**Align to a Resilience Framework**
• Some disciplines incorporate climate change • Some aspects designed for beyond-code requirements	• Addresses all potential weak links • Aligns resilient standards across all disciplines

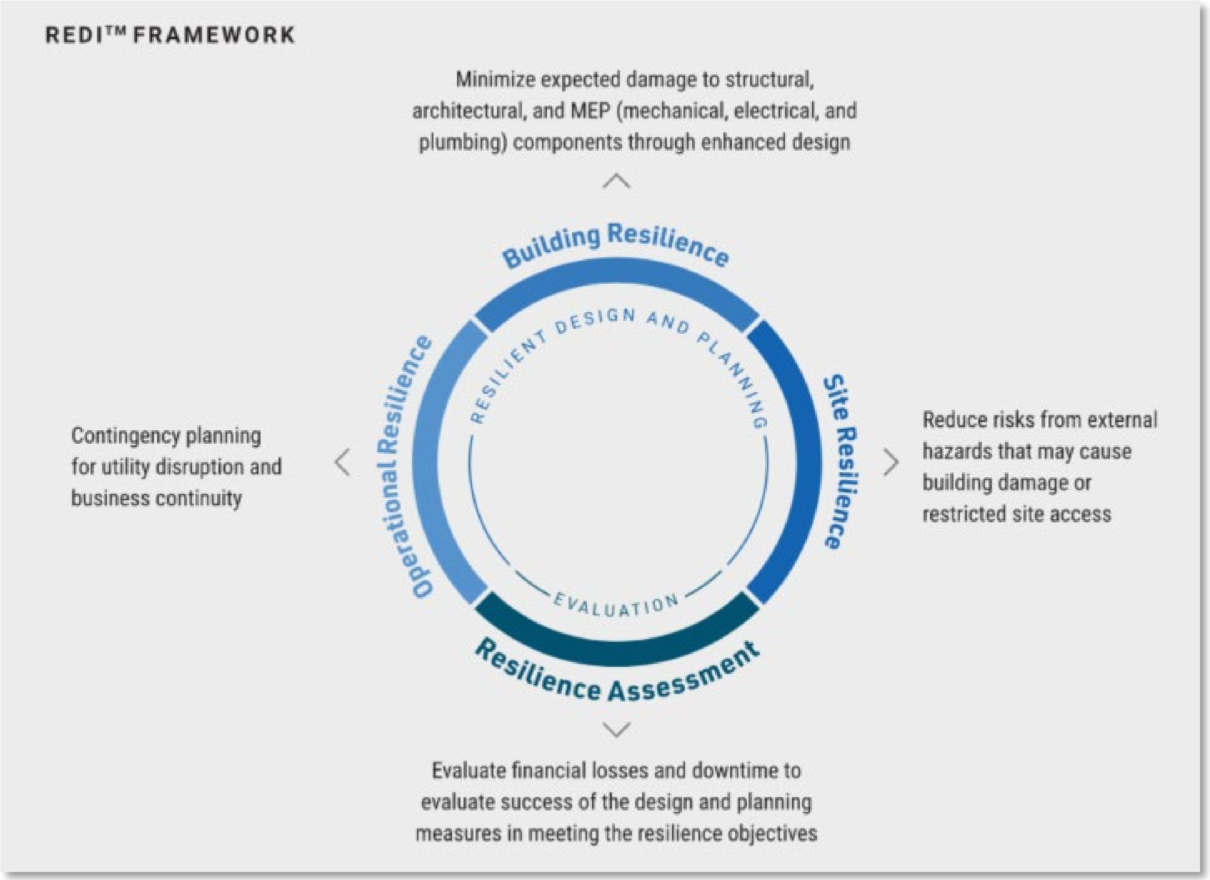
Three Tiers of Resilience Objectives

REDi™ uses **a tiered system of "resilience objectives"** based on the desired level of building functionality and performance following a natural hazard event.

Design teams conduct an initial workshop with the client to establish resilience objectives for a project, which **REDi™ then lays out actions to meet those objectives**

Rating	Downtime	Property Damage	Occupant Safety
● ○ ○ Platinum	Immediate Re-Occupancy Functional recovery in < 72 hours	Probable Loss < 2.5%	Physical injury due to failure of building components unlikely
○ ● ○ Gold	Immediate Re-Occupancy Functional recovery in < 1 month	Probable Loss < 5%	Physical injury due to failure of building components unlikely
○ ○ ● Silver	Re-Occupancy in < 2 weeks Functional recovery in < 6 months	Probable Loss < 10%	Physical injury due to failure of building components unlikely

Framework for Holistic Resilience



To achieve holistic resilience, REDi™ lays out **clauses for design teams to follow** to across **four key areas**:

- Operational: contingency plans and processes to support downtime objectives
- Building: enhanced structural and non-structural component design
- Site: consideration of outside-the-perimeter factors and access
- Assessment: ensure that the design meets desired objectives

REDi Framework

- Back-up utilities, communications, security, etc.
- Engineer / contractor on retainer
- Protection of critical systems / long-lead time components
- Business continuity plan

REDi Framework

Structural systems

2

BUILDING RESILIENCE

Minimize expected damage to structural, architectural and MEP components through enhanced design

- Performance-based design / NLTHA
- Limit building drifts
- Seismic protective devices
- Explicit quantification of collapse

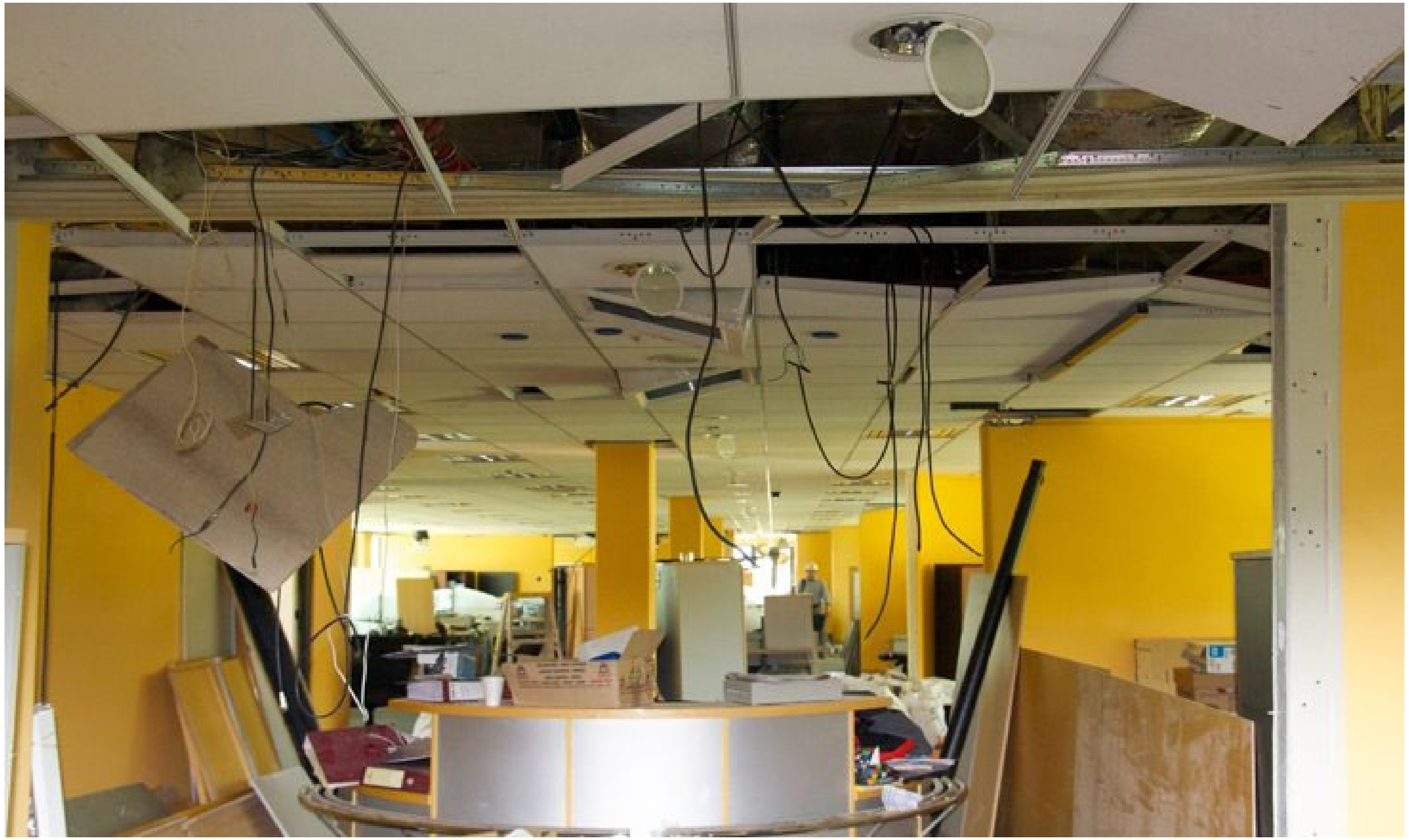
REDi Framework

Non-structural systems

2

BUILDING RESILIENCE

Minimize expected damage to structural, architectural and MEP components through enhanced design



REDi Framework

3

SITE RESILIENCE

Reduce risks that external earthquake-induced hazards damage building or restrict site access

REDi Framework

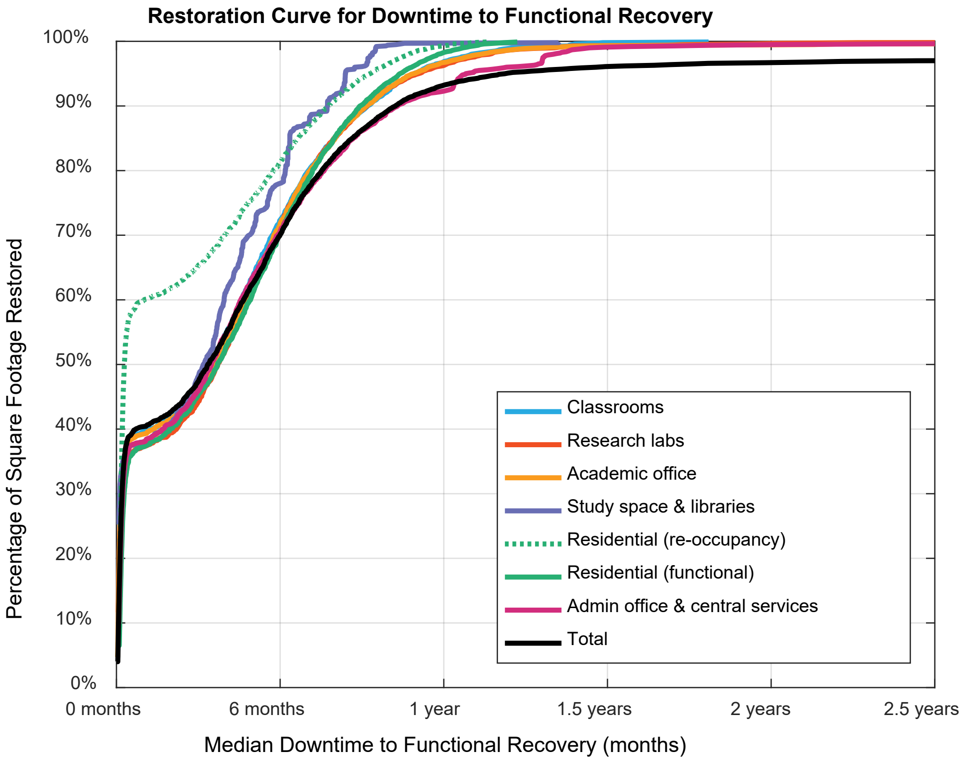
3

SITE RESILIENCE

Reduce risks that external earthquake-induced hazards damage building or restrict site access

AIA HKS ARUP

REDi Framework

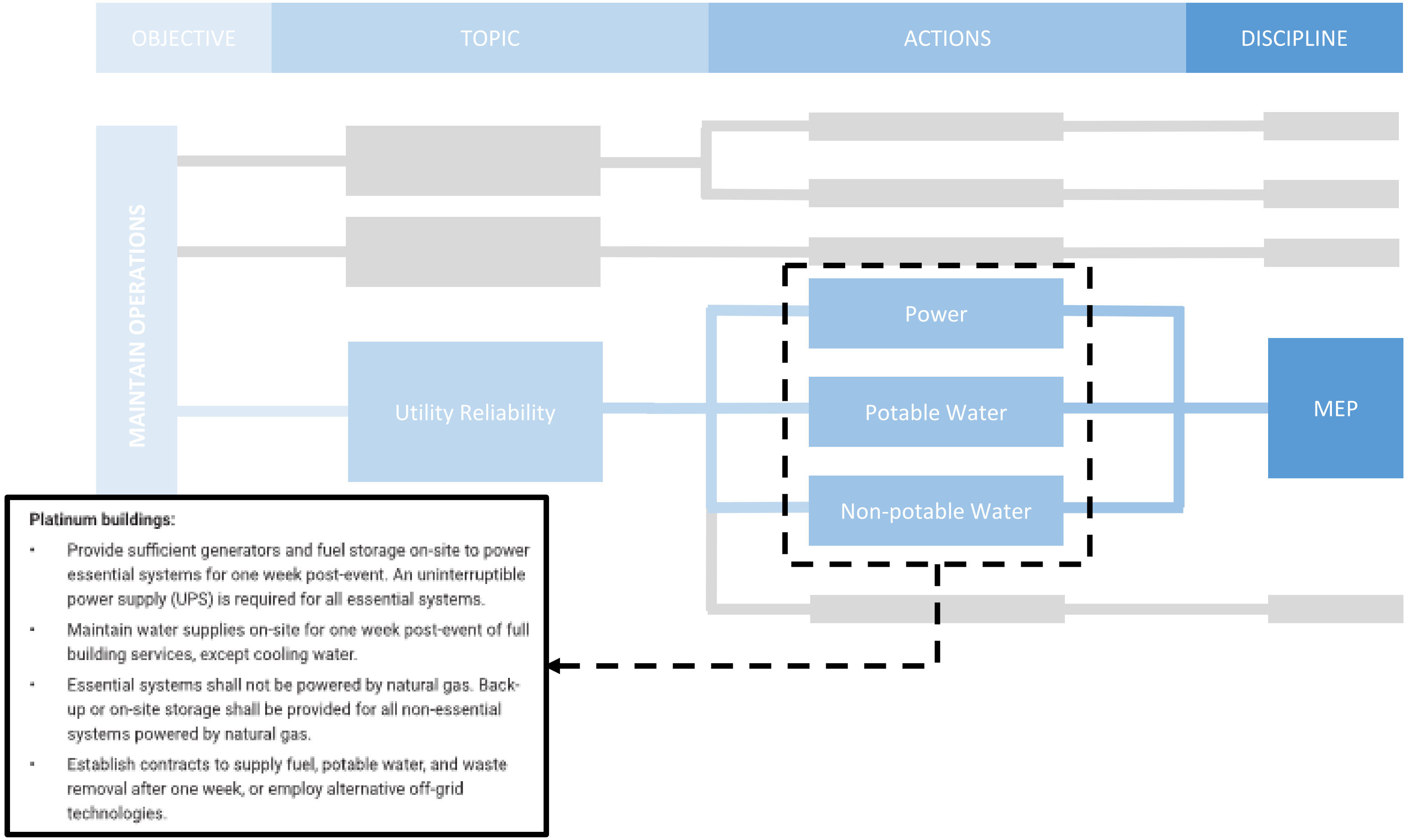


The REDi Risk Models are now **publicly available**!

https://www.arup.com/news-and-events/redi-seismic-downtime-model-released-as-open-source-software-to-advance-resilient-design

Action-Oriented Guidance

Each clause provides objective-specific guidance on how it can be met in order to **lower the barrier to uptake of resilient design actions**



REDi™ in Practice

181 Fremont achieved REDi™ Gold Rating

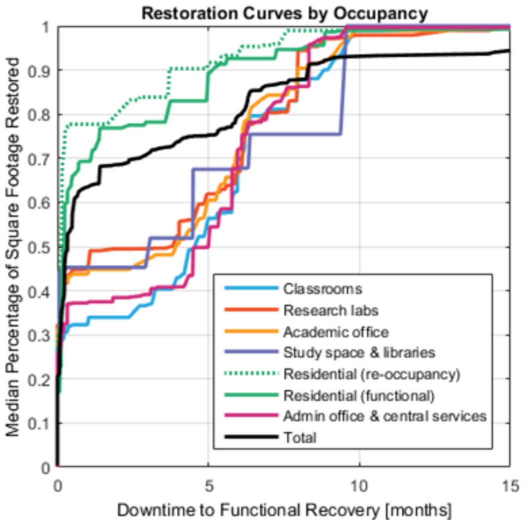
AIA HKS ARUP

Case Study | University of British Columbia

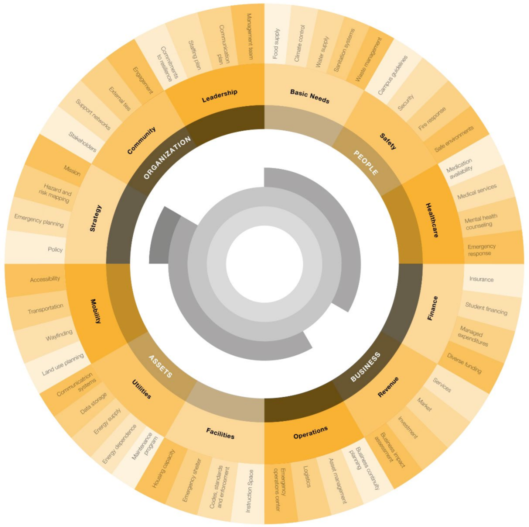
ARUP

Case Study | University of British Columbia

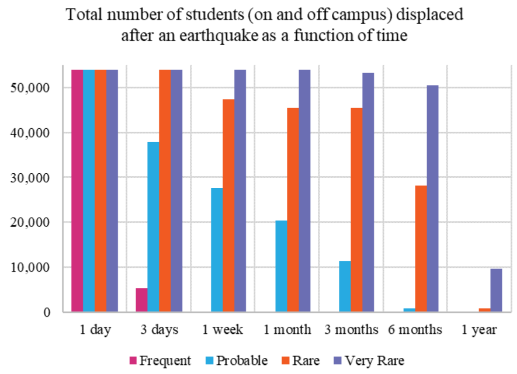
Assess damage to buildings and critical services



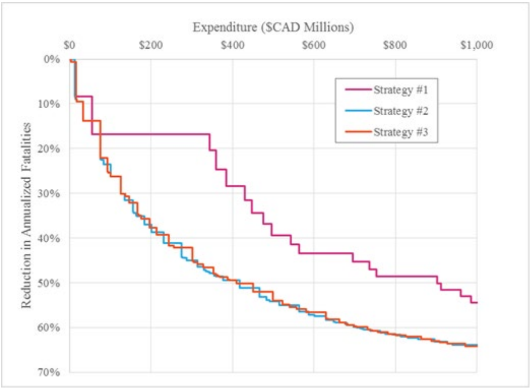
Assess vulnerability of operations



Quantify seismic risk for scenarios



Develop resilience strategies based on C/B



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Link to 2017 UBC Campus Resilience Report:https://facilities.ubc.ca/projects/seismic/seismic-planning-timeline/

Case Study | University of British Columbia

Guides Decision Making

Users: UBC staff

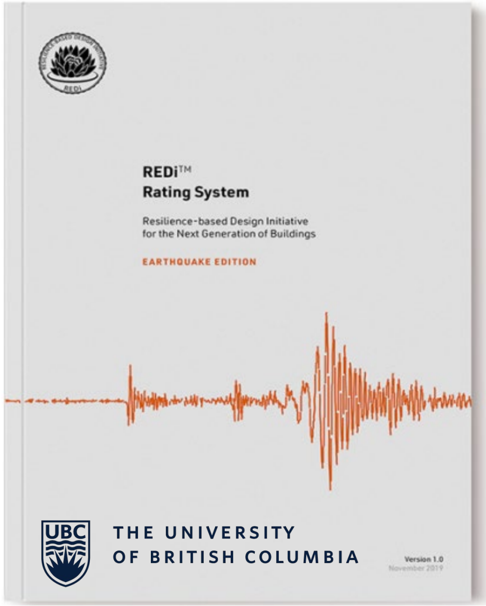
Seismic Real Estate Framework

THE UNIVERSITY OF BRITISH COLUMBIA

Implementation of **Resilience Vision**

REDi Guides Design of New Construction & Retrofits

Users: Designers



University of British Columbia

Guideline for Resilience-based Seismic Design of Nonstructural Systems

Final Draft | November 13th, 2020

University of British Columbia

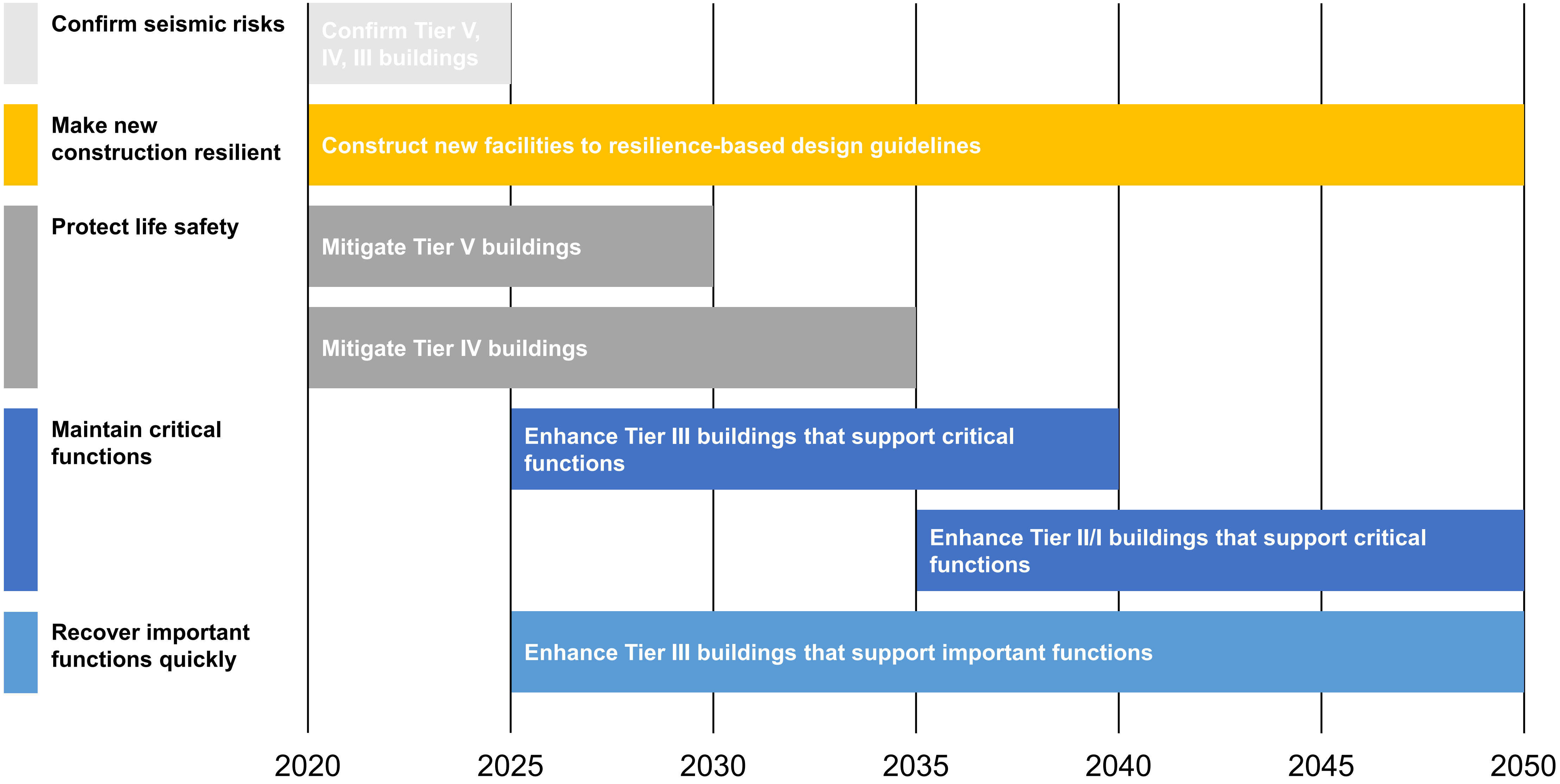
Guidelines for Seismic Protection of Building Contents

Final Issue | September 28, 2018

Case Study | University of British Columbia

	Operational category	**Required performance**
New facilities	Critical	Platinum
	Important	Gold
	Normal	Gold
Mitigation of existing buildings	Critical	Platinum
	Important	Gold
	Normal	Silver

Case Study | University of British Columbia



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Example project | Macleod Building, UBC, Vancouver

REDi Rating
None

Architect: Proscenium
Resilience Consultant: Arup

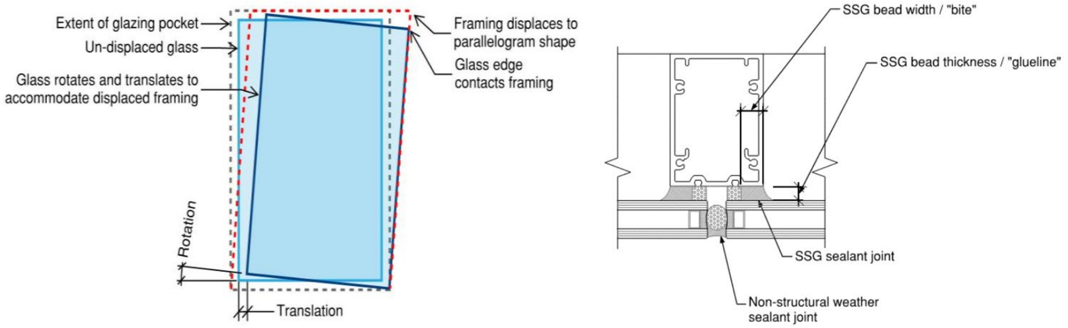
Example project | Jack Bell Building, UBC, Vancouver

REDi Rating
Silver

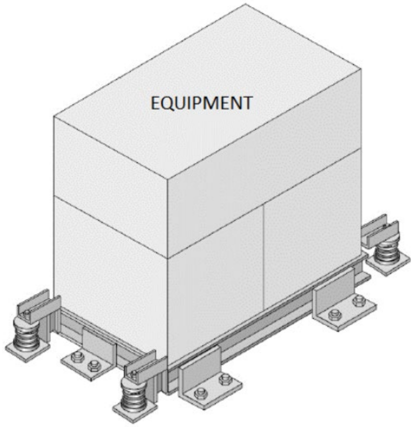
Architect: Proscenium
Engineer of Record: RJC
Structural Peer Reviewer: Arup
Resilience Peer Reviewer: Arup

How did REDi affect these projects?

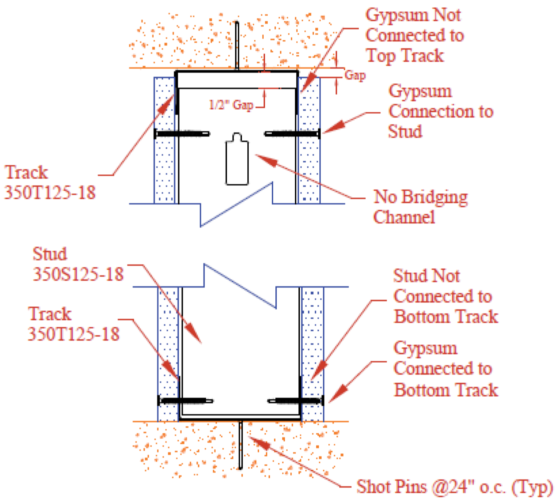
Architectural considerations



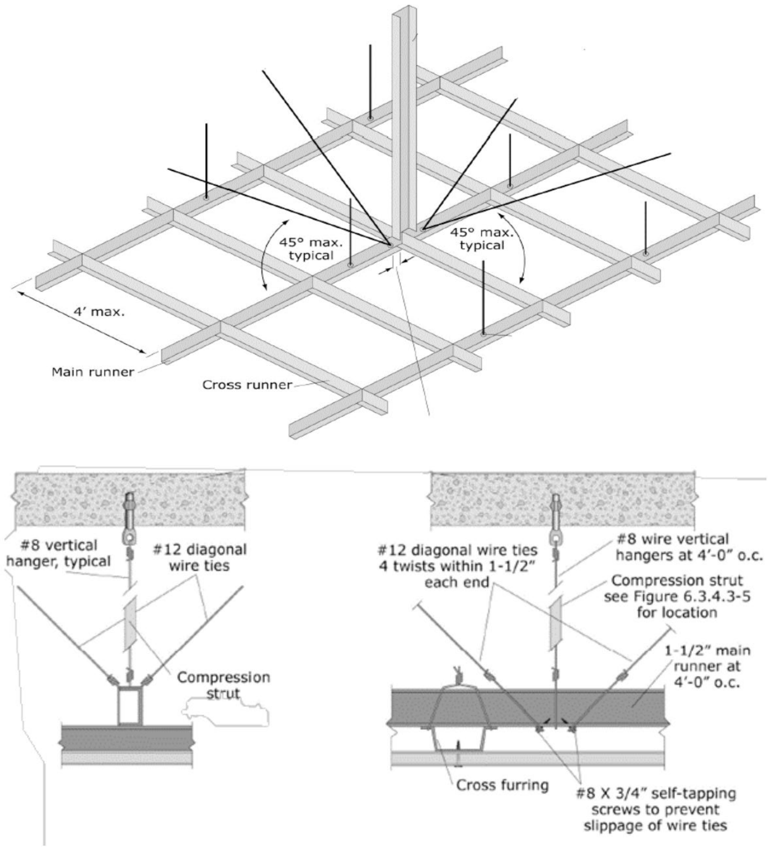
Façade enhancements and testing



Relocation & testing of equipment



Enhanced partition detailing



Enhanced ceiling detailing

Closing Thoughts

Leveraging Integrative Frameworks for Resilient Design

Resilient Design

Early Engagement

Business Case

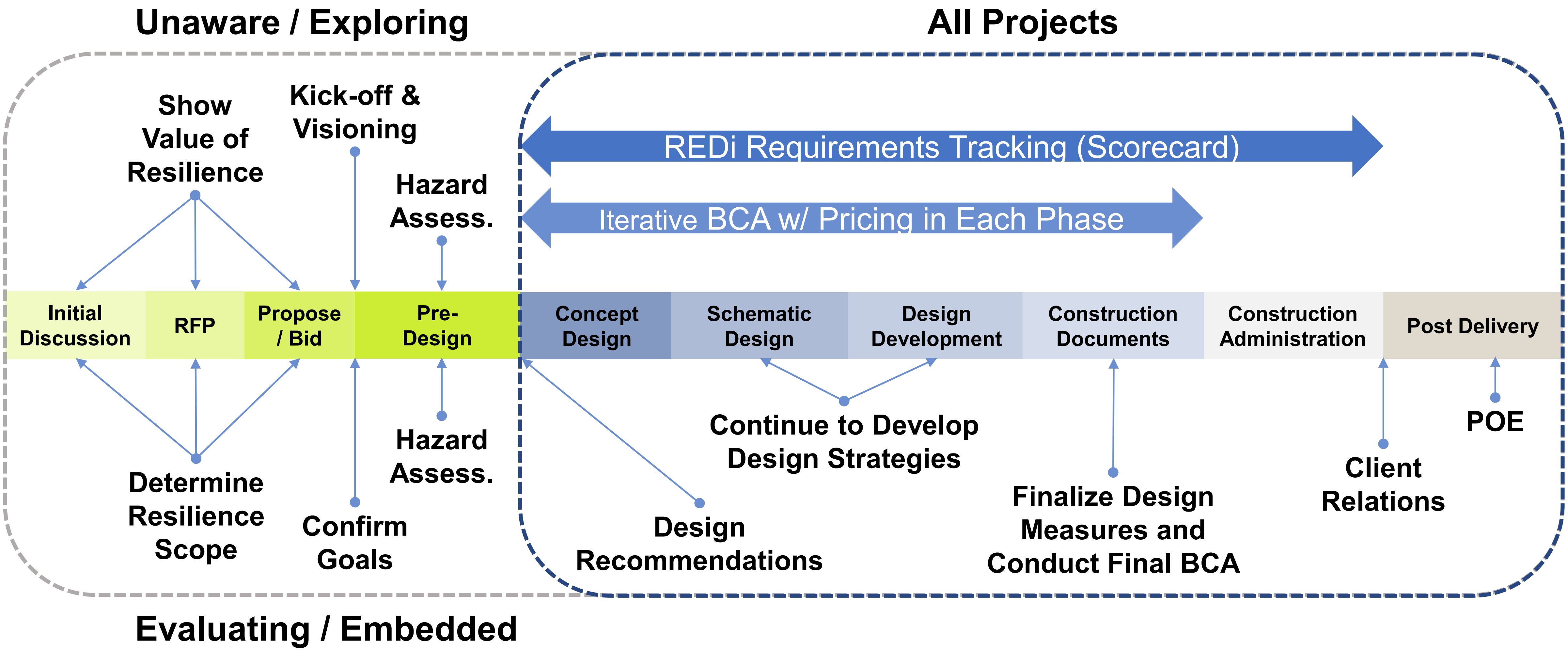
Holistic Collaboration

Industry Trending this Way

New Standard Practice

Mitigating Professional Risk

Resilience Design Coordination Timeline



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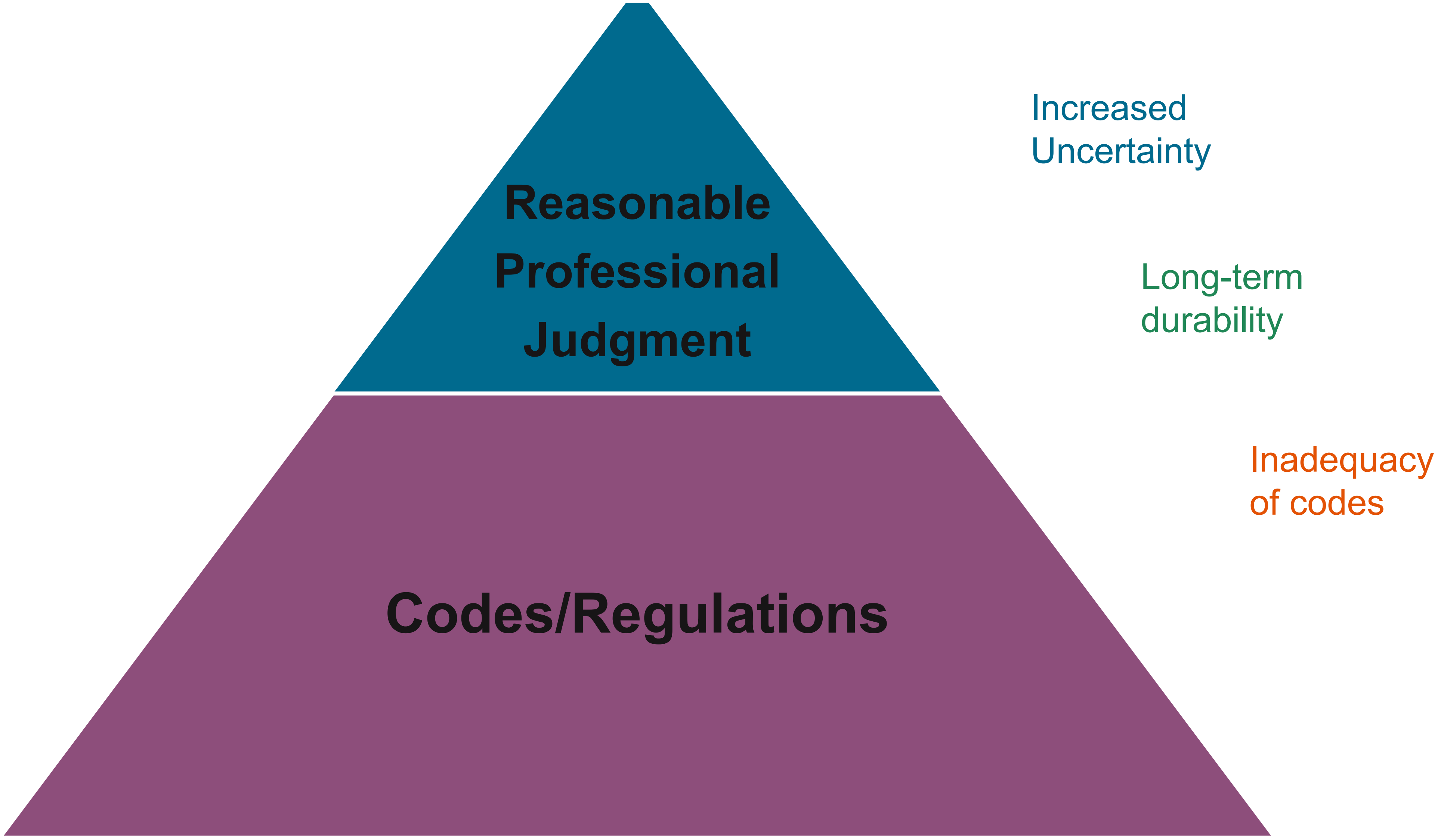
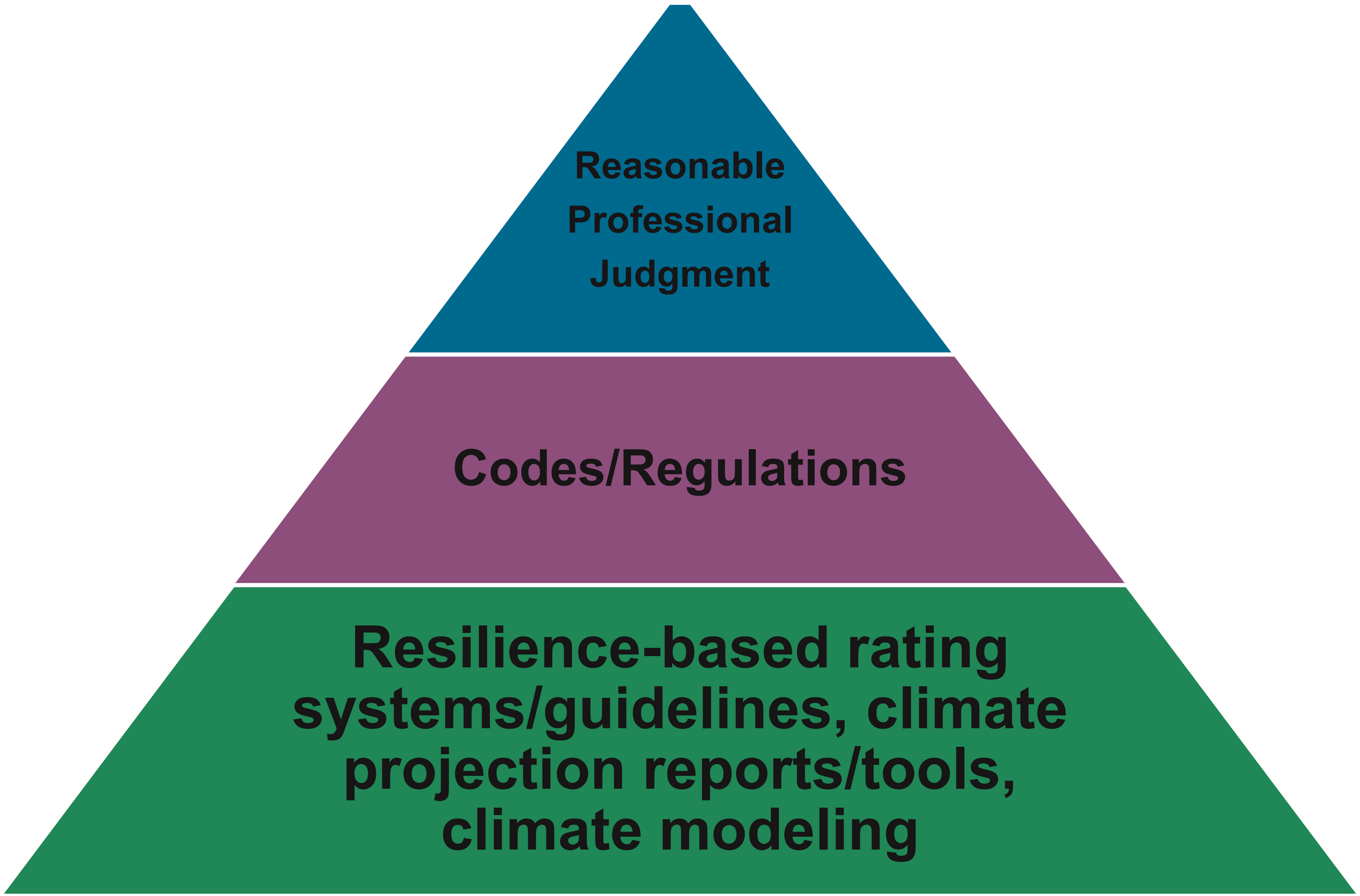
Navigating Professional Liability and Climate Change

Yvonne Castillo, Esq.
SVP, Director of Risk Advisory
Victor Insurance Managers, LLC

Standard of Care – Traditional Context



Evolving Standard of Care for Climate Change



Reaction by Courts
Balancing Test

Lawsuits against:

- industry for failing to adapt facilities against severe weather events
- government entities for failing to adapt or adapting improperly
- federal agencies for not considering climate change factors in project development

VICTOR

Resilience & The Evolving Standard of Care

Part 1

September 18, 2024

AIA California

Q+A

To submit your question, click on the Q&A button located on the black menu bar at the lower or upper portion of your screen, then type in our questions.