Introduction to the LEED Resilient Design Pilot Credits

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NESEA Building Energy Conference

Mainstreaming Resilience: Making Resilient Design Standard Practice

Flat Street, Brattleboro, Vermont, Sept, 2011.
Photo: Charlie Boswell

Suite of 3 LEED pilot credits

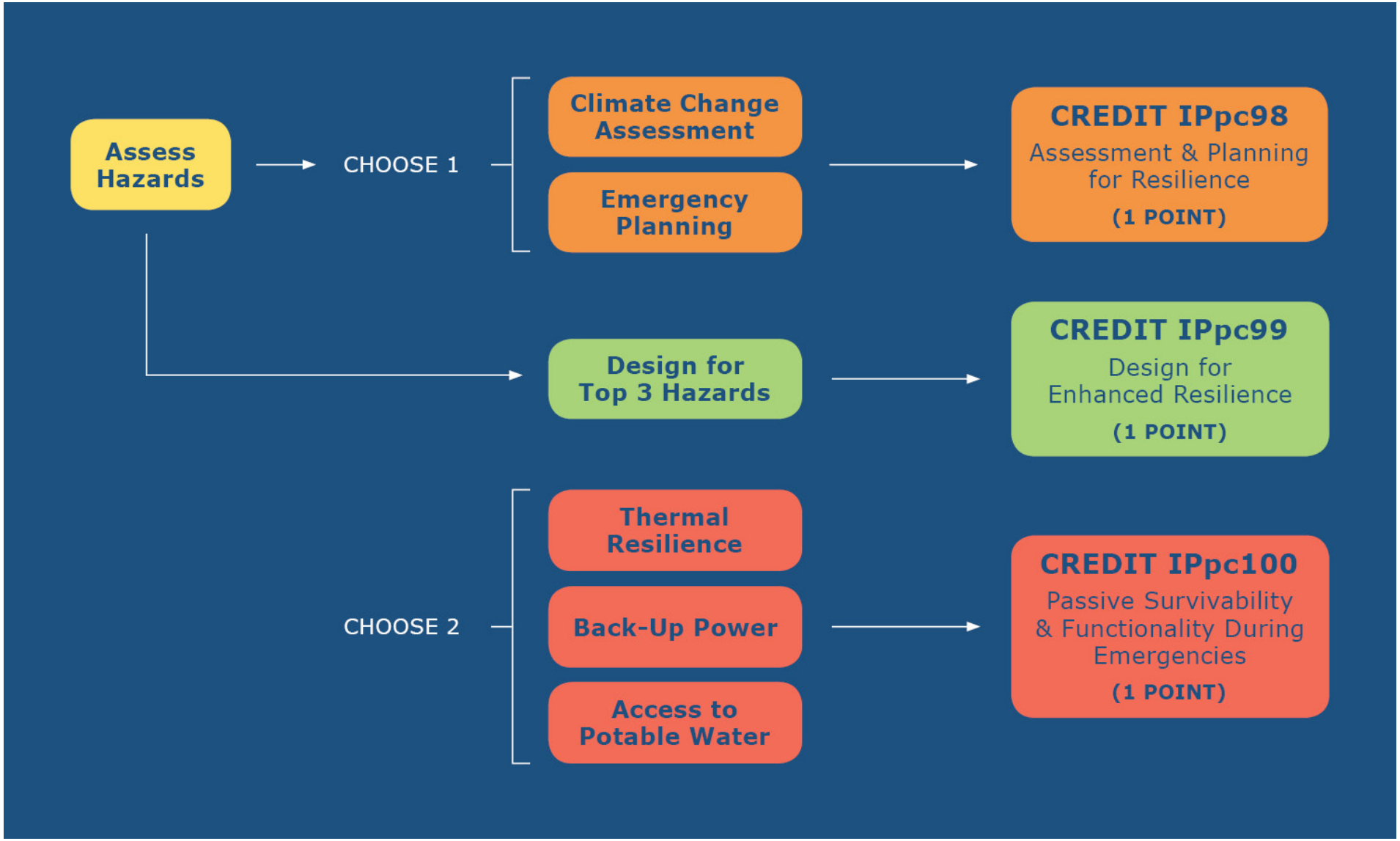
IPpc98: Assessment and planning for resilience

IPpc99: Design for enhanced resilience

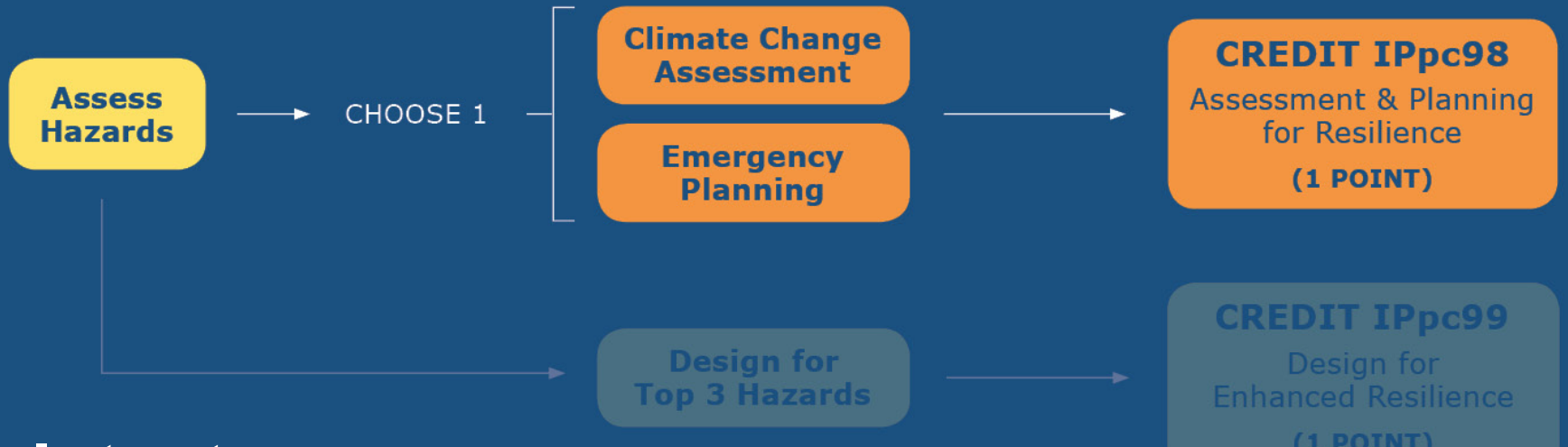
IPpc100: Passive survivability and functionality during emergencies

Operable, triple-glazed windows in patient rooms at Spaulding Rehab Hospital - photo: Perkins + Will

3 Credit Suite:
LEED Pilot Credits on Resilient Design



IPpc98– Assessment and planning for resilience



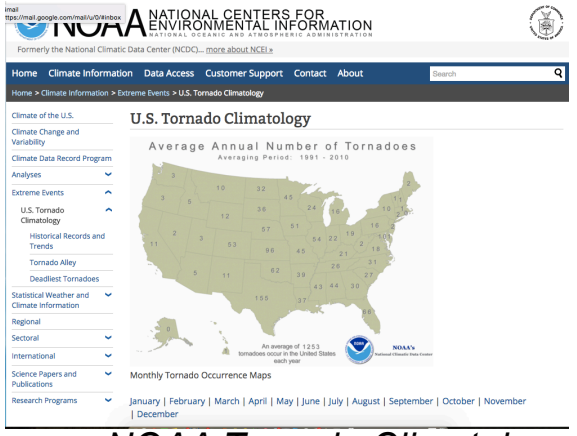
Intent:

To encourage designers, planners and building owners/ operators to proactively plan before design commences for the potential impacts of natural disasters or disturbances as well as address issues that impact long-term building performance such as changing climate conditions.

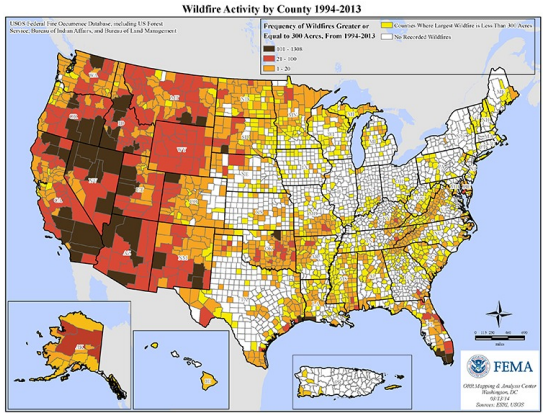
IPpc98: Assessment and planning for resilience

Required: Hazard assessment of project site

- Identify top 3 hazards early in planning
- Use local/regional mitigation plans where available
- If not available, use identified national standards or international equivalents
  - Flooding
  - Hurricane
  - Tornado/High Wind
  - Earthquake
  - Wildfire
  - Drought
  - Landslides/unstable soils



NOAA Tornado Climatology



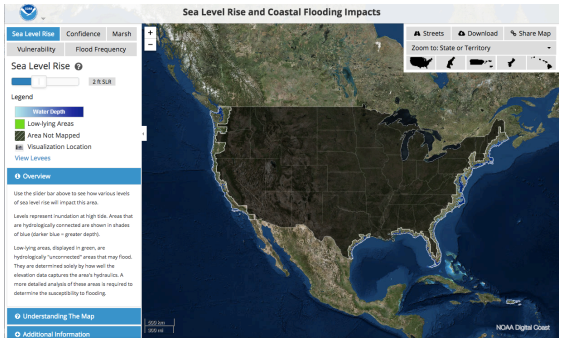
FEMA Wildfire Map

IPpc98: Assessment and planning for resilience

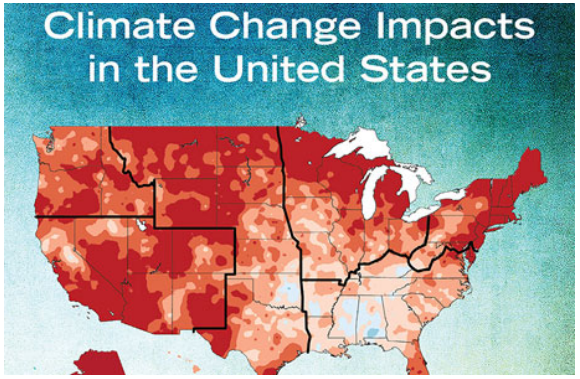
Option 1: Planning for Climate Resilience

Identify key vulnerabilities

- Use local plans where available
- If not available, use identified national resources or international equivalents:
  - Sea Level Rise/Storm Surge
  - River Flooding
  - Winter Storms
  - Temperature, Precipitation Changes and Storm Intensity



NOAA Sea Level Rise and Coastal Flooding

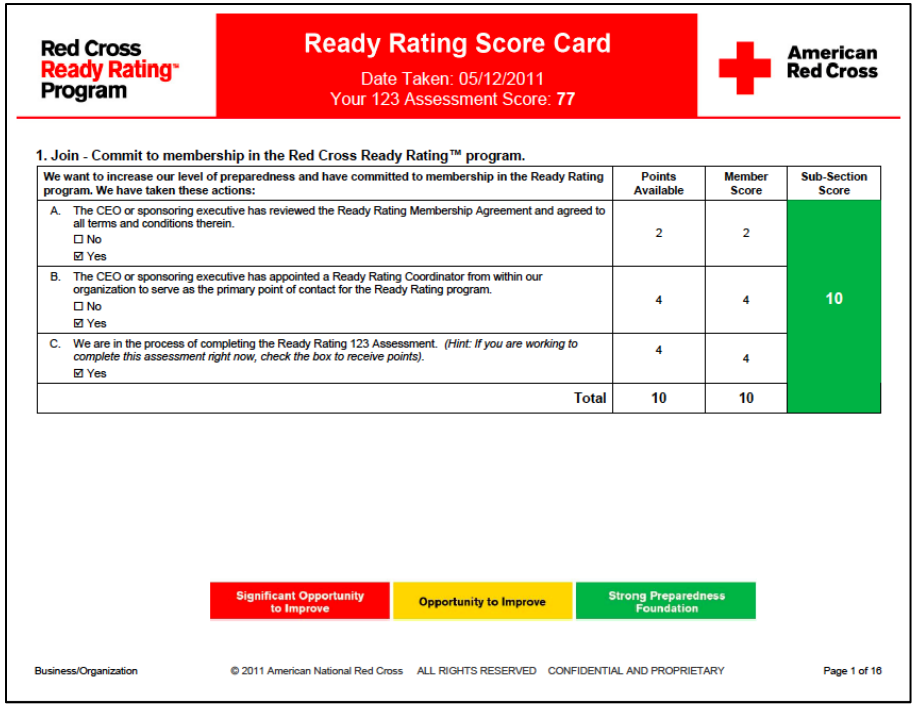


U.S. National Climate Assessment Report

IPpc98: Assessment and planning for resilience

Option 2: Emergency preparedness planning

- Establish a ‘preparedness’ baseline in 5 key areas using Ready Rating 123 Assessment™ Score Card
- Track continuous improvement using Score Card
- No performance metrics required
- Use Ready Rating 123 Program Guide™ for an optional deeper dive



Red Cross Ready Rating™ Program

Ready Rating Score Card

Date Taken: 05/12/2011
Your 123 Assessment Score: **77**

American Red Cross

1. Join - Commit to membership in the Red Cross Ready Rating™ program.

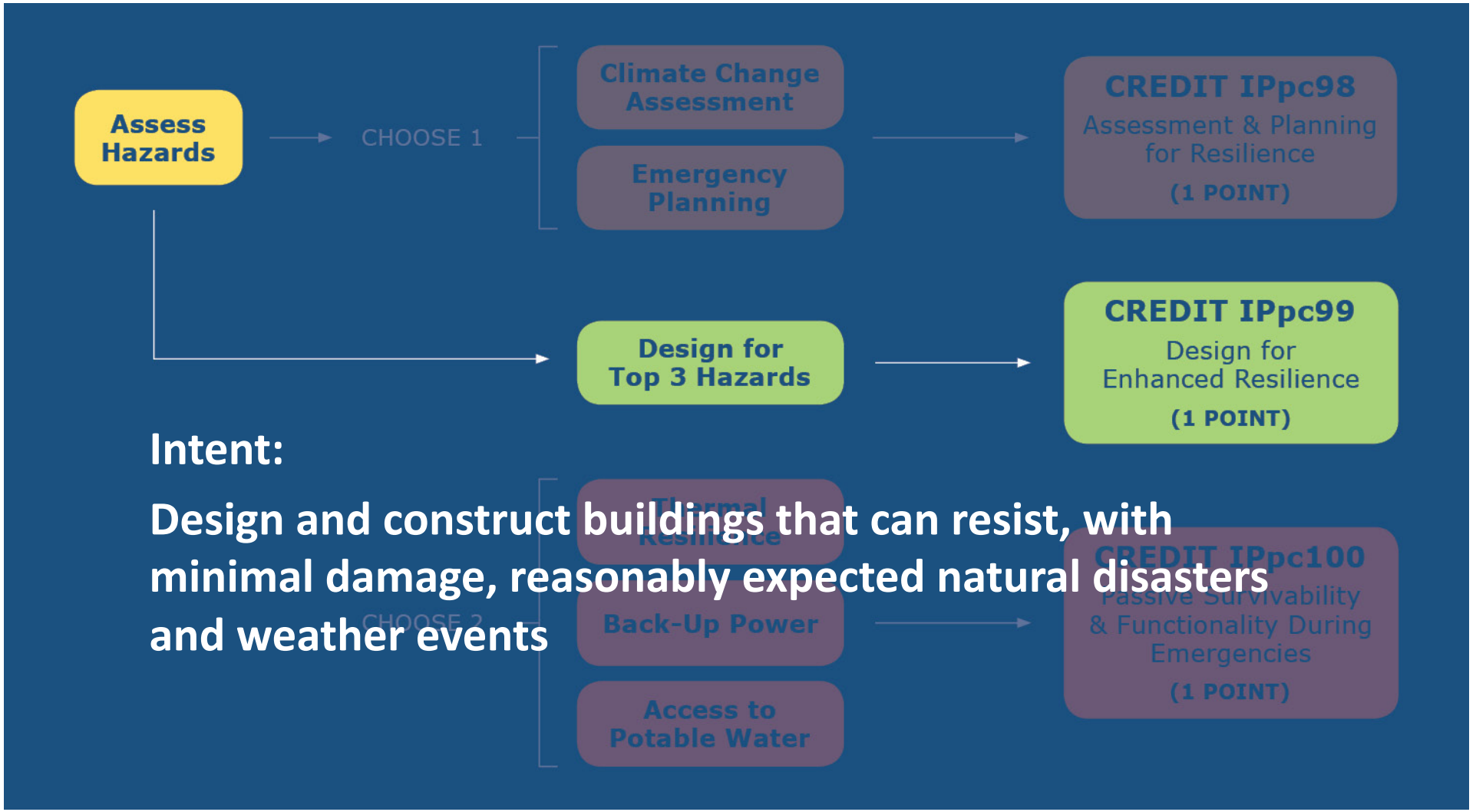
We want to increase our level of preparedness and have committed to membership in the Ready Rating program. We have taken these actions:	Points Available	Member Score	Sub-Section Score
A. The CEO or sponsoring executive has reviewed the Ready Rating Membership Agreement and agreed to all terms and conditions therein. ☐ No ☑ Yes	2	2	10
B. The CEO or sponsoring executive has appointed a Ready Rating Coordinator from within our organization to serve as the primary point of contact for the Ready Rating program. ☐ No ☑ Yes	4	4	
C. We are in the process of completing the Ready Rating 123 Assessment. *(Hint: If you are working to complete this assessment right now, check the box to receive points).* ☑ Yes	4	4	
Total	10	10	

Significant Opportunity to Improve | Opportunity to Improve | Strong Preparedness Foundation

Business/Organization

Red Cross Ready Rating Score Card

IPpc99: Design for enhanced resilience



IPpc99: Design for enhanced resilience

Design and Document mitigation solutions that address top 3 identified site-specific hazards based on hazard assessment.

- Flooding
- Hurricane
- Tornado/High Wind
- Earthquake
- Wildfire
- Drought
- Landslides/unstable soils

Deployable flood barriers in Nashville - photo: EKO Flood, USA

Flooding Mitigation Requirements

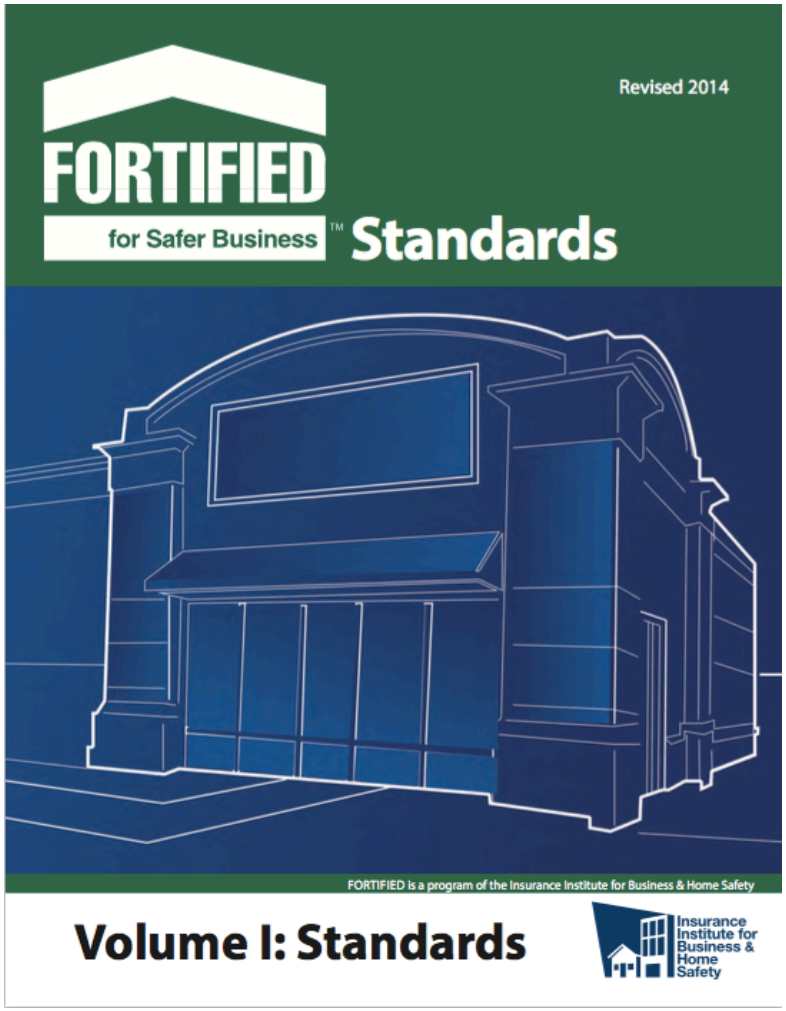
OPTION 1: Flooding-Specific design measures

- Structures must incorporate all flood resistant provisions *of ASCE 24-14 Flood Resistant Design and Construction, (2014)*.
- The lowest occupied floor's lowest structural member must be a minimum of five (5) feet above the FEMA-defined base flood elevation (BFE+5), as defined for FEMA NFIP Zone V and recommended for Coastal Zone A. As an alternative, in commercial projects only, dry flood-proofing practices may be followed and certified by a Licensed Design Professional for any spaces located below BFE+5. - OR - Meet Executive Order (EO) 13690 Federal Flood Risk Management Standard.
- Foundations in the Coastal Zone A shall be the same as required in the Coastal Zone V.
- Primary mechanical and electrical equipment, including HVAC equipment, water heating equipment, electrical panels, and generators, must follow FEMA 55 guidelines and FEMA Technical Bulletins and Advisories for wet and dry flood-proofing. All sewer connections must include sewer backflow preventers at the point of entry into the building on the main discharge sewer line.

Flooding Mitigation Requirements

OPTION 2: FORTIFIED standards

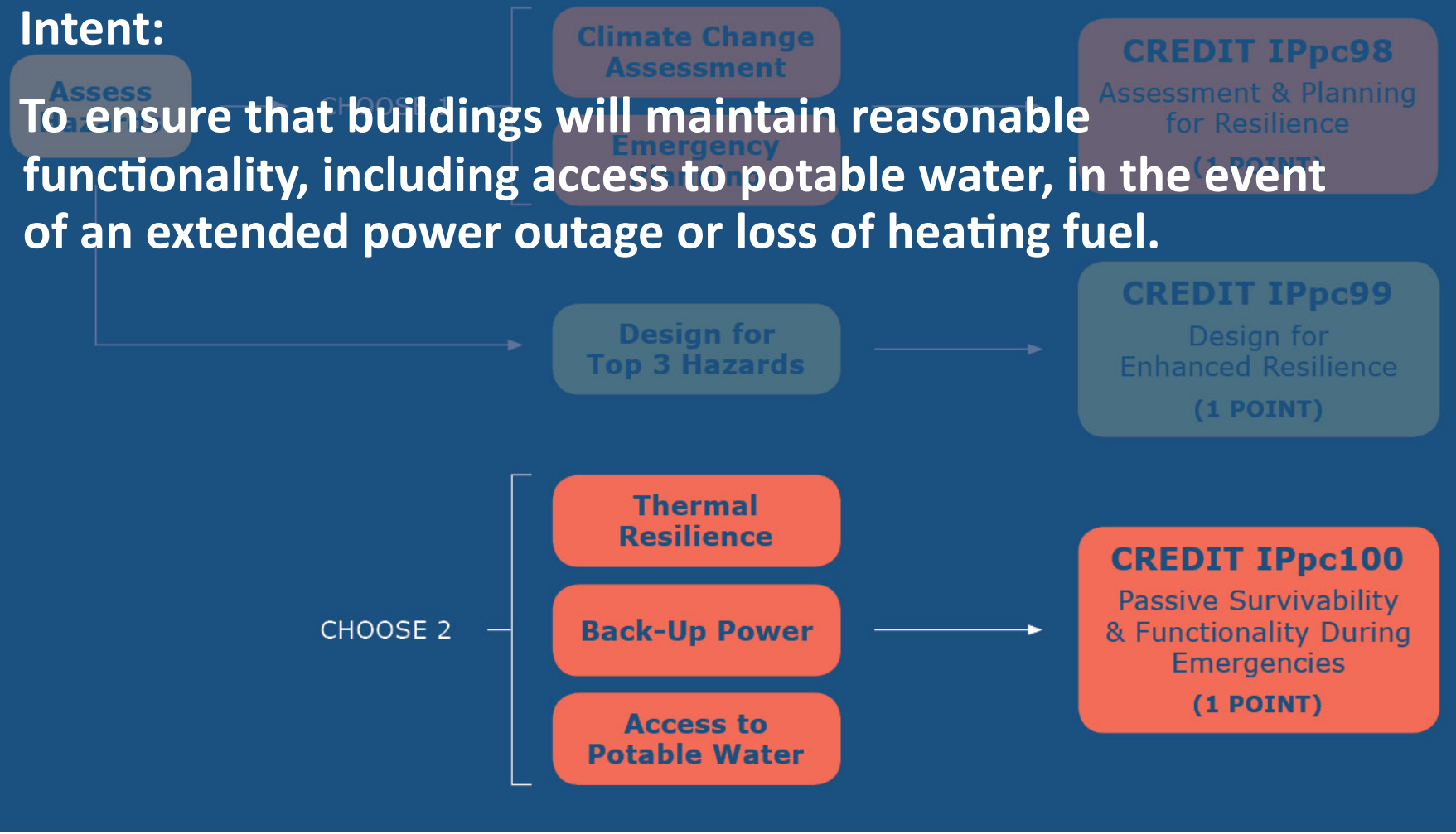
- All non-residential projects shall meet the FORTIFIED for Safer Business (Revised 2014) DESIGN CRITERIA 3.4 Flood Specific Design Requirements.



IPpc100: Passive Survivability & Functionality During Emergencies

Intent:

To ensure that buildings will maintain reasonable functionality, including access to potable water, in the event of an extended power outage or loss of heating fuel.



IPpc100: Passive Survivability & Functionality During Emergencies

Provide two out of three:

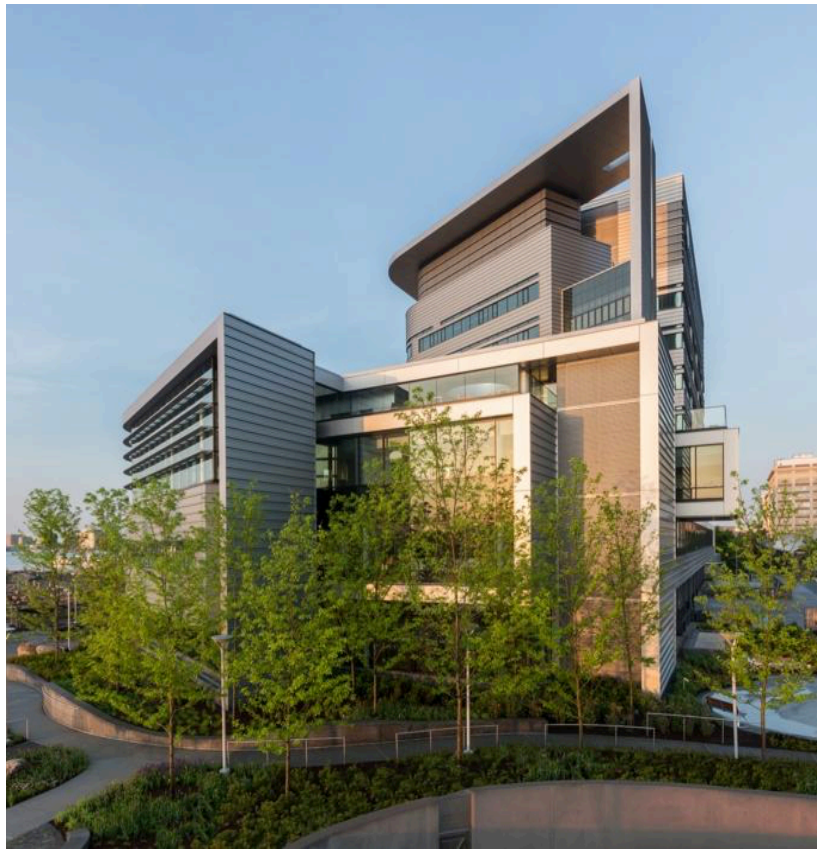
1. Thermal Resilience
2. Backup Power
3. Access to Potable Water

Blackout caused by Hurricane Sandy on October 29, 2012 – photo: Eric Chang

IPpc100: Passive Survivability & Functionality During Emergencies

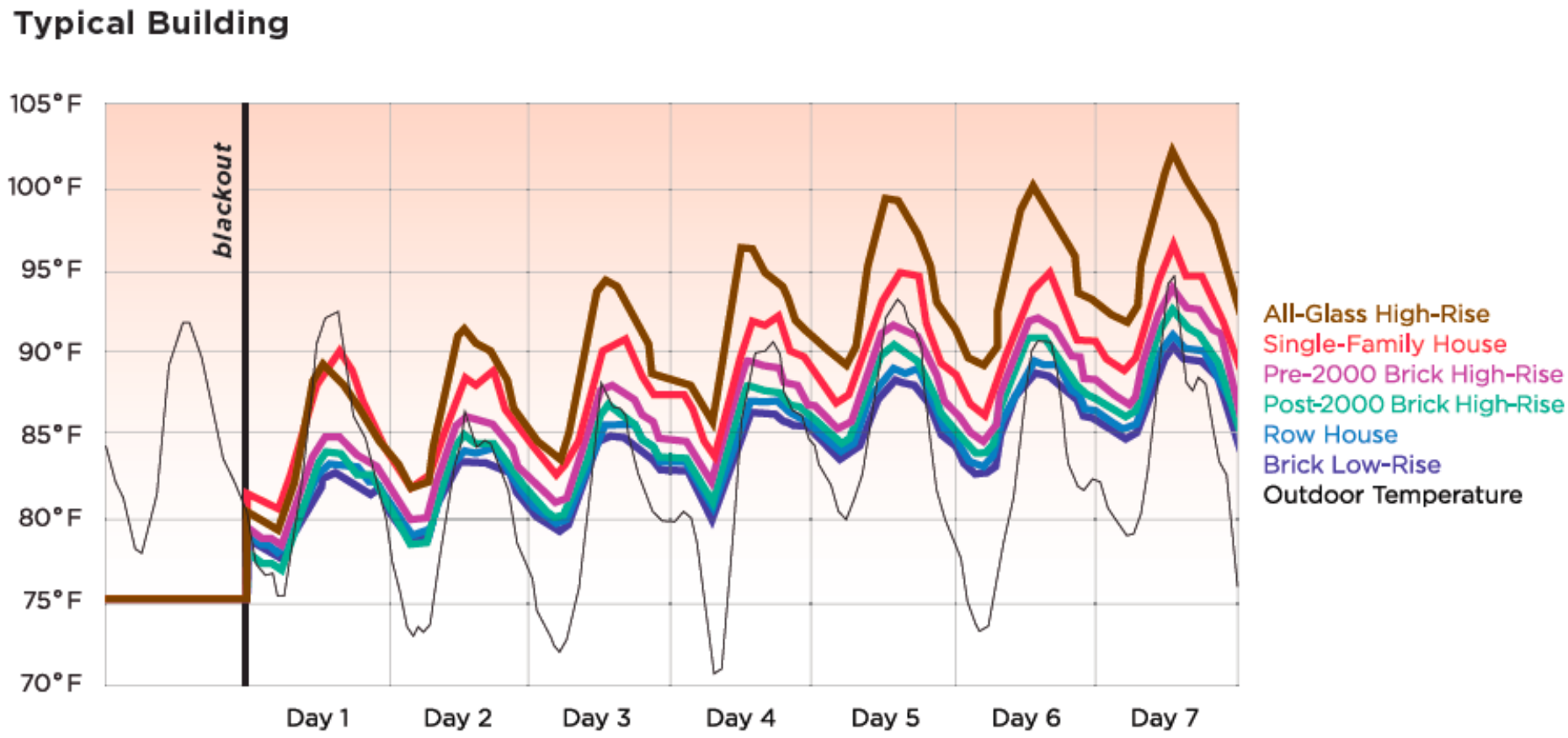
Option 1: Thermal Resilience

100% of the normal building occupancy can occupy habitable zones that maintain “livable temperatures” during a power outage for 7 days in the typical extreme hot and cold weeks of the year.



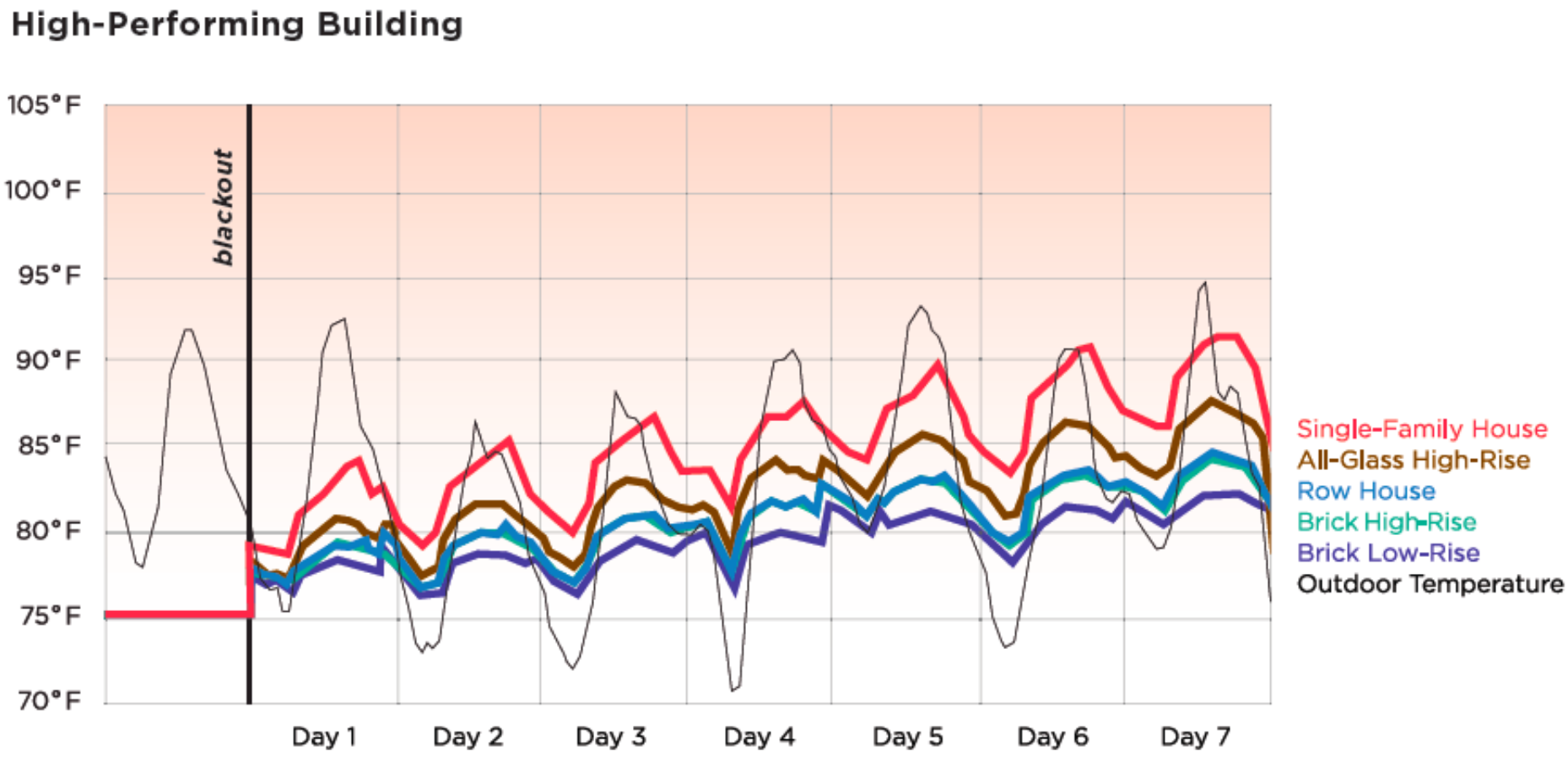
Spaulding Rehab Hospital, Boston
Photo: Perkins+Will

Drift temperatures during outages - summer



Temperature modeling: Atelier Ten, New York City in "Baby It's Cold Inside," Urban Green Council

Drift temperatures during outages - summer



Temperature modeling: Atelier Ten, New York City in "Baby It's Cold Inside," Urban Green Council

Thermal Resilience Documentation

1. Building plans demarcating Habitable Zones
2. Calculation of maximum available natural ventilation rate, minimum required ventilation rate and emergency occupancy for each habitable zone.
3. Summary of calculated °F SET-hours for heating and cooling for each representative habitable zone.
4. Emergency Operation Plan.

New Criteria: Thermal Resilience

Requirements:

- Demonstrate through thermal modeling that a building will maintain “livable temperatures” during a power outage that lasts 7 days during peak summertime and wintertime conditions of a typical year.

Key Definitions:

Standard Effective Temperature:

SET factors in relative humidity and mean radiant temperature

Habitable Zones: Defined by team

Occupant Density: necessary to accommodate the total building population in the habitable zones.

Ventilation: All habitable zones must have access to natural ventilation

Livable temperature:

- Cooling: Not to exceed 9 °F SET-days (216 °F SET-hours) above 86°F SET for residential buildings.
- Cooling Not to exceed 18 °F SET-days (432°F SET-hours) above 86°F SET for non-residential buildings.
- Heating: Not to exceed 9 °F SET-days (216 °F SET-hours) below 54° SET for all buildings.

IPpc100: Passive Survivability & Functionality During Emergencies

Option 2: Back-Up Power

To ensure that a reasonable level of functionality can be maintained in a building in the event of loss of power.

Provide adequate power for:

- Fuel fired heating
- Fan for emergency cooling
- Water pumps
- 3 FC emergency lighting
- 30 FC area @ 500 SF interval
- Electrical receptacle
- Online access
- One elevator if applicable

250-kW generator at Spaulding Rehab.
Photo: Alex Wilson

Acceptable sources of backup power

- Fuel-fired back-up generator(s), with stored fuel supply - 7 days residential bldg; 72 hours non-residential
- A solar-electric system with battery storage - 72 hours residential; 24 hours non-residential
- Micro-grid service that supplies the building

Net-zero-energy Bullitt Center, Seattle
Photo: Alex Wilson

IPpc100: Passive Survivability & Functionality During Emergencies

Option 3:

Access to potable water

To ensure that residents or occupants of a building will have at least minimal access to potable water during a power outage

Bison hand pump on standard well casing
Photo: Alex Wilson

Potable Water Requirements

On municipal water:

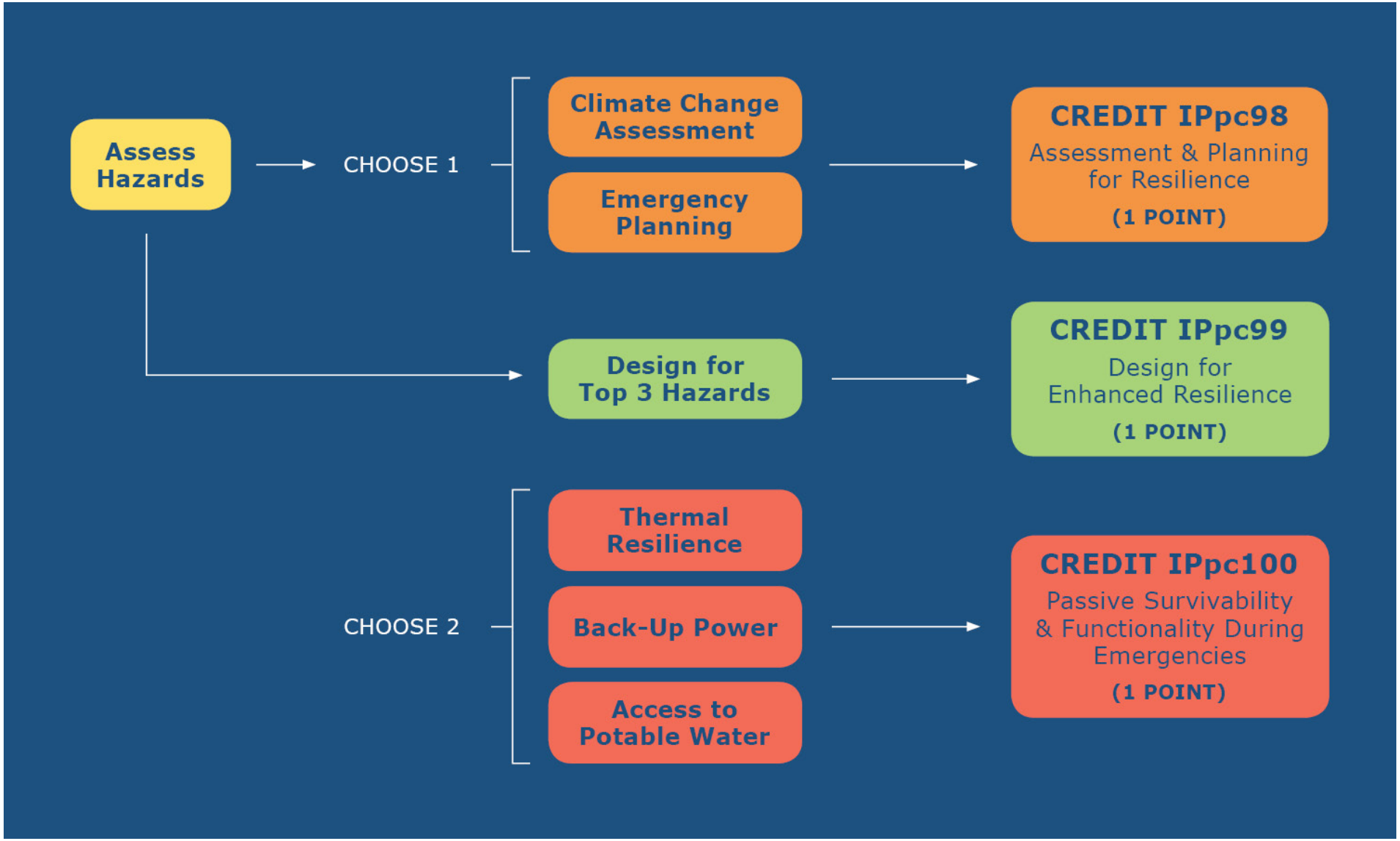
- In tall bldgs. With pumps to deliver water to upper floors: resident access to potable water on lower floor (or)
- Potable water pumps served by back-up power (or)
- Stored water in building (2 gal per resident per day)

Not on municipal water:

- On-site well served by back-up power (or)
- Gravity-flow water from cistern or spring (or)
- Hand pump on well (or)
- Stored water in bldg.

Rainwater cisterns at the Chesapeake Bay Foundation headquarters. Photo: Alex Wilson

LEED Pilot Credits on Resilient Design



LEED Pilot Credits on Resilient Design

A GROUP effort:

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