

NEW ECOLOGY

Community-Based Sustainable Development



LISC BOSTON

Energy Cohort
March 2023

Resilient Design Tools

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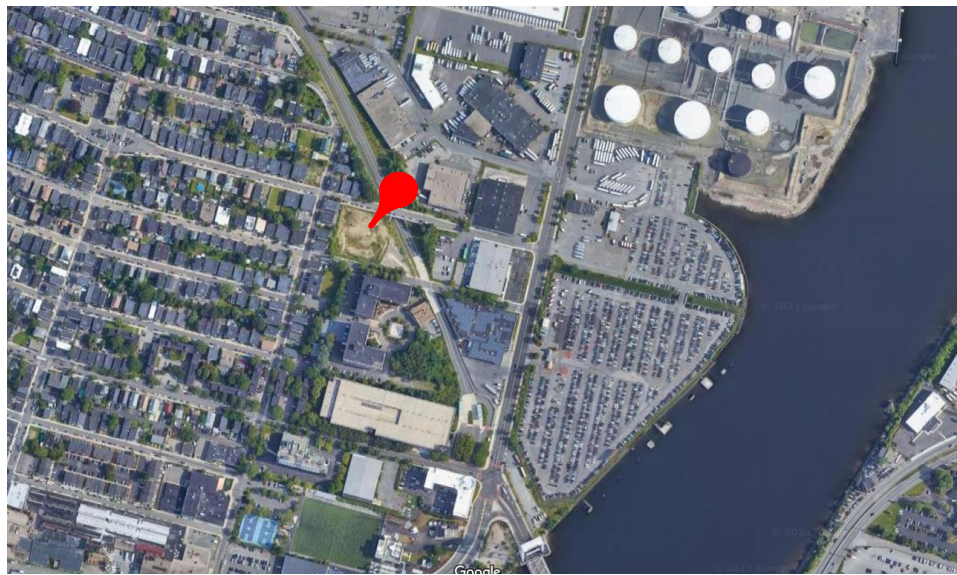
Introduction

- 1 Communities and buildings in Massachusetts are continuing to face pressures due to the changing climate.
- 2 By using publicly available design tools, development teams can effectively assess climate risks to properties through the year 2070.
- 3 This *Resilient Design Brief* is intended to help property managers and developers to understand risk factors, plan for them, and include design elements and features in order to reduce risks to residents.
- 4 The report reviews tools and strategies to measure and mitigate risk, as well as evaluate the opportunity for renewable power and backup battery systems.
- 5 Example resilience assessment using these tools: 170 Cottage Street in Chelsea, MA.

[Link to Report](#)

170 Cottage St, Chelsea, MA

- Currently undeveloped
- Chelsea Creek located to the south and southeast of site
- Lowest site elevation approximately 14 feet



Climate Resilience Design Standards Tool


- How do we consider risks over the lifespan of the building?
- What is the property's climate risk profile?
- Tool dashboard = a great starting place
- Maintained by the Resilient MA Action Team, draws from the Mass. Coastal Flood Risk Model (MC-FRM) and has access to some of the most up to date flood maps available.

[Link to Design Standards Tool](#)

Project Summary

Estimated Capital Cost: \$50000000.00
 End of Useful Life Year: 2094
 Project within mapped Environmental Justice neighborhood: Yes

Ecosystem Service	Scores
Benefits	
Project Score	Low
Exposure	
Sea Level Rise/Storm Surge	Moderate
Extreme Precipitation - Urban Flooding	High Exposure
Extreme Precipitation - Riverine Flooding	Not Exposed
Extreme Heat	High Exposure

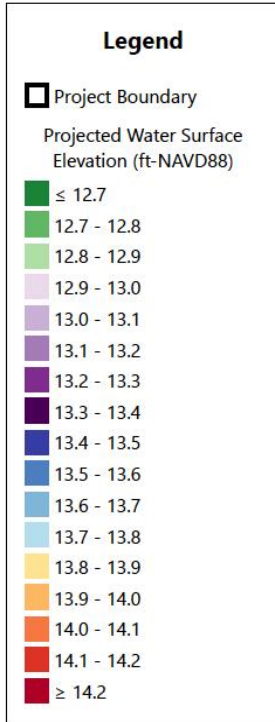


Asset Preliminary Climate Risk Rating Number of Assets: 1

Summary

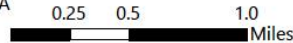
Asset Risk	Sea Level Rise/Storm Surge	Extreme Precipitation - Urban Flooding	Extreme Precipitation - Riverine Flooding	Extreme Heat
Potential Multifamily Housing	Moderate Risk	High Risk	Low Risk	High Risk

Climate Resilience Design Standards Tool



**Climate Resilience Design Standards Tool:
Sea Level Rise/Storm Surge Design Criteria
Projected Water Surface Elevation Map: 0.5% (200-yr)**

Project Name: 170 Cottage Street, Chelsea, MA
Location (Town): Chelsea



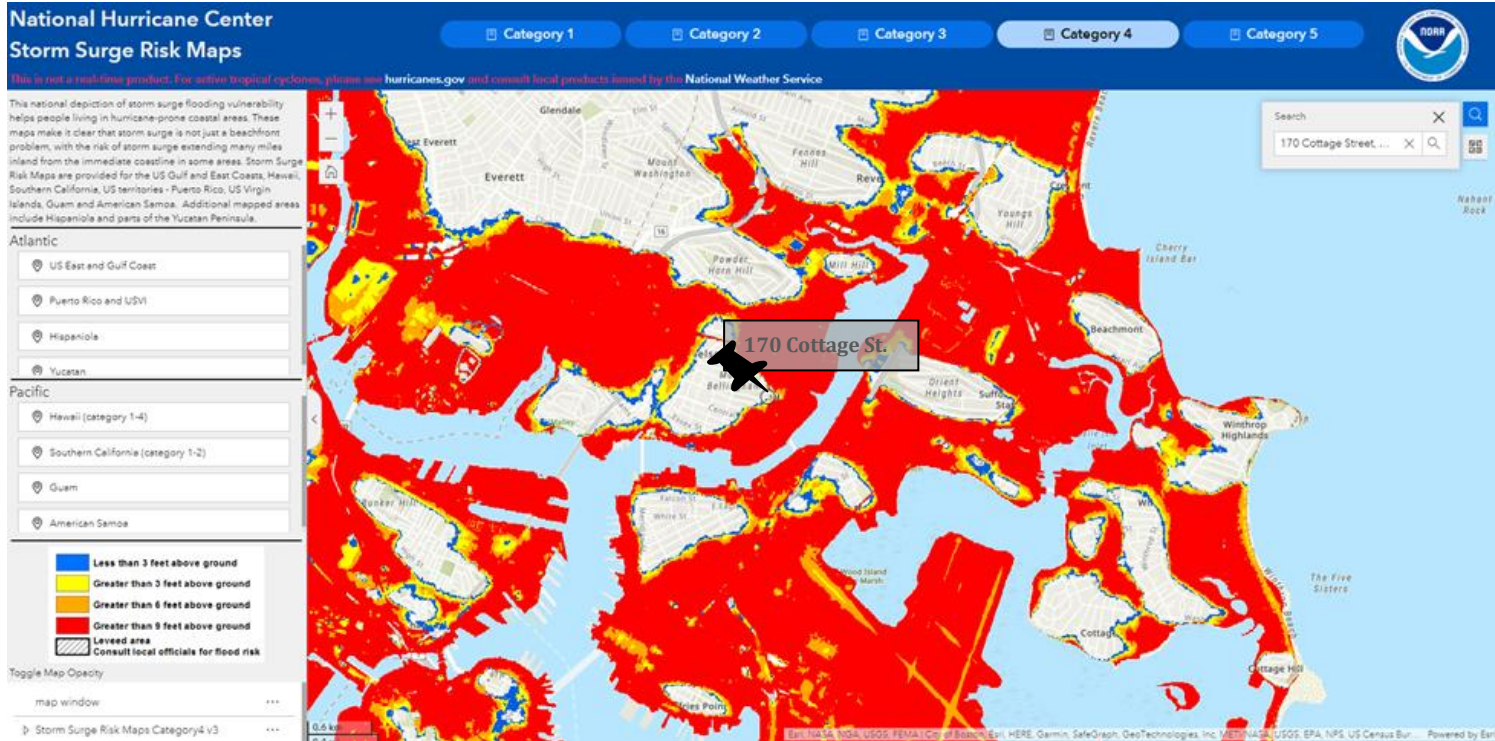
Created by: fstone
Date Created: 10/3/2022
Tool Version: 1.2



Asset Name	Planning Horizon	Return Period	Max	Min	Area Weighted Average (ft-NAVD88)
Potential Multifamily Housing	2030	0.5% (200-yr)	N/A	N/A	N/A
	2050	0.5% (200-yr)	12.7	12.7	12.7
	2070	0.5% (200-yr)	14.2	14.2	14.2

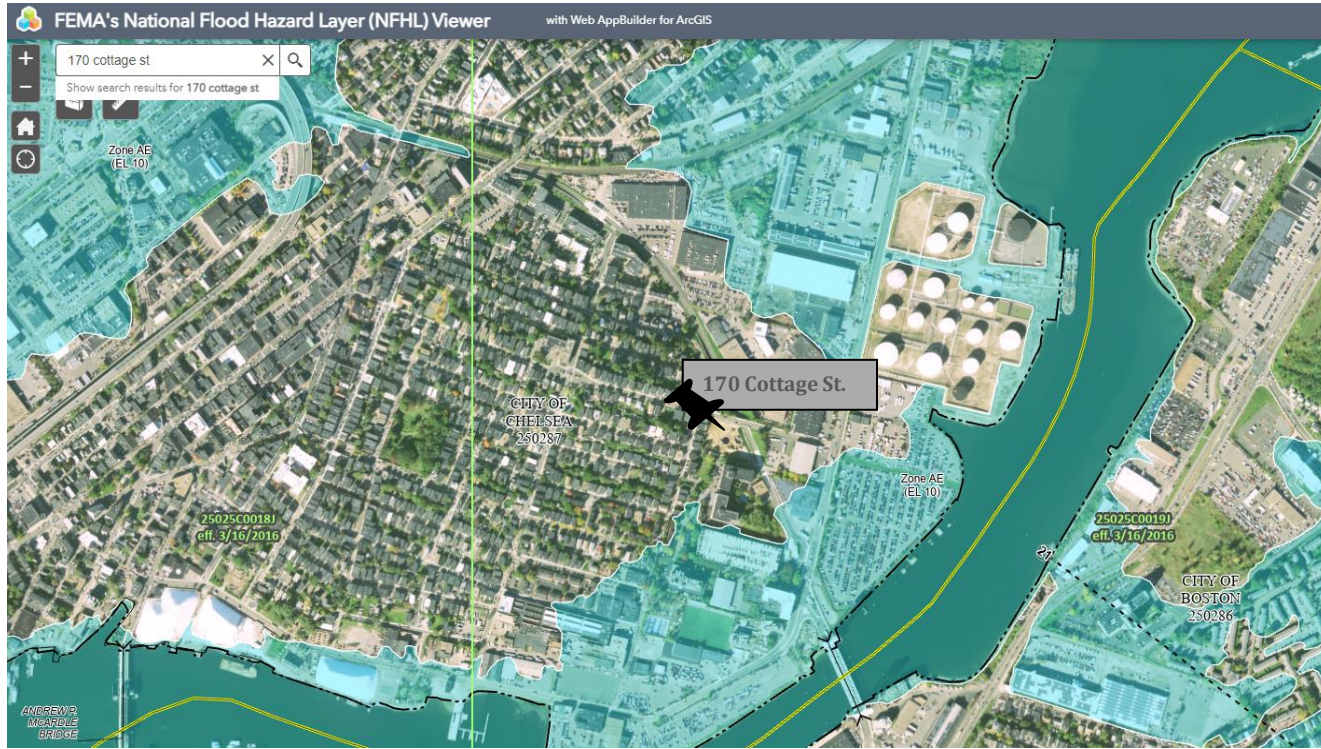
[Link to Design Standards Tool](#)

NOAA National Hurricane Center Storm Surge Risk Maps



[Link to NOAA Tool](#)

FEMA's National Flood Hazard Layer (NFHL) Viewer



[Link to NFHL Tool](#)

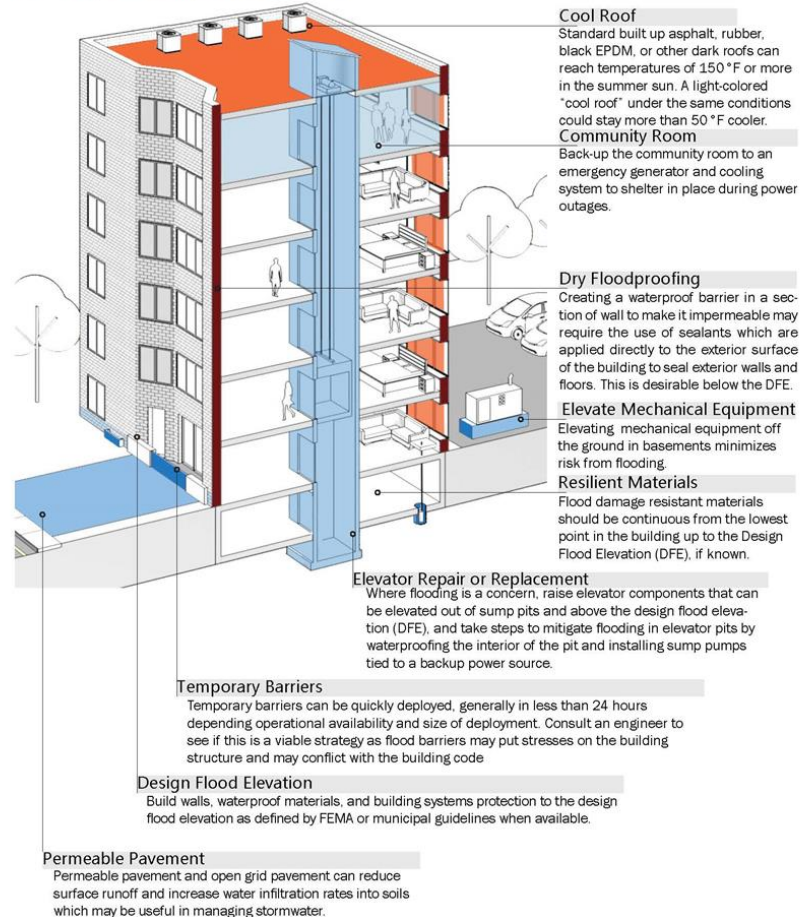
CHARM (Climate Hazard Adaptation and Resiliency Masterplan) Resource #1 - Graphics

- MA Department of Housing and Community Development (DHCD), Kleinfelder and New Ecology designed these resources to support resilience at publicly funded housing in Massachusetts
- The graphical depictions are an excellent way to begin planning for resilience.
- Broadly applicable both to new construction projects and when conducting periodic renovations of existing buildings

[Link to CHARM Graphics & Site Guidelines](#)

LARGE DEVELOPMENT STRATEGIES

The graphic below demonstrates a suite of potential strategies for a concrete frame, masonry enclosure building, the most common large construction type in the DHCD portfolio.



CHARM Resource #2 – Rapid Risk & Vulnerability Assessment

Diagnose Risk Onsite – 26
Yes/No Questions – Excel or
Paper



Talk through applicable
solutions



Plan for facilities upgrades at
a time that fits for you. Let
the Design Guidelines help!

BUILDING EXTERIOR	YES / NO	HAZARD(s)	COMMENTS	APPLICABLE RESILIENCE STRATEGIES
Is the development located outside a FEMA flood zone AE, AO, AH, D, or V? See: https://msc.fema.gov/portal/search		P/SLRSS		22, 26
Have residents and staff avoided severe weather-related challenges getting to and from the development? Examples include flooding or downed trees.		P/SLRSS		22, 26, 27
Is the development free of vents or other penetrations in the outside walls (above or below grade) that could let water into the building(s)?		P/SLRSS		1, 2, 7, 8
Are stormwater and sanitary sewer systems separated at this location?		P/SLRSS		6
Are exterior pathways and entrances safe and accessible?		EP		24
Are exterior pathways free of tripping hazards, broken steps or overgrown plants?		EP		24

[Link to DHCD Rapid RVA Tool](#)

CHARM Resource #3– Design & Construction Guidelines

Resiliency Design Guidelines - Compiled | CHARM

CHARM

In September 2016, Governor Baker signed *Executive Order 569: Establishing an Integrated Climate Change Strategy for the Commonwealth*. Complementing the Global Warming Solutions Act, the EO is aimed at greenhouse gas emission reductions that cause climate change, to provide leadership and protect public safety by reducing emissions of greenhouse gases, preparing for impending climate change, and enhancing the resilience of public assets.

Since then, state agencies and authorities, as well as cities and towns, have been working to address the impacts of climate change by assessing vulnerability and adopt adaptive capacity and resiliency of building facilities and other infrastructure. In 2018, the Department of Housing and Community Development’s Building Construction (DHCD/BHDC) initiated the Climate Hazard Adaptation and Resilience project to:

- assess the state-funded public housing portfolio’s risk and vulnerability
- provide a detailed climate change resilience opportunity assessment and develop design guidelines for DHCD facilities to implement climate adaptation and resilience best practices.

CHARM provided a unique opportunity for DHCD to assess climate risk and develop resilience guidelines, and advance a strategic plan for implementation.

RAPID RISK AND VULNERABILITY ASSESSMENT

The Rapid Risk and Vulnerability Assessment (RRVA) tool was developed as an informational and planning tool when used by Local Housing Authority and reference to applicable resilience guidance when used by the Building Service Unit (AESU) and the Regional Capital Assistance Teams (RCATs) to develop capital projects.

CLIMATE CHANGE IMPACTS

DHCD has summarized best available resilient design guidance for these four categories:



Precipitation Protection: The risk of flooding is increasing as the impacts of climate change lead to more frequent and intense rainfall events. Flooding is often occurring beyond designated flood zones adjacent to water bodies, because of site design and aging, or undersized storm sewer infrastructure unable to carry stormwater during extreme rainfall events.



Sea Level Rise & Storm Surge is also exposing some high-rise developments to increased, coastal flooding and other impacts which may worsen through time. Adapting to sea level rise and storm surge to adapting to the flooding risk from extreme precipitation, but in some cases may require more expansive interventions to mitigate risk.



Extreme Heat: As the climate warms, the number of days with high temperatures and increased risk from high heat index (the combination of temperature and humidity) will grow drastically. Some parts of the state experience this trend more acutely, and locations already experiencing urban heat island will be more impacted. Measures for reducing impacts at a site and building are recommended in the relevant guidance.



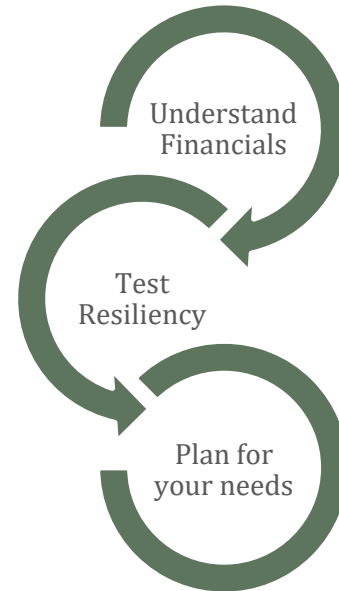
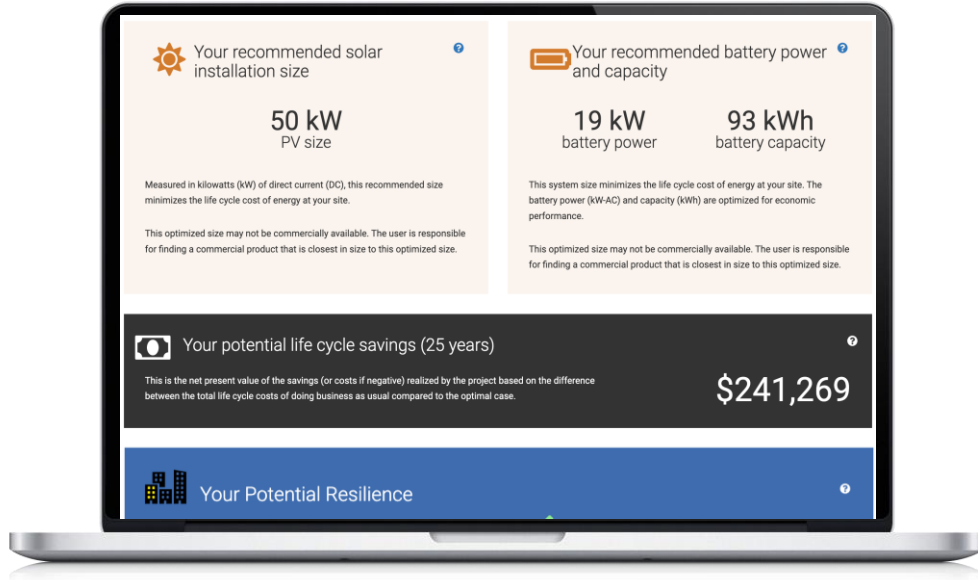
Emergency Preparedness: To help ensure staff and resident safety during extreme events, and to shelter in place during power outages and extreme weather, when and where possible, these items recommend strategies for public authority developments. These recommendations will be used in developing operational emergency preparedness planning guidance from DHCD.

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[Link to Charm Design and Construction Guidelines](#)

REopt: Renewable Energy Integration & Optimization Tool from the National Renewable Energy Laboratory (NREL)

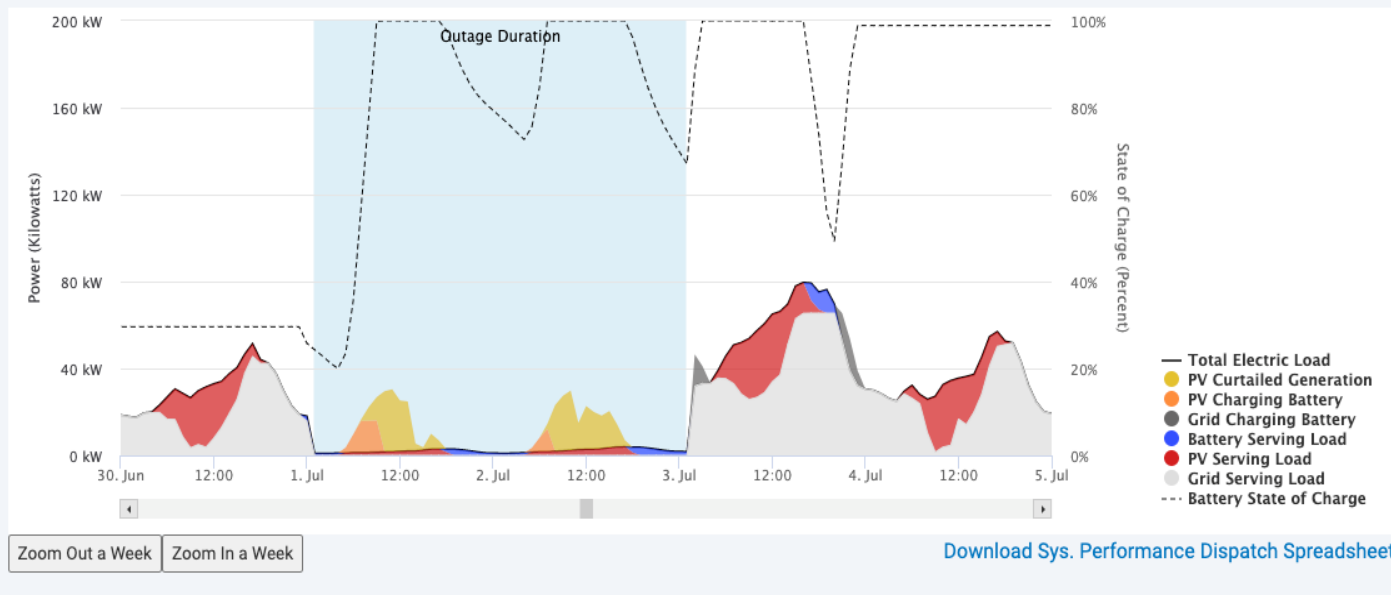


[Link to REopt Tool](#)

REopt: Renewable Energy Integration & Optimization Tool from the National Renewable Energy Laboratory (NREL)

System Performance Year One [?](#)

This interactive graph shows the dispatch strategy optimized by REopt for the specified outage period as well as the rest of the year. To zoom in on a date range, click and drag right in the chart area or use the "Zoom In a Week" button. To zoom out, click and drag left or use the "Zoom Out a Week" button.



[Link to REopt Tool](#)

USDN Guide to Developing Resilience Hubs

- Support for resilience hubs
 - *The risk of power disruptions*
 - *The potential for the site to serve as a place of refuge for nearby areas that could be inundated by storm surge*
- Function of resilience hubs
 - *Providing a space of refuge for cooling or heating, charging communications devices, refrigerating medicines and providing food and water*
- Urban Sustainability Directors Network Resource
 - *A step-by-step guide to creating and operating resilience hubs to support residents and distribute resources before, during and after a natural hazard event*

[Link to USDN Tool](#)



Design Tools Reviewed

- *Climate Resilience Design Standards Tool (RMAT)*
- *NOAA National Hurricane Center Storm Surge Risk Maps*
- *With FEMA flood maps as a secondary resource*
- *REopt: Renewable Energy Integration & Optimization*
- *CHARM (Climate Hazard Adaptation and Resiliency Masterplan)*
Resources
- *Urban Sustainability Directors Network (USDN) – Guide to Developing Resilience Hubs*

[Link to Report](#)


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