Sea Level Rise and Resiliency: Creating a Climate Risk Assessment for Nantucket's Built Heritage

Niles Parker Gosnell Executive Director Nantucket Historical Association

EASY & BROAD STREETS

8.04 FEET in 2100



PACIFIC CLUB & LOWER MAIN STREET

8.04 FEET in 2100







December 2022 National Park Service Symposium



CURRICULUM FRAMEWORK



- Archival Research
- Documentation & Modeling
- Site Context Analysis
- Materials
 - Characterization
- Conditions Assessment
- Risk Analysis



Risk Assessment - Methodology RISK Hazard Exposure Vulnerability Site conditions & Weather events and trends Material qualities & assembly building orientation - Cracking - Coastal Flooding - Loss of Brick - Non-Coastal Flooding - Site Topography - Loss of Structural Wood - Erosion - Nearby Vegetation - Efflorescence - Sea Level Rise - Coastal Proximity - Rising Damp - Wind - Function/Usage - Corrosion - Rising Water Table - Biological Growth - O.O.P. Behavior - Animal/Insect Infestation

- Poor Drainage

Goals for climate data capture

- Identify characteristics of microclimate
- Compare microclimate to ACK Airport weather data
- Record moisture levels over time
- Establish baseline data for future work

ATMOS 41 All-in-one weather station



HYDROS 21 Conductivity, Temperature, Depth Sensor







3:47 -	3:48 1 ITE	3:48 1 LTE	3:48 1 I LTE	3:47 1 I LTE
X Nantucket Rapid Risk Assessment Survey 🔌 😑	$ imes$ Nantucket Rapid Risk Assessment Survey 🔌 \equiv	$ imes$ Nantucket Rapid Risk Assessment Survey 🔖 \equiv	Nantucket Rapid Risk Assessment Survey 💣 🚍	$ imes$ Nantucket Rapid Risk Assessment Survey 💣 \equiv
Researcher Initials * NCG	Interior Condition: Out-of-Plane Behavior * If present, include picture below. Not Present Interior Condition Photo: Out-of-Plane Behavior	Exterior Condition: Animal/Insect Infestation * If present, include picture below. Not Present Exterior Condition Photo: Animal/Insect Infestation	Exterior Condition: Biological Growth * If present, include picture below. Not Present Exterior Condition Photo: Biological Growth	Photo(s) of Roof B 1 of 1
Photo of Structure/Site * i a structure, take a picture of the primary facade. If no structure exists in the site, take a general photo trying to capture as much of the site as isossible. I of 1 I of 1	I of 1 Interior_condition_photo_out_of-20230630-153933.jpg	<pre> 1 of 1 1 of 1</pre>	☐ 1 of 1	 photos_of_roof-20230630-152719.jpg Roofing Materials Present * Wood Shingle Slate Shingles
photo_of_structuresite-20230630-152400.jpg	Notes on Interior Out-of-Plane Behavior	Notes on Exterior Animal/Insect Infestation Woodpecker on downspout covering, carpenter bees present	Notes on Exterior Biological Growth Roof recently scrubbed, north side bio growth	Composite Shingles Unknown Other
Date and Time of Survey * Friday, June 30, 2023 Address * Address * At Lane, Nantucket, MA, 02554, USA Date of Construction * 1686	Interior Condition: Loss of Integrity of Brick * If present, include picture below. Not Present Interior Condition Photo: Loss of Integrity of Brick	Exterior Condition: Poor Water Drainage * If present, include picture below. Not Present Exterior Condition Photo: Poor Water Drainage 1 of 3	Exterior Condition: Rising Damp * If present, include picture below. Not Present Present Exterior Condition Photo: Rising Damp	Notes on Roofing Materials Foundation Type * Stone Brick
		ATT -		Mortar

- Materials and Collections
 - Exterior wall, roofing, and foundation
- Conditions

$_{\circ}$ $\,$ 13 conditions from RAS $\,$

Condition	Wind	Coastal Flooding		Hurricane Inundation	Erosion	Noncoastal Flooding
Rising Damp	0		1	1	0	1
Corrosion	1		1	1	0	1
Efflorescence	0		1	1	0	1
Biological Growth	0		1	0	0	1
Nearby Vegetation	1		0	1	0	0
Out-of-plane behavior	1		1	1	1	1
Loss of brick integrity	1		1	1	0	1
Loss of wood integrity	1		1	1	0	1
Cracking	1		0	1	0	1
Loss of Finishes	0		0	0	0	0
Animal Infestation	0		0	0	0	0
Poor Access	0		0	0	0	0
Poor Water Drainage	0		1	1	0	1

- Risk Map Hazards
 - FEMA, NHC, WPI, NAIP
- Indicators
 - Hazard, Vulnerability, and Exposure
 - Significance



"Deep-Dive" Selections

- Wooden Structures
 - Oldest House
 - Greater Light
- Both vulnerable to noncoastal flooding, though with varying materials/systems/functions



"Deep-Dive" Selections

- Brick Structures
 - Candle Factory
 - Thomas Macy Warehouse
- Similar materials and vulnerabilities
- Similarity acts as barometer for efficacy of data collection



Bringing It All Together

How do all factors

translate to

potential

future



1847 Candle Factory



	CONSEQUENCE	IMPACT	LOCATION	RISK	RECOMMENDATION - SHORT TERM	RECOMMENDATION - MEDIUM TERM
Façades	Humidity in masonry	Salts and eflorescence	All	Appearance	Water barriers + increase regular maintenance	Improve drainage + design water permeable streets
	Freeze & thaw cycles	Mortar loss and instability	Lower parts 3 ft	Structural stability + appearance	Damp proof course +Increase regular maintenance + monitoring	
	Freeze & thaw cycles	Brick masonry deterioration	Lower parts 3 ft	Structural stability + appearance	Consolidation treatment + maintenance	
	increase in Biological growth	Aesthetic alteration	All	Appearance and deterioration	Apply biocide, increase cleaning	
Roofing	Excess stormwater	Ineffective site	All	Moisture ingress	Regular gutter cleaining	Replace gutters + increase
	overtoaunig gutters	urainage				downpipe capacity
Collections	Building inundation	Compromise	All	Object loss	Collections Monitoring +	DRM strategy,
	Change to internal temp & humidity controls	integrity of collection		Financial, revenue loss	Disaster risk mgmt plan	Removing concrete slab & raising ground floor Raise the height of displays, find alternative storage Interpret the collection digitally
	Post flooding	Dirt and debris	All	More closing days	Increased cleaning expenditure	Control inundation with physical barriers
Community	Flooding	More closing days	All	Lose the museum as an event space, decrease in revenues	Host events only on the upper floors	Find an alternative venue for events

