

# Municipal Infrastructure Resilience Critical Facilities Assessment



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MILONE & MACBROOM®

SCCOG

Southeastern Connecticut  
Council of Governments

# Project Background

Most of southeastern Connecticut's municipalities developed along Connecticut's coast and waterways

Critical facilities such as town halls and fire stations were built in flood zones

2012 Regional Hazard Mitigation Plan and The Nature Conservancy regional work called for region-wide assessment of the vulnerability of critical facilities to natural hazards

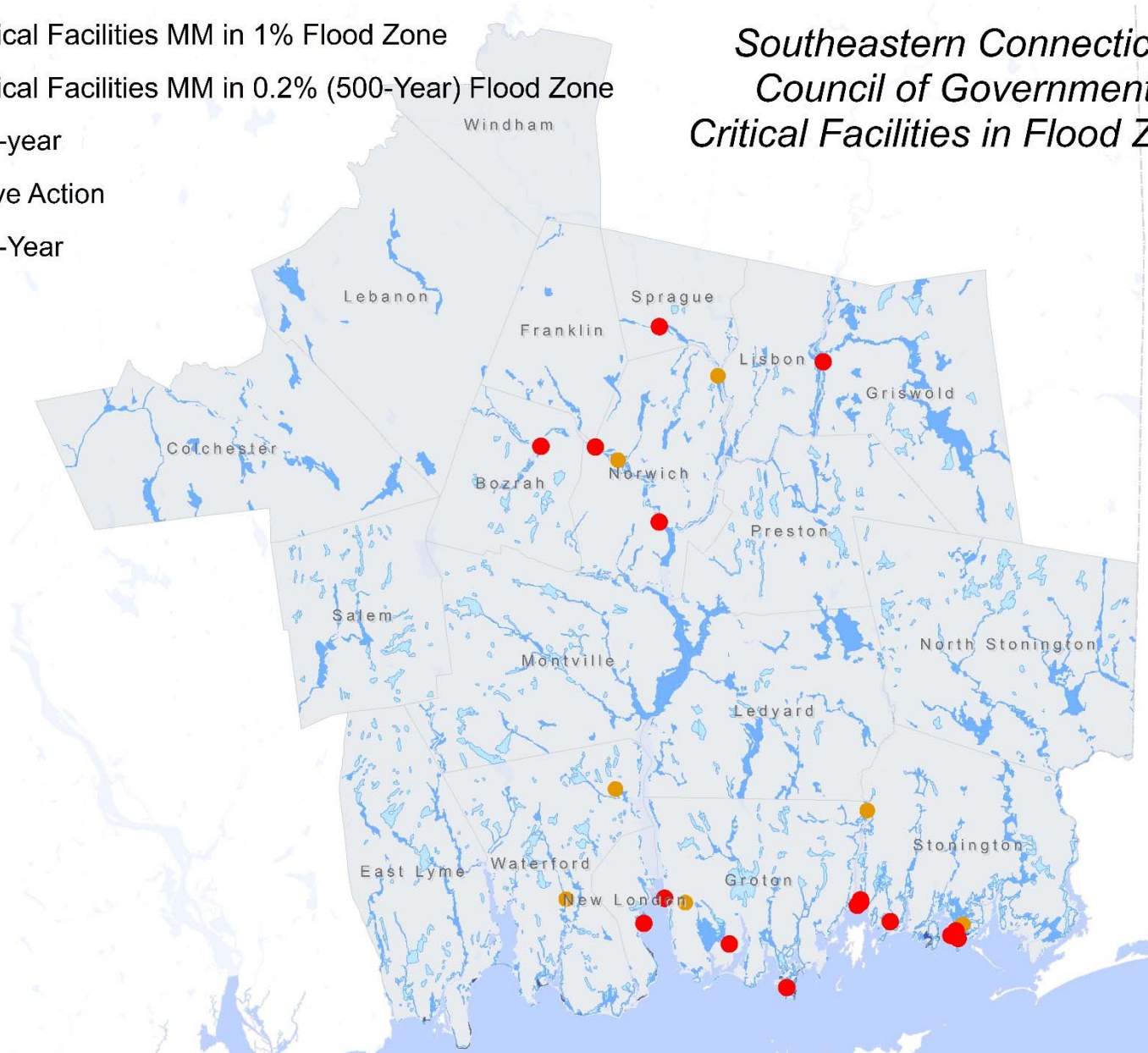
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# Project Background

- Critical Facilities MM in 1% Flood Zone
- Critical Facilities MM in 0.2% (500-Year) Flood Zone
- 100-year
- Wave Action
- 500-Year

## *Southeastern Connecticut Council of Governments Critical Facilities in Flood Zones*

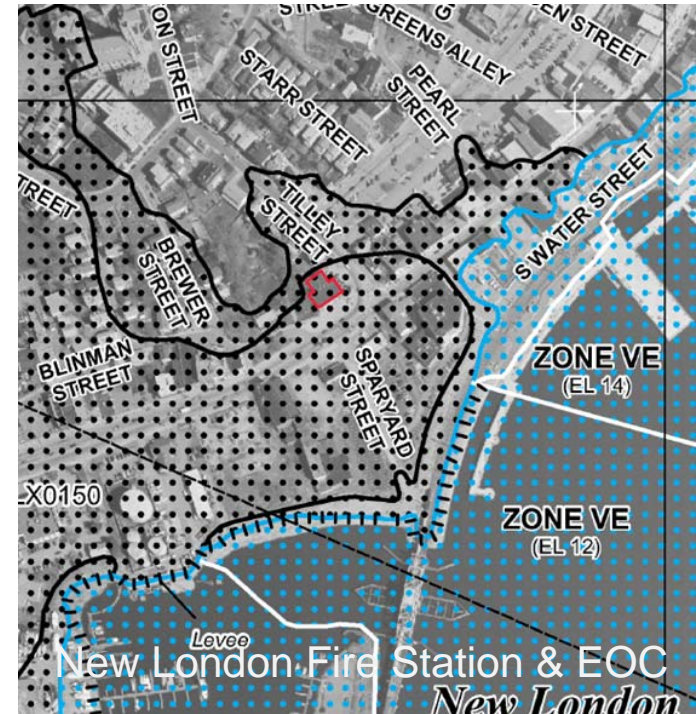


# Project Background

- SCCOG received a grant from the Connecticut Institute for Resilience and Climate Adaptation (CIRCA) for this assessment
- 18 sites included town halls, fire stations, DPWs, police stations, and Emergency Operations Centers (EOCs) located in or very close to 1% or 0.5% annual flood risk zones (100-yr or 500-yr flood zones).
- Did not address schools, privately-owned critical facilities, or water treatment or utility facilities
- Assessments were performed by Milone & MacBroom  
(Project Manager: Dave Murphy)

# Assessment Questions

- Has the facility experienced flooding?
- What are the elevations of site components relative to potential flood levels?
- Is the property vulnerable to damage from wind or snow loads?
- What are appropriate short-term and long-term actions to prevent damage and allow for continued use?
- Is the property viable for long-term use as a critical facility?
- Special circumstances?



# Wind-Related Findings and Recommendations

- No big problems
- Shutters advised to protect operations
- Outdoor equipment and vehicles are at risk
- Secure sites from debris
- If a roof is planned for replacement, higher design wind speeds should be considered





# Snow-Related Findings and Recommendations

- No big problems
- Procedures for removing heavy snow loads should be formalized
- If a roof is planned for replacement, higher design loads should be considered



*Preston DPW (above) and  
Norwich DPW (below)*



# Measuring Flood Risks

- Base Flood Elevation (BFE):
  - *How high will water rise?*
- Lowest Adjacent Grade Elevation (LAG)
  - *Ground nearest building*
- First Floor Elevation (FFE)
- Utilities Elevation
- Next Floor Elevation (NFE)
  - *Can site activities retreat somewhere within the building?*





# Critical Facility Floodproofing





# Critical Facility Floodproofing


- Dry floodproof: seal property from water infiltration
- Wet floodproof: design property so that floodwaters can enter but do not cause damage or interruptions in service
- Elevate utilities
- Fill in low basements
- Relocate critical services

# Least Vulnerable

Municipality	Facility	In FEMA Zone	Relative to BFE			Flooding	
			First Floor Elevation vs BFE	Utility Elevation vs BFE	Next Floor Elevation vs BFE	Short-Term (0-20 years)	Long-Term (>20 years)
Preston	Public Works	X	2.8	3.3	NONE	No action needed	Wet and dry floodproofing
Town of Groton	Town Hall	X	2.1	10.6	10.6	No action needed	Low berm or flood wall
Stonington Borough	Fire House and EOC	AE	-2.2	-6.2	14.0	No action needed	Increase height of floodproofing
Stonington	Old Mystic FD	500	3.9	3.9	17.7	No action needed	Wet and dry floodproofing or low berm or flood wall
Montville	Chesterfield Fire Co.	X	3.2	3.2	18.8	No action needed	No action needed



# Least Vulnerable

Municipality	Facility	In FEMA Zone	Relative to BFE			Flooding	
			First Floor Elevation vs BFE	Utility Elevation vs BFE	Next Floor Elevation vs BFE	Short-Term (0-20 years)	Long-Term (>20 years)
Preston					NONE		et and dry oodproofing
Town of G				6	10.6		w berm or flood ill
Stonington B				2	14.0		crease height of oodproofing
Stonington					17.7		et and dry oodproofing or low berm or flood
Montville	Chesterfield Fire Co.	X	3.2	3.2	1		




**Stonington Borough Fire House**

Built in 2004 with  
wet-proofed garage and  
dry-proofed utility room

# More Vulnerable

Municipality	Facility	In FEMA Zone	Relative to BFE			Flooding	
			First Floor Elevation vs BFE	Utility Elevation vs BFE	Next Floor Elevation vs BFE	Short-Term (0-20 years)	Long-Term (>20 years)
Borough of Stonington	Borough Hall and Public Works	AE	-3.5	-3.0	-0.3	Dry floodproof the utility room	Wet floodproof all remaining lower areas
Stonington	Mystic FD	AE	-2.4	-1.3	-1.3	Dry floodproof the utility room	Wet floodproof all remaining lower areas
City of Groton	Municipal Building	X	-3.2	8.6	8.6	Drainage improvements	Update drainage as needed
City of Groton	Public Works	500	N/A	N/A	N/A	Wet and dry floodproofing	Low berm or flood wall
New London	Fire HQ and EOC	500	-3.8	-3.8	11.1	Stormwater improvements and backflow prevention; dry floodproof utility room	Wet floodproof all remaining lower areas
Norwich	Public Works	500	2.8	6.4	NONE	Dry floodproof the utility room	Wet floodproof all remaining lower areas
Sprague	Town Hall	AE	-2.0	-3.3	10.0	Eliminate utility room basement	Wet floodproof all remaining lower areas; or construct flood wall
Sprague	Public Works	AE	-3.6	-3.3	5.7	Eliminate utility room basement	Wet floodproof all remaining lower areas; or construct flood wall

# More Vulnerable

Municipality	Facility	In FEMA Zone	Relative to BFE			Flooding	
			First Floor Elevation vs BFE	Utility Elevation vs BFE	Next Floor Elevation vs BFE	Short-Term (0-20 years)	Long-Term (>20 years)
Borough of Stonington	Borough Hall and Public	AE	-3.5	-3.0	-0.3	Dry flood utility room	
						Dry flood utility room	
						Drainage improvements	
						Wet and floodproof	
						Stormwater improvements and backflow	Wet floodproof all remaining lower
Norwich	Public Works	500	2.8	6.4	NONE		
Sprague	Town Hall	AE	-2.0	-3.3	10.0		
Sprague	Public Works	AE	-3.6	-3.3	5.7	Eliminate utility room basement	Wet floodproof all remaining lower areas; or construct flood wall



## Sprague Town Hall and Public Works


Main utilities are >3' below BFE  
Elevate them and fill in basement  
**\$50,000-\$100,000**



# Most Vulnerable

Municipality	Facility	In FEMA Zone	Relative to BFE			Flooding	
			First Floor Elevation vs BFE	Utility Elevation vs BFE	Next Floor Elevation vs BFE	Short-Term (0-20 years)	Long-Term (>20 years)
Town of Groton	GLP Police and Fire	AE	-6.7	-5.3	-5.3	Additional utility room dry floodproofing and expanded wet floodproofing	Relocate facility
Stonington	Quiambaug FD	AE	-4.0	-4.0	-	Wet and dry floodproofing	Relocate facility
Waterford	Quaker Hill Fire Co.	500	1.1	9.3	4.4	Wet floodproofing	Relocate facility
Norwich	Yantic Fire Co. No. 1	AE	-10.7	-10.1	-0.9	Eliminate basement, elevate equipment	Relocate facility
Norwich	Occum FD	AE	-6.1	-6.0	0.5	Eliminate basement	Relocate facility

# Most Vulnerable

Municipality	Facility	In FEMA Zone	Relative to BFE			Flooding	
			First Floor Elevation	Utility Elevation	Next Floor Elevation	Short-Term (0-20)	Long-Term (>20)
Town of Norwich		AE	BFE				
				9.3	4.4	Wet floodproofing	Relocate facility
Norwich	Yantic Fire Co. No. 1	AE	-10.7	-10.1	-0.9	Eliminate basement, elevate equipment	Relocate facility
Norwich	Occum FD	AE	-6.1	-6.0	0.5	Eliminate basement	Relocate facility

Norwich's c1906 Yantic Fire Station floods frequently. 500-year flood levels are above the first floor. Staff relocate equipment when floods are forecast.



Short-term prevention would cost >\$100,000.

The site cannot accommodate elevating the building. Long-term, the facility should be relocated.

# Most Vulnerable



			Relative to BFE			Flooding	
			Floor Elevation vs BFE	Utility Elevation vs BFE	Next Floor Elevation vs BFE	Short-Term (0-20 years)	Long-Term (>20 years)
Norwich Occum FD Norwich	Fire					Additional utility	
	Groton Long Point Police & Fire		-4.0				
	Marks on the garage show the level to which floodwaters rose during Hurricane Sandy		1.1				
	Short-term: Additional dry-proofing of utilities and expanded wet-proofing		-10.7	-12.6	NONE -0.9	Eliminate basement, elevate equipment	Relocate facility
	Long-term: Relocate facility		-6.1	-6.0	0.5 0.5	Eliminate basement	Relocate facility







# Planning for Sea Level Rise

- CIRCA issued recommendation towards end of study to plan for 20" Sea Level Rise by 2050
- Having building elevations mean we're able to estimate risks from SLR
- Planning for SLR of 1'8":
  - Least vulnerable: all still ok
  - More vulnerable & Most vulnerable: Sites with problems have the same problems, they're just worse

# Planning for Sea Level Rise



- *“Since the coastal areas are flat, small increases in MSL will cause a large increase in flood risk...”*
- *The geometry and orientation of the Sound causes tides and surge to be larger in the west of CT so the impact of SLR on the flood risk is higher in the east.”*
- In other words
  - We’ll get more flooding
  - “100-year” floods will be 8x more frequent in southeastern Connecticut (i.e. “12-year” floods)
  - At what point does relocation become a necessity?

# Final Thoughts

- Every site/building is unique
- Beware of changing FEMA maps and go higher when possible
- Money is always an issue
- Adapt-as-you-go
- In SE CT, increased frequency of flooding may be as important as Sea Level Rise
- Not all fire chiefs use email