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IGC

Location

Coastal Resilience Planning in Connecticut

Rates of sea level rise are more than 50% higher than the global average in Long Island Sound, Connecticut, United States, according to the Connecticut Institute for Resilience and Climate Adaptation (CIRCA). Projections estimate that sea level will be 20” higher than the national tidal datum by 2050. This data has prompted the Connecticut Senate to pass Senate Bill # 7, which recognizes the threat of climate change and the need to prepare for sea level rise. As a result, this legislation has challenged coastal cities and towns across the state to consider mitigation solutions.

University of Connecticut’s Community Research and Design Collaborative (CRDC), is working with CIRCA on the coastal resilience planning under the projection of sea level rise project in the county of New London and Fairfield, CT. The City of New Haven is one of the 15 coastal towns/cities which are facing the increasing risk of flooding and SLR. The focused area in this research is located in the industrial district along the shoreline in which most lands were filled up from the original open water. According to FEMA 100-year flood hazard datum, the current flooding area is 774.1 acre which is projected to increase to 1038.8 acre in 2035 and 1213.1 acre in 2050.

Methodology
Analysis phase: this phase follows a design-oriented approach with the objective of developing a set of recommendations that will guide future project proposals. This process begins by understanding the existing conditions of social and natural systems. Next, it explores existing plans and policies that determine projections and visions for the future. Lastly, the project focuses on identifying areas of shared risk that arise from the analysis of the inventoried data to establish a set of project recommendations.
Interactive design phase: in this phase, public involvement was key to the development of the design solutions. Participants including officials, property and business owners, public works and municipal planners, environmental scientists, urban planner and landscape designers worked in collaboration with an expert in public engagement and outreach to moderate the discussions and ensure that all voices were heard during the public engagement.

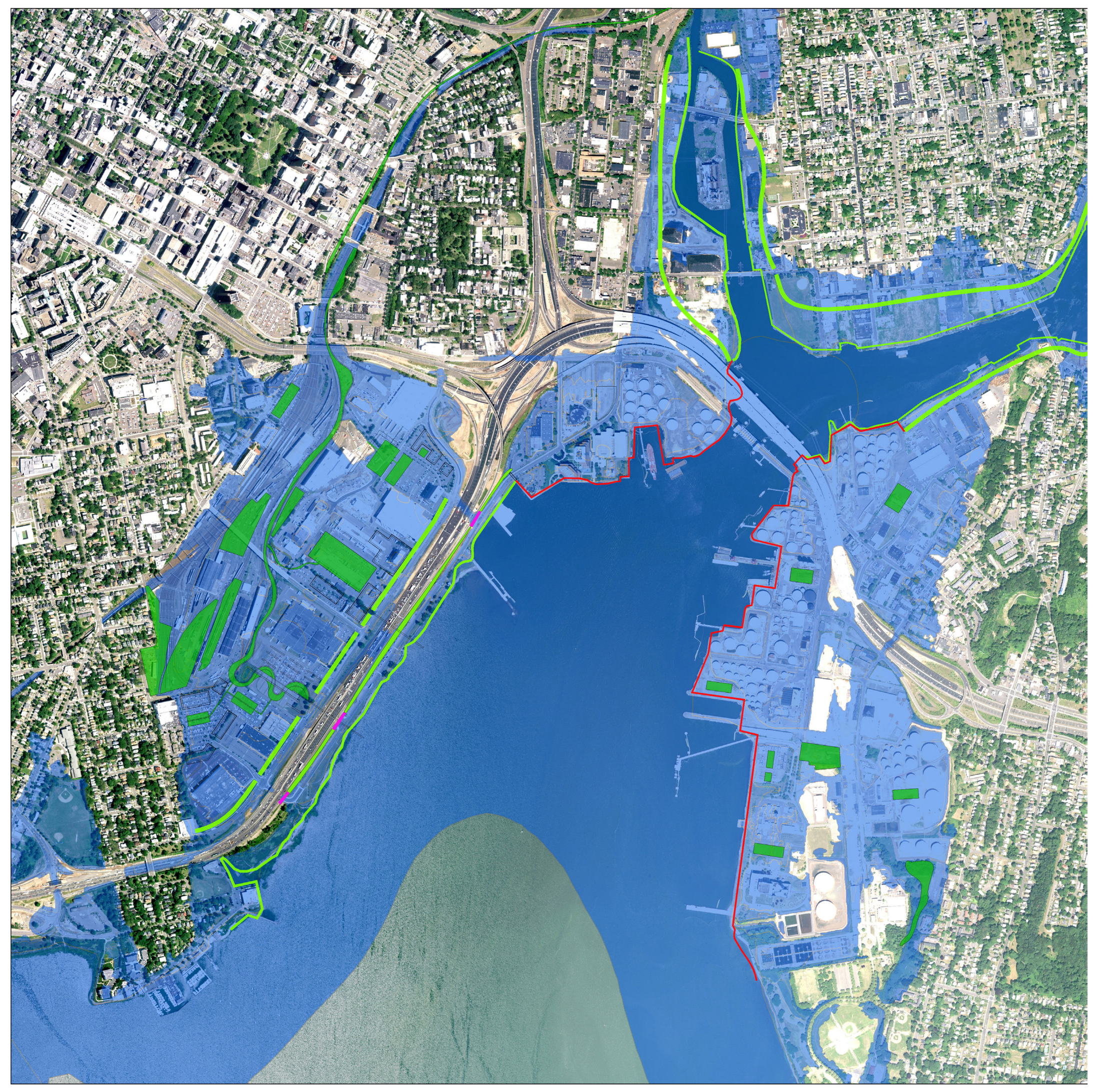
Requirements and Assumptions

1. Global warming and sea level rise
2. Increased extreme weather events and coastal flooding
3. Population growth and urban development
4. Zoning change (a transfer from industrial to mixed-use)
5. Clean energy and net-zero carbon building/area
6. The built environment will be more networked and smarter
7. Brownfield remediation and Pollution concerns intensify

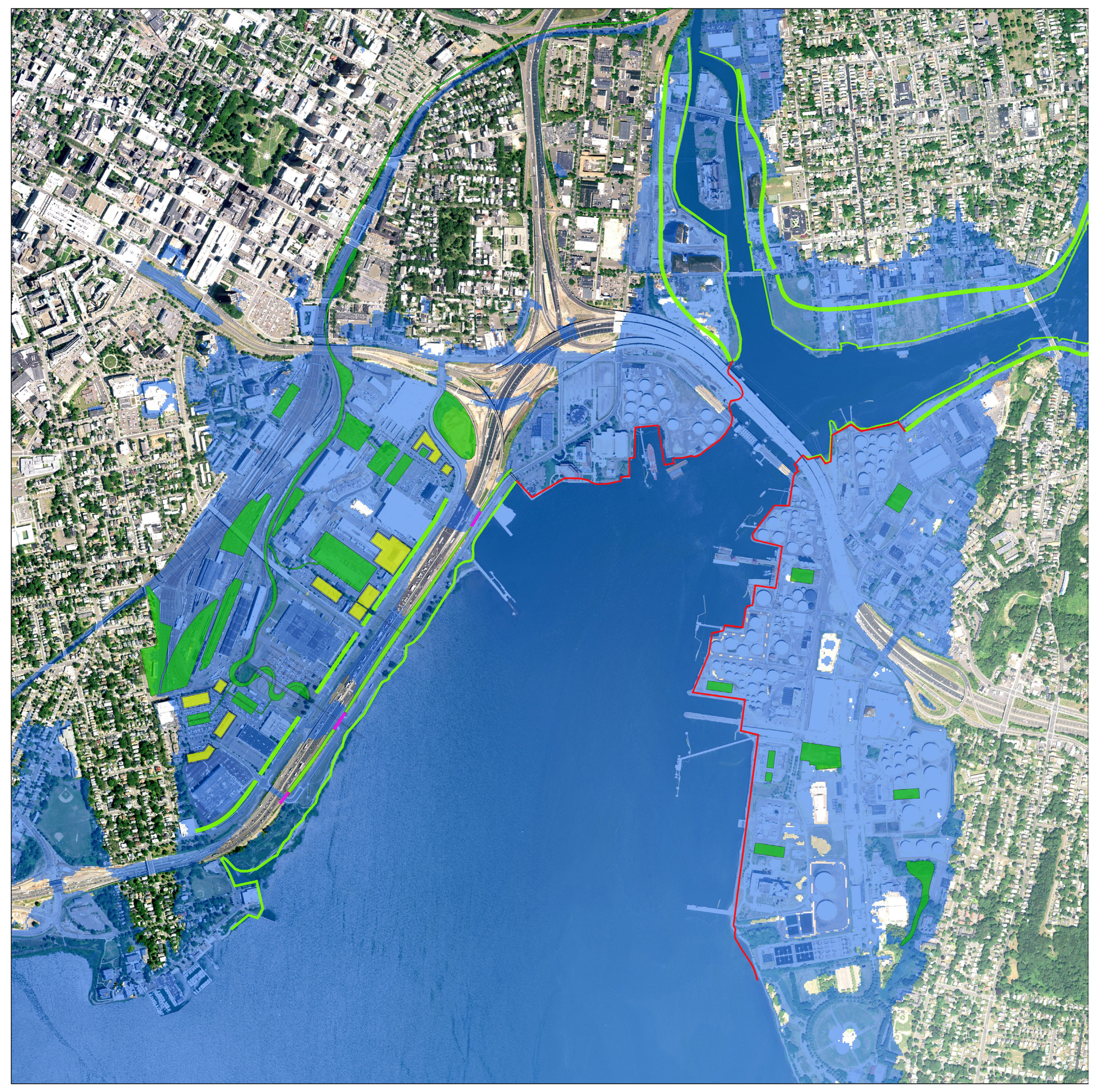
Major Innovations Employed

WAT: Water Retention(2), Bioretention(8)
GRN: Integrated Vegetated Stormwater Infrastructure(3), Green Roofs(12), Climate Change Adaptation(15), Resilient Green Coastal Infrastructure(17)
ENE: Renewable Energy Sources(1)
TRA: Permeable Pavement and Stormwater Management(20)
IND/COM: The Future Office Workspace(1)
MIX: Mixed Use Development(1), Sustainable Urban Infrastr(16)
INS: Diversification in Entertainment Venues(12)

Existing 2020



Early Adopter 2035



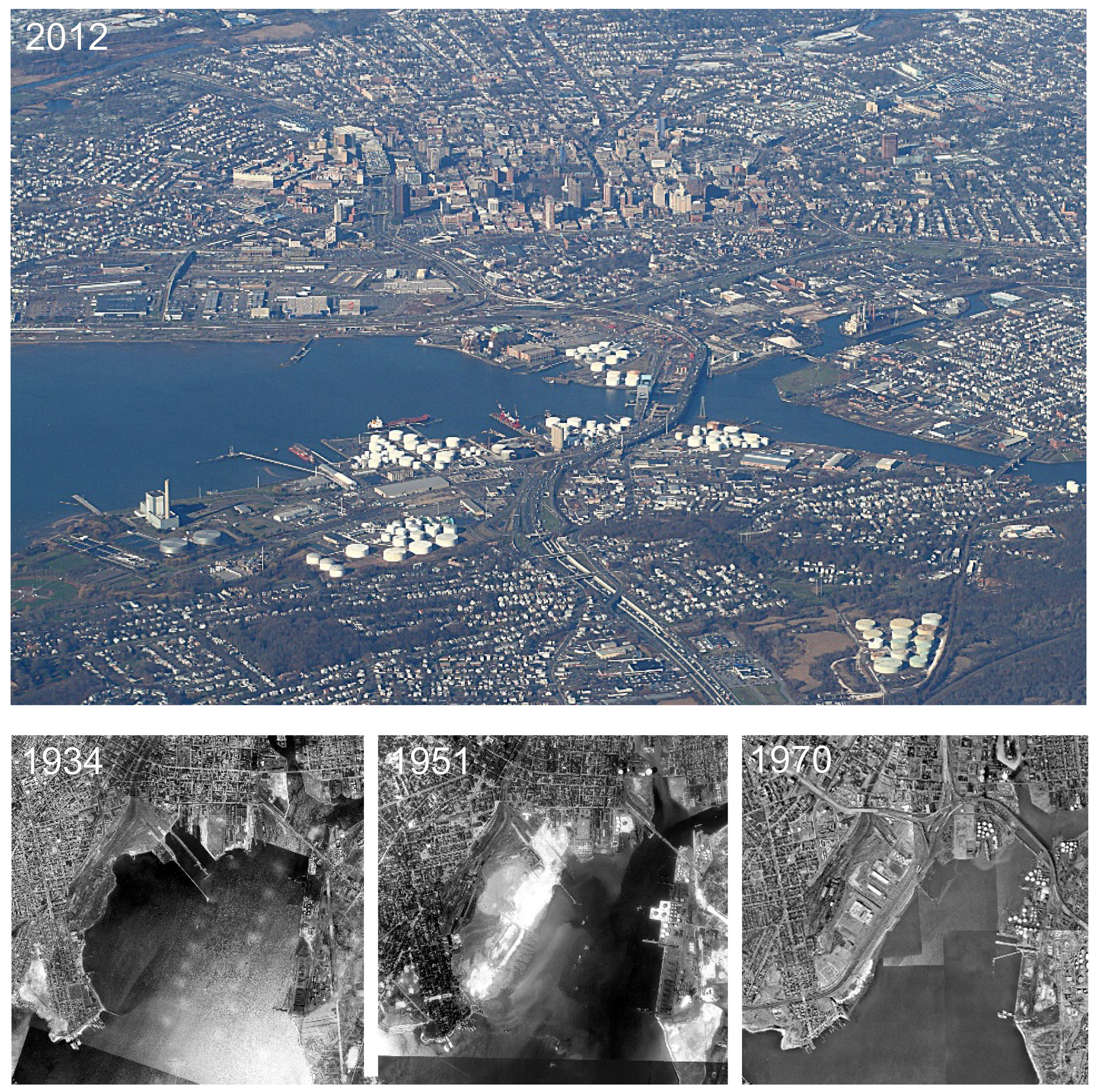
Early Adopter 2050

Early Adopter Scenario

To mitigate the hazard of coastal storm and flooding, in the early adopter scenario, double systems of living shoreline and berm/floodwall play an important role to reduce the energy of the wave and stop the floodwater. Two barriers function together to secure the inland low-lying area and coastal residential from the storm surge.
First barrier:
- living shoreline and green buffer
- floodwall along with the industrial facilities on the shoreline

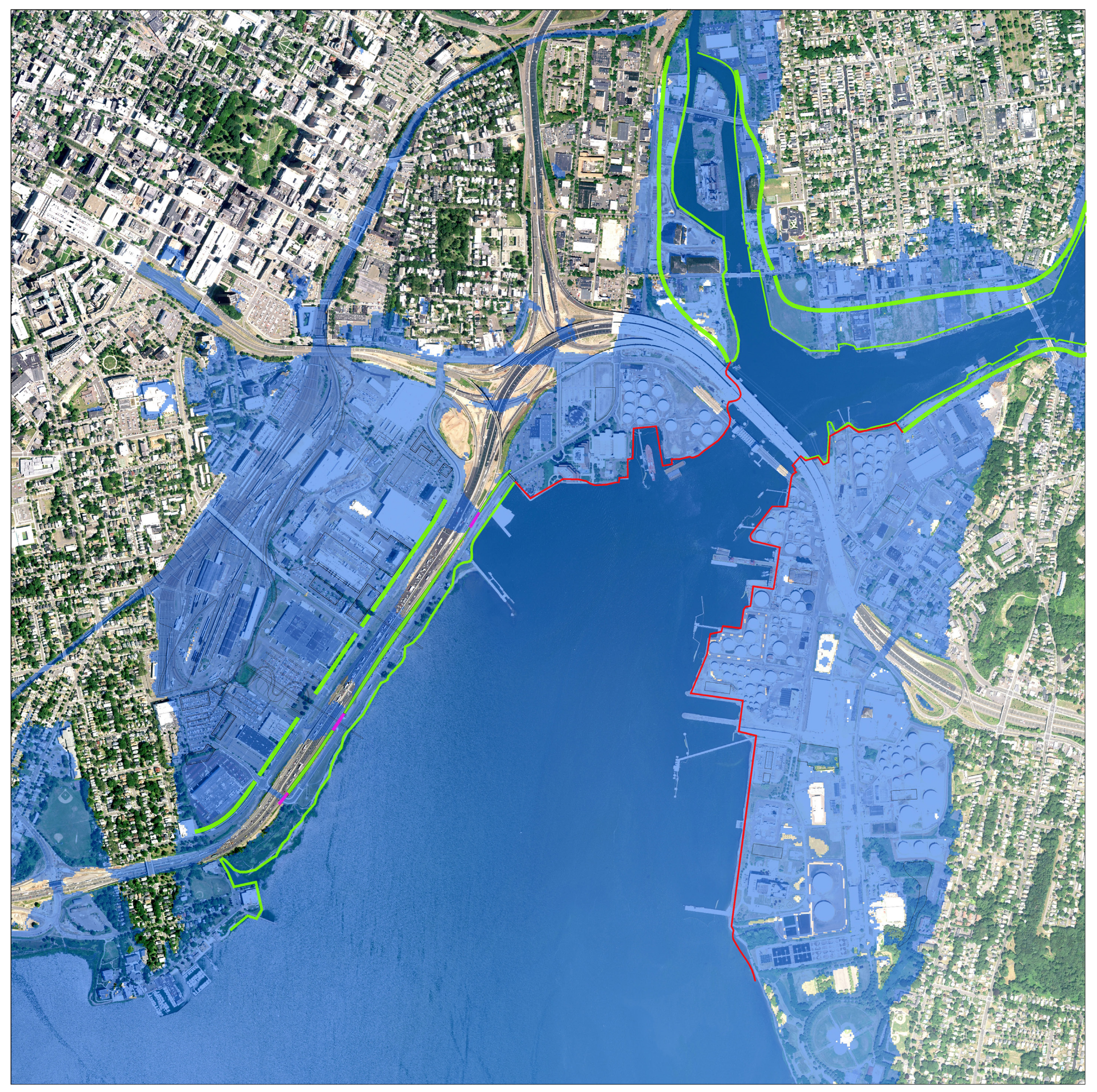
Second barrier:
- berm system along the highway I-95 and residential area
- three flood gates connect the berms and allow people to access the waterfront park

To cope with inland low-lying area flooding, the stormwater retention/drainage systems combined with new green infrastructure and open space are incorporated. The resilient measures include new constructed wetlands and retention ponds, bioswale, green roof, drainage system, and pump station. The strategies of stilt buildings and pervious pavement will be gradually emerging under the planning guidance and regulations.



Project Surroundings

Non and Late Adopter 2035



Late Adopter 2050

Late Adopter Scenario

In the late adopter scenario, the situation may become worse. Repetitive flooding negatively affects the properties and business, thus decreases the value of the land. Flooding exacerbates environmental pollution in the industrial area as well. Deteriorating ecological and living environment may reduce the attraction of investment which in turn accelerate the pace of deterioration.

The increasing severe flooding hazard and high tide as a consequence of sea level rising necessitate the mitigation interventions, such as the measures of berm system combined with flood gates, drainage system combined with pump station, flood wall, and living shoreline. But deteriorated lands might not be attractive for new development, the existing residential and commercial properties might be forced to retreat because of the repetitive flooding, after land reclamation, new land use or zoning might be adopted.

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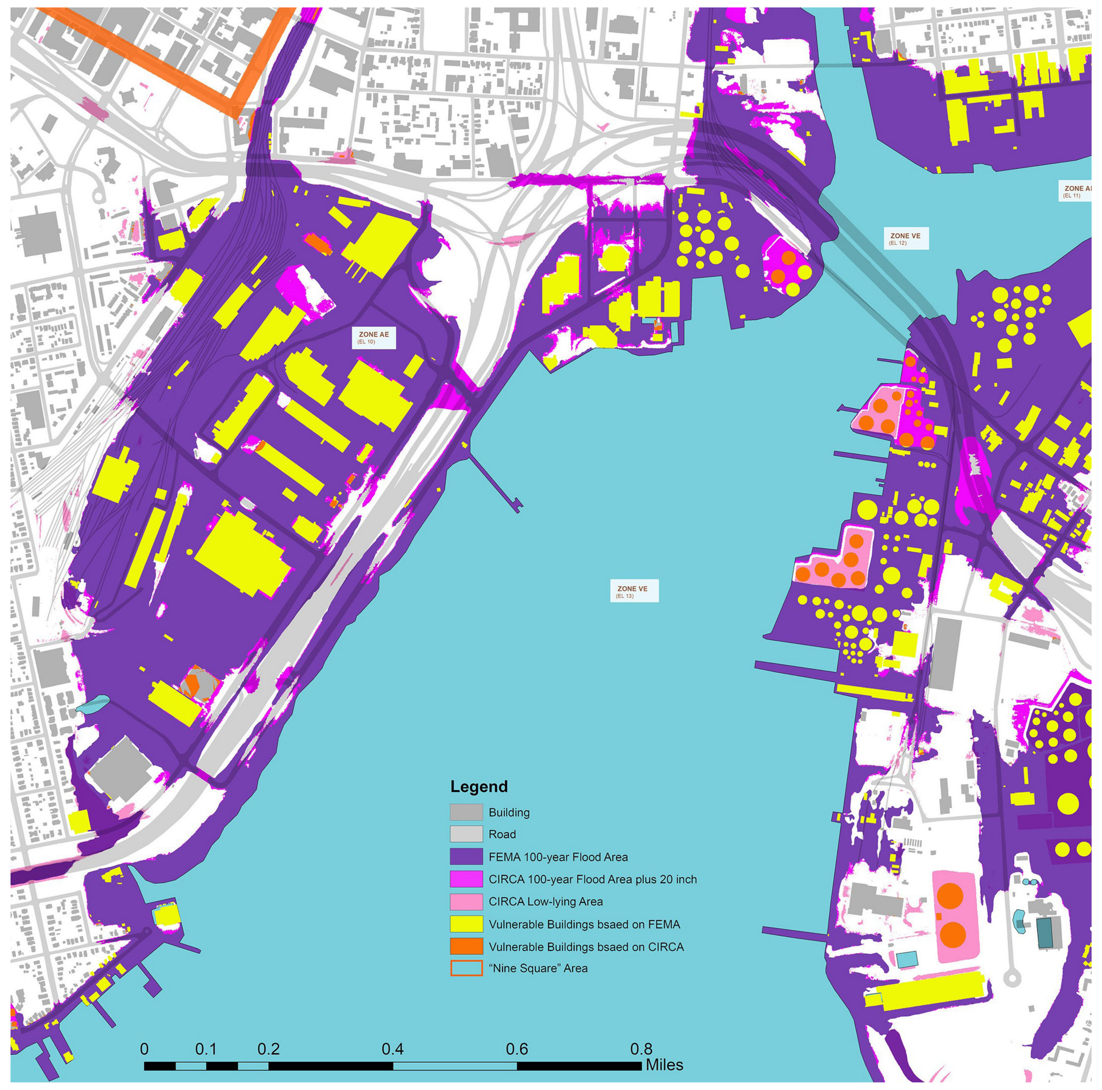


Flood Vulnerability Analysis

Planning Interventions

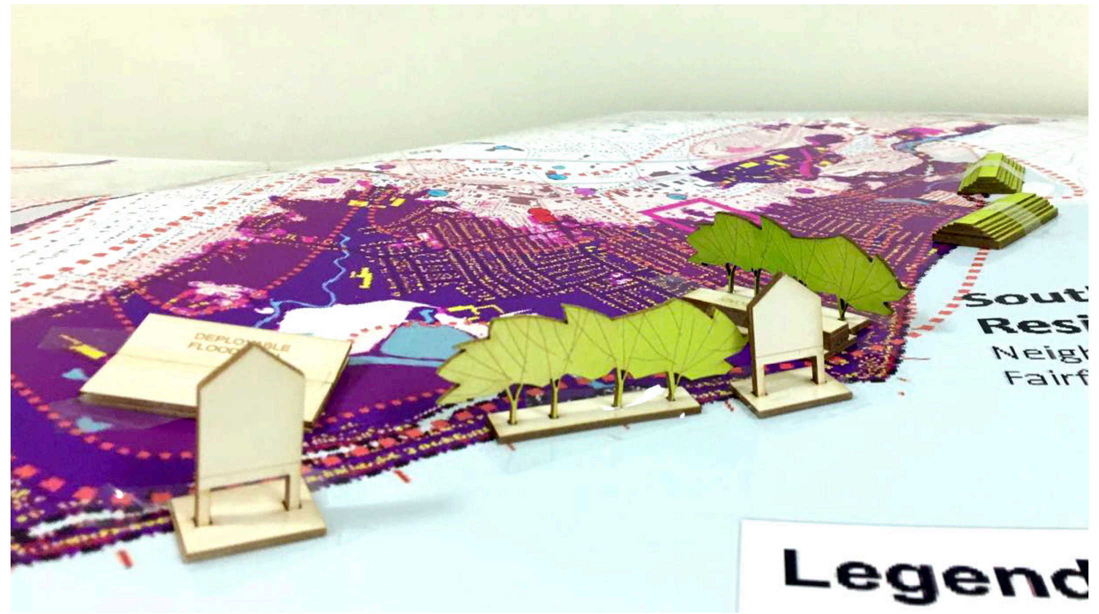
Non Adopter 2050

Non-Adopter scenario

The non-adopter scenario will see severe land deterioration caused by sea level rise, high tide, and repetitive flooding. This scenario inevitably causes passive retreat. After repetitive flooding, the property owners might finally swap their lands with the safer and drier area, the factories have to spend an enormous sum of money to elevate the road, facilities, and buildings, or move to other places.

The retreat might trigger more brownfields emerging and the problem of pollution would be even worse which will pose great threats to the coastal ecological environment. With the population continues to decline, the value of coastal land will be losing its economic and social value.

Non-adopter is a very passive scenario for the New Haven harbor area which loses the strength of coastal resources and aggravates the influence of flood hazard, and harms the ecological, social and economic system.



Models Kits for Participatory Design Process

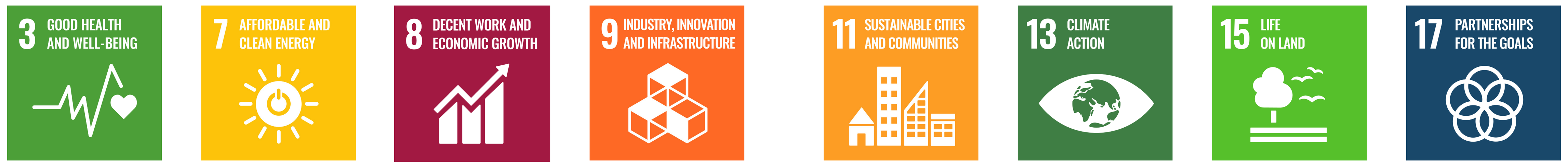
Charrette in the CIRCA Summit 11/19/2019

SUSTAINABLE DEVELOPMENT GOALS	EARLY ADOPTER WAT	AGR	GRN	ENE	TRAN	IND	INST	RES	HLT	MIX	sum
1. No Poverty	3	0	1	1	1	1	3	1	3	1	15
2. Zero Hunger	0	0	0	0	0	0	0	0	0	0	0
3. Good Health and Well-being	3	0	3	1	1	1	1	1	3	3	17
4. Quality Education	1	0	1	0	0	0	1	0	1	0	4
5. Gender Equality	0	0	0	0	0	0	0	0	0	0	0
6. Clean Water and Sanitation	3	0	3	0	0	0	0	0	1	1	8
7. Affordable and Clean Energy	3	0	1	3	0	1	0	1	1	1	11
8. Decent Work and Economic Growth	3	0	3	1	1	1	3	0	1	1	14
9. Industry, Innovation and Infrastructure	3	0	3	3	1	1	3	0	1	1	16
10. Reduced Inequality	1	0	1	1	1	1	3	1	1	1	11
11. Sustainable Cities and Communities	3	0	3	3	1	1	1	1	3	3	19
12. Responsible Consumption and Production	1	0	1	1	0	1	1	0	1	0	6
13. Climate Action	3	0	3	3	3	1	3	3	3	3	25
14. Life Below Water	3	0	3	1	0	0	1	0	1	1	10
15. Life on Land	3	0	3	1	0	0	1	0	1	3	12
16. Peace and Justice Strong Institutions	1	0	1	1	1	0	3	0	0	1	8
17. Partnerships to Achieve the Goals	3	0	1	1	0	0	3	1	1	3	13
	37	0	31	21	10	9	27	9	22	23	189

SUSTAINABLE DEVELOPMENT GOALS	LATE ADOPTER WAT	AGR	GRN	ENE	TRAN	IND	INST	RES	HLT	MIX	sum
1. No Poverty	1	0	0	0	0	1	1	1	0	0	4
2. Zero Hunger	0	0	0	0	0	0	0	0	0	0	0
3. Good Health and Well-being	-1	0	1	1	0	0	1	1	1	1	5
4. Quality Education	0	0	0	0	0	0	1	0	0	0	1
5. Gender Equality	0	0	0	0	0	0	0	0	0	0	0
6. Clean Water and Sanitation	-1	0	1	1	0	0	0	0	1	1	3
7. Affordable and Clean Energy	0	0	0	1	0	-1	0	1	0	0	1
8. Decent Work and Economic Growth	1	0	1	1	0	1	1	0	1	0	6
9. Industry, Innovation and Infrastructure	1	0	1	1	1	0	1	0	0	0	5
10. Reduced Inequality	0	0	0	0	1	1	1	1	1	1	6
11. Sustainable Cities and Communities	0	0	1	1	1	1	1	1	1	1	8
12. Responsible Consumption and Production	0	0	0	1	0	-1	1	0	1	1	3
13. Climate Action	-1	0	1	1	1	1	1	1	1	0	6
14. Life Below Water	0	0	1	0	0	0	0	0	1	0	2
15. Life on Land	0	0	1	0	0	0	0	0	1	1	3
16. Peace and Justice Strong Institutions	0	0	1	1	0	0	1	0	0	0	3
17. Partnerships to Achieve the Goals	0	0	1	1	0	0	1	0	1	1	5
	0	0	10	10	4	3	11	6	10	7	61

SUSTAINABLE DEVELOPMENT GOALS	NON-ADOPTER WAT	AGR	GRN	ENE	TRAN	IND	INST	RES	HLT	MIX	sum
1. No Poverty	-1	0	0	0	-1	1	-1	0	0	-1	-3
2. Zero Hunger	0	0	0	0	0	0	0	0	0	0	0
3. Good Health and Well-being	-3	0	-3	-1	-1	-1	0	0	-1	-1	-11
4. Quality Education	0	0	-1	0	0	0	-1	0	0	0	-2
5. Gender Equality	0	0	0	0	0	0	0	0	0	0	0
6. Clean Water and Sanitation	-3	0	-3	0	0	-3	0	0	0	-1	-10
7. Affordable and Clean Energy	-1	0	0	-3	0	-1	0	0	0	-1	-6
8. Decent Work and Economic Growth	-1	0	-1	-3	-1	-1	-1	0	0	-1	-9
9. Industry, Innovation and Infrastructure	-1	0	-1	-1	-1	-1	-1	0	0	-1	-7
10. Reduced Inequality	-1	0	-1	-1	0	-1	0	0	0	-1	-5
11. Sustainable Cities and Communities	-3	0	-3	-1	-3	-3	-1	-1	-1	-3	-19
12. Responsible Consumption and Production	-1	0	-1	-1	0	-1	0	0	0	0	-4
13. Climate Action	-3	0	-3	-1	-3	-1	-3	-1	-1	-3	-19
14. Life Below Water	-3	0	-3	0	0	0	0	0	0	0	-6
15. Life on Land	-3	0	-3	0	0	0	0	0	0	-1	-7
16. Peace and Justice Strong Institutions	-1	0	-1	0	-1	0	0	0	0	-1	-4
17. Partnerships to Achieve the Goals	-3	0	-3	-1	-1	-1	-1	0	-1	-1	-12
	-28	0	-27	-13	-12	-13	-9	-2	-4	-16	-124

Most beneficial	Beneficial	Neutral	Detrimental	Most detrime
3	1	0	-1	-3



How do Scenarios address Sustainable Development Goals?

These scenarios analyses revealed what results can bring by different resilience strategies and when is the best time to introduce or implement these interventions.

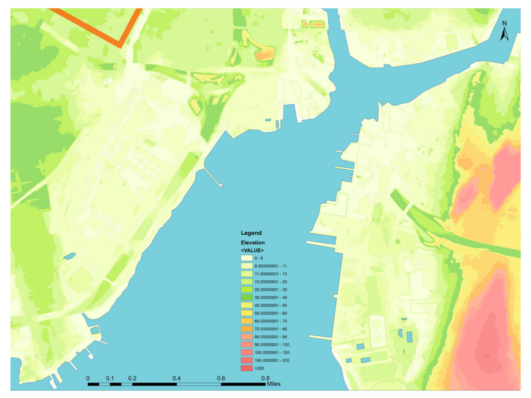
The early adopter shows a positive response to the urgent problem which not only focuses on hazard mitigation, but more on the systematic green infrastructure building, land use transformation and smart growth. Late or non-adopter might have the risk of losing the value of social and triggering economic and environmental deterioration.

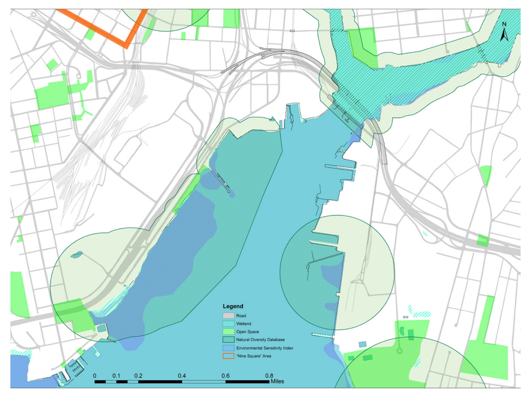
This project describes the planning process of connecting science to decision-making:

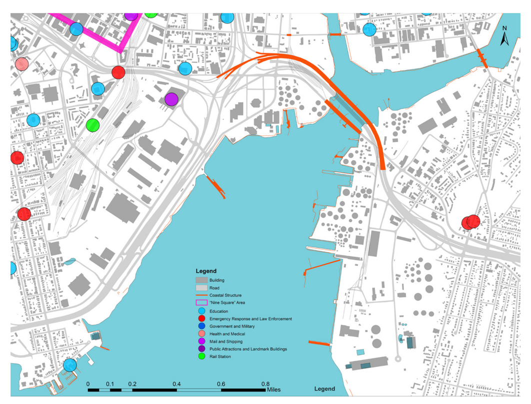
- the thematic maps helped to sort out the potential hazards, flood vulnerability and social-economic vulnerability of the research area;
- the interactive design process ensured community participation in the planning process, it figured out the main concerns of the people and the city, helped to find the potential opportunities and resources, and creative interventions.

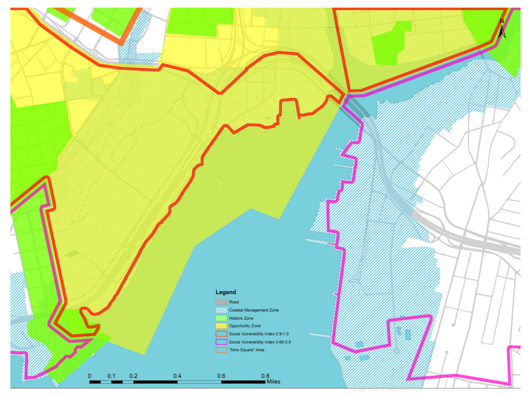
Interventions/Resilienc Strategies

The 5 analytic/thematic maps for flood resilience planning:
1 Topography/Elevation
2 Flooding Projections (Flood Vulnerability Analysis)
3 Ecological Systems
4 Structures & Roadways
5 Land Uses & Social Characteristics









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3. Tsvetanov, Tsvetan; Shah, Farhed, 2013. The economic value of delaying adaptation to sea-level rise: An application to coastal properties in Connecticut. Climatic Change, Vol.121(2), pp.177-193

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