



Living Above the Street

Stewarding New York City's Historic Built Environment Towards Flood Resilience

6

BUILDING ZONE RESTRICTIONS HEIGHT ZONES

All properties this side of heavy line are in zone 2, and the height of buildings is restricted to two times the width of the Street or Avenue on which they front

DIGITAL REPORT 06

Policy & Procedural Recommendations

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About

This report is part of the independent research project “Living Above the Street: Stewarding New York City’s Historic Built Environment Towards Flood Resilience,” which is supported by [Onera Foundation](#) under [2022 Onera Prize for Historic Preservation](#).

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Further Readings

To view and download the whole series of policy & design reports, please visit:

<https://www.livingabovestreet.nyc/reports>.

This Onera Prize research project is developed upon the author’s M.S. Historic Preservation thesis:

Wang, Ziming. 2022. “Living Above the Street: Flood Retrofitting and Adaptive Streetscape of New York City’s Historic Districts.” M.S. Historic Preservation Thesis, Columbia University.

<https://doi.org/10.7916/fn43-vb19>.

Cover Image based on:

G.W. Bromley & Co. *Manhattan Land Book* (1934), Plate 4. New York : G.W. Bromley & Co., 1934.



As a conclusion to the whole research project, this report puts forward policy-making agendas and procedural recommendations synthesized from findings made and directions explored throughout the author’s research.

PFIRM Floodplain at the Junction of Manhattan, Brooklyn, and Queens.
Source: FEMA PFIRM Panels 3604970201G; 202G; 203G; 204G. FEMA Map Service Center.

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01

Executive Summary

Executive Summary

Addressing the “missing pieces” that lie within New York City’s current heritage resilience framework, this research project seeks to better understand the vulnerability of New York City’s historic streetscapes under physical flood risks and flood adaptation interventions, and develop value assessment methods, design strategies and policy solutions for the adaptive transformation of New York City’s historic streetscapes towards flood resilience. As a conclusion to the whole project, this report synthesizes all the findings made and policy-making potentials identified throughout the author’s research, and turns them into specific policy-making agendas and procedural recommendations.

In Chapter 02, the author briefly summarizes the issues investigated and findings made in [Digital Reports 01 – 05](#). Chapter 03 proposes a “planning – design – review” process for the flood adaptation of historic street corridors generalized from the real-world, street-scaled adaptation design studies made in this project. In Chapter 04, the author summarizes all needs for policy reform and policy-making identified throughout the project into 9 policy-making agendas, covering measures and actions that include building code reform, retrofitting mandate establishment, design guideline production, heritage mapping, neighborhood-scaled thinking, information sharing, incremental retrofitting, and financial incentives. These agendas are developed in New York City’s context, based on both the previous Digital Reports and suggestions and opinions extracted from the [Policy-Maker & Stakeholder Interview](#) series carried out as part of the project. To envision how these policy-making agendas may be carried out in the real world, each agenda is paired with one or more governmental agencies identified as key institutional actors on Federal, State, and local level.

While some explorations have already been made in this project on the issues and agendas raised by the author, this project’s investigation is still largely experimental in nature. Real-world changes must be supported by more systematic and large-scale policy-making efforts undertaken by the city’s preservation and planning agencies, along with necessary Federal-level policy reforms. By providing a more generalized planning and design process and situating the project within the larger picture of heritage resilience policy-making, this report seeks to shed some light on the efforts that can be made in the near future to further support the flood adaptation of New York City’s various flood-threatened historic assets.

02

Research Summary and Key Findings

This research project seeks to better understand the vulnerability of New York City's historic streetscapes under physical flood risks as well as flood adaptation interventions as regulated by the city's existing flood policy framework, and develop design and policy solutions for the adaptive transformation of New York City's historic streetscapes towards flood resilience. This Chapter offers a concise summary of the research carried out in this project, as well as key findings made in the previous Digital Reports.

Report 01 - Flood Risk of New York City's Historic Built Environment examines how New York City's historic urban forms are susceptible to adverse impacts brought by physical flood risks, and compounded by the lack of sufficient flood adaptation and preservation policy-making. GIS mapping of historic districts, historic neighborhoods, and designated buildings within (or intersecting) the city's current floodplain reveals that physical flood threats do cause a significant risk to New York City's historic built environment, and that the city's floodplain covers a vastly diverse collection of historic assets that vary in scale, construction, style, use, and designation status. The examination of the city's flood regulation framework and historic preservation standards demonstrates that flood elevation mandates established in the city's Building Code and flood zoning have caused uncontrolled streetscape changes in waterfront communities; although there have been some policy and design guidelines made to regulate the flood retrofitting design of general existing structures and waterfront neighborhoods, historic buildings and districts have been largely left out in the city's flood resilience discourse. Without innovative design strategies, review processes, financial incentives and effective retrofitting mandates, historic urban forms are left at even higher stakes.

Identifying streetscape change as the key area of tension brought by flood adaptation interventions, Report 02 - Adaptive Streetscape: Concept & Framework demonstrates that flood resistance is not the only goal in the adaptation of New York City's historic built environment, and that we must take a broader scope of heritage and economic values into account. A set of adaptation goals, parameters, and metrics should be set up, in order to better evaluate streetscape quality changes brought by adaptation interventions, and balance the tradeoffs between different values. On this front, the report proposes an "Adaptive Streetscape" framework that features four key adaptation and preservation goals including "Flood Resilience," "Building Integrity & Visual Consistency," "Streetscape Experience & Social-Spatial Relationship," and "Floor Area Transfer." Based on existing streetscape theories, adaptation regulations and preservation standards, 24 semi-quantitative metrics are set up under these four lenses to evaluate streetscape change; the intricate tradeoffs between Adaptive Streetscape goals, and the association between each goal and specific flood adaptation design strategies are also discussed.

Addressing the absence of streetscape-sensitive design strategies targeted at New York City's historic buildings and neighborhoods, Report 03 - Streetscape-Sensitive Design Strategies seeks to explore such strategies based on nationwide flood retrofitting regulations and guidelines (including the city's own flood zoning and *Retrofitting Buildings for Flood Risk* report), successful built cases, together with the author's own illustrative input. Although

many design guidelines for the flood retrofitting of historic or existing building stock have been actively developed by policy-making entities across the country in recent years, New York City's historic built environment still poses a unique challenge, given its high-density building types that often involve mixed uses, multi tenants, narrow lots, active basement use and attached construction, as well as the city's flood retrofitting policy framework that only has relatively preliminary streetscape provisions and especially lacks historic preservation considerations. On the individual building scale, this report characterizes New York City's floodplain building stock into six major building types, pairs each building type with one or two overall retrofitting methods, lists preservation and streetscape considerations under each retrofitting scheme, provides streetscape mitigation design solutions, and examines their Building Code compliance; on the neighborhood scale, this report briefly lists the several adaptation models that have been recently proposed or implemented in cities across the U.S. These design strategies are further summarized into a *streetscape-sensitive design toolbox* – a preliminary flood adaptation and streetscape mitigation design guideline presented in tabular form for New York City's historic buildings and neighborhoods. Policy discussions at the end of Report 03 reveal that reforms in local flood regulation and extensive local preservation policy-making are urgently needed to better accommodate streetscape-sensitive design strategies, address unique challenges associated with urban building types, embrace incremental retrofitting, incorporate neighborhood-scale thinking, and guide the whole flood adaptation process of historic urban environment.

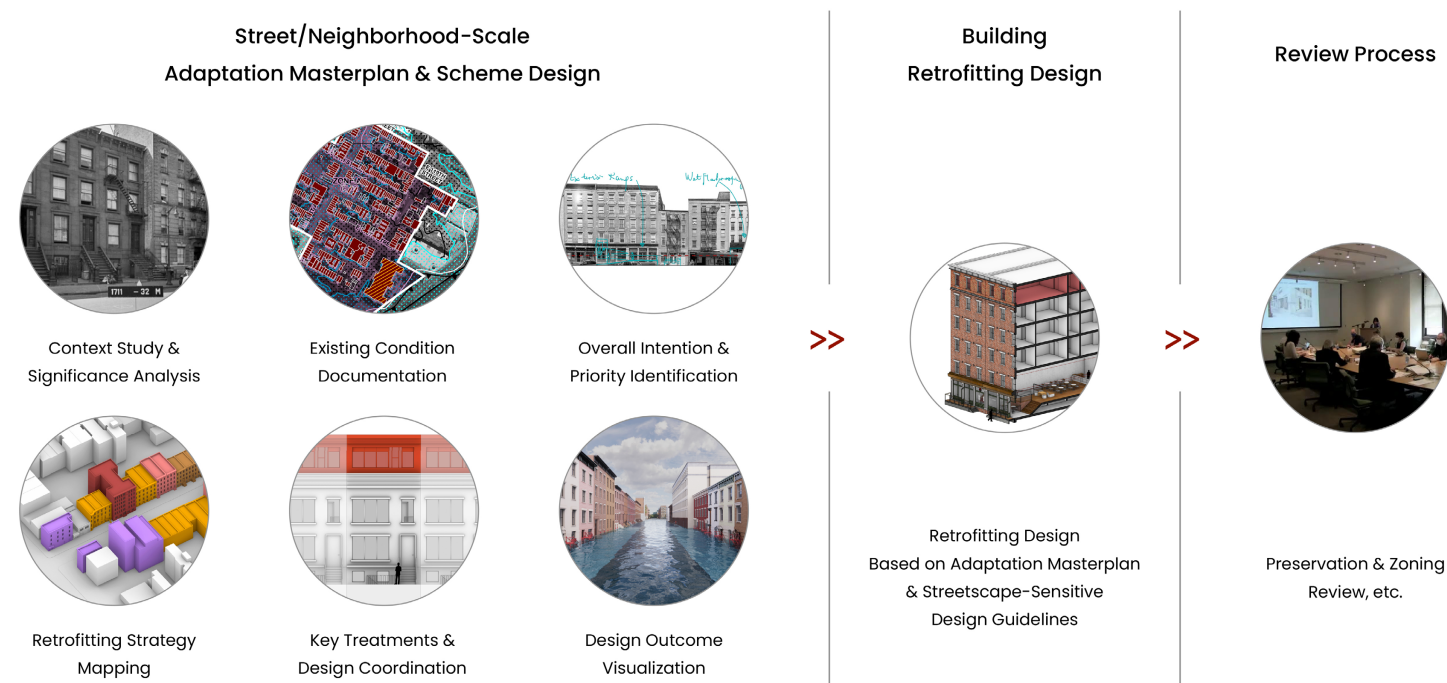
Applying the Adaptive Streetscape framework and streetscape-sensitive design strategies to New York City's real-world historic built environment, Digital Reports 04 and 05 feature two street-scaled adaptation design studies respectively investigating a historic mixed-use/commercial corridor (Front Street in South Street Seaport) and a historic residential corridor (East 118th Street in East Harlem). In each report, the author carries out a context study, maps the street corridor's current condition and building profiles, and evaluates the existing streetscape's significance with the Adaptive Streetscape framework. Such information provides a ground for the identification of adaptation priorities and suitable retrofitting strategies for each building type; based on overall priorities and strategies set up for each street corridor, the author then proceeds to building-scaled design studies, and visualizes the streetscape transformation brought by proposed adaptation interventions – which is evaluated again with the Adaptive Streetscape framework to reveal streetscape quality changes. The design studies demonstrate that although historic street corridors can be flood adapted with their key streetscape values and characters largely retained, such adaptation intervention will inevitably involve tradeoffs with other preservation and economic goals, and can only be achieved upon necessary regulation reforms and procedural establishments. More importantly, they reveal that since different historic streetscapes have different uses, heritage values, characters and adaptation priorities that lead to drastically different design strategies and outcomes, a neighborhood-scaled scenario planning process is vitally important for the adaptive transformation of urban historic built environment.

With an intention to bridge the gaps between the discourses of flood adaptation and historic preservation in the context of New York City, these reports address the “missing pieces” that lie within New York City’s current heritage resilience framework by understanding flood risk, exploring localized design strategies, developing value assessment methods, and delineating needs for policy reform and policy-making. However, as a project experimental and exploratory in nature, the author’s research alone is far from sufficient to cover every issue in the whole city’s heritage resilience planning and policy-making. Synthesizing the findings made and directions explored in Reports 01-05, Chapter 3 will introduce a *planning-design-review* process summarized from the street-scaled design studies carried out in this project, and Chapter 4 will lay out the key policy-making actions that could be taken by Federal, State and local-level institutional actors to further facilitate the adaptive transformation of New York City’s historic built environment. As the conclusion to this research project, these policy and procedural recommendations seek to provide a more generalized solution, and link the project’s exploration with larger policy reform and policy-making agendas well needed in New York City’s flood regulation systems and historic preservation standards.

03

Design Process & Recommended Practices in the Flood Adaptation of Historic Street Corridors

As the design studies in this project have demonstrated, different historic streetscapes have different uses, heritage values, characters and adaptation priorities, which may lead to drastically different design strategies and outcomes. Given the diversity that lies in historic neighborhoods and streetscapes, normative standards (e.g. design guidelines) laying out appropriate or inappropriate treatments at large – the typical tool that historic preservation practice has heavily relied on – may not be sufficient; instead, a neighborhood-scaled scenario planning **process** is required in order to reach site-specific decisions that balance multiple conflicting values, and provide guidance for building-level retrofitting solutions which achieve both flood resilience and consistent urban form transformation. Generalizing the methodology explored in real-world adaptation studies featured in Digital Reports 04 & 05, this Chapter proposes a flood adaptation process for historic street corridors, which follows the “planning – design – review” procedure as illustrated and narrated below.



Recommended design process for the flood adaptation of historic street corridors. Image sources: NYC Department of Records and Information Services (“Context Study & Significance Analysis”); NYC Landmarks Preservation Commission (“Preservation & Zoning Review”). All other illustrations are made by the author.

Stage 1 | Street/Neighborhood-Scale Flood Adaptation Master Plan & Scheme Design.

As multiple streetscape-sensitive flood retrofitting design strategies identified in this project involve coordination among adjacent structures or interventions on sidewalk space, a street or neighborhood-scale adaptation master plan and scheme design is an essential first step to ensure the appropriate transformation of urban historic streetscape towards flood resilience. Such master plan and scheme design may be in the form of an individual document commissioned by local planning or preservation agency (like Philadelphia’s 2020 *Manayunk*

Main Street Historic District Guide or NYCDPC’s *Resilient Neighborhood* studies), or, in New York City’s context, be incorporated into LPC’s historic district master plan system.

Such master plan should be able to inform community stakeholders of local flood risk and building profiles, and recommend appropriate retrofitting strategies for major building types along the street corridor. It should also point out key areas where proportions, visual consistency and streetscape expression shall be coordinated among different structures, and establish a design guideline to aid individual retrofitting design projects. It is recommended that the street/neighborhood-scale master plan incorporate the following components:

- 1. Context Study and Significance Analysis.** Basic historic context research shall be provided to establish an understanding of the historic street corridor’s designation status and significance. Such understanding is essential in the identification of high-priority values and goals to be pursued in the flood adaptation planning process.
- 2. Existing Condition Documentation.** The street corridor’s site plan shall be surveyed, and overlaid on historic designation boundaries and FEMA floodplains; street elevation and building profiles (e.g. age, type, and use) shall also be documented. These information are critical to community stakeholders and property owners as they help them to understand the applicable flood adaptation mandates and historic preservation standards, and plan for retrofitting projects on individual properties.
- 3. Overall Intention & Priority Identification.** Street/neighborhood-scale adaptation master plan shall explicitly lay out the resilience, heritage, and economic goals prioritized in adaptation planning and preservation design. Such goals (e.g. “to achieve flood resilience while retaining the vigorous retail street interface,” or “to identify feasible retrofitting strategies that enhance flood resilience with limited spatial alteration”) will serve as an overall philosophy that guides the selection of flood retrofitting strategies on buildings and street space, and shape the outcomes of adaptation design.
- 4. Retrofitting Strategy Mapping.** Based on the distribution of major building types along the street corridor and street/neighborhood-scale adaptation priorities set above, an overall retrofitting method shall be assigned to each building. Such designation streamlines the resilience planning process, and informs property owners of the suitable retrofitting actions they could take. Existing neighborhood-scaled resilience infrastructure projects in the area (if any) should also be taken into account, as they may have impact on the flood risks that local buildings will face and the suitable retrofitting methods that should be chosen. A group of neighboring buildings with the same design, or buildings under the same type shall generally be designated the same retrofitting method, in order to ensure a consistent streetscape transformation. If alterations are proposed on sidewalk or street space (e.g. local sidewalk widening) to accommodate retrofitting interventions, they should also be laid out upon consultation with local transportation authorities.

5. Key Retrofitting Treatments & Provisions for Retrofitting Design Coordination. Building on the previous steps, the master plan shall lay out key building-level retrofitting treatments that can be repeated along the street corridor wherever possible (such as “solid, articulated foundation,” “storefronts raised from the interior,” or “dry-floodproofing anchors on street-level openings”), and delineate key architectural elements (e.g. cornice) or formal and physical features (e.g. height of elevation, overall design of rooftop addition) that must be coordinated among structures for a consistent design outcome. Specific design guidelines and provisions can be made based on existing preservation standards to further regulate the design of these features.

6. Design Outcome Visualization. If possible, the master plan shall visualize the potential permanent streetscape changes brought by proposed retrofitting interventions through elevation drawing or renderings. A clear, visual representation of the adaptation design helps mitigate confusion and accelerate the adaptation process. By agreeing on the neighborhood-scale scheme design, both local planning and preservation agencies and individual homeowners will have a clearer understanding regarding how the structures shall be retrofitted, how streetscape changes shall be coordinated, and which interventions are likely able to go through design reviews.

The street/neighborhood-scale master plan is recommended to be made based on a collective dialogue among local preservation organizations, city-level planning, transportation and preservation agencies, community members, along with consulting firms and other stakeholders. A successfully developed master plan may in many ways serve as a “roadmap” to flood resilience for local communities. With the street/neighborhood-scale master plan in hand, community leaders and stakeholders will have a transparent understanding of the community’s resilient future; and individual homeowners will be well informed of the flood risks of their properties, as well as how they may achieve flood resilience through incremental retrofitting or substantial improvement. In the meantime, streetscape provisions and guidelines ensure a coordinated streetscape expression despite that the actual process of flood adaptation is carried out on a building-by-building basis.

Stage 2 | Individual Building Retrofitting Design

Retrofitting designs of individual structures along the historic street corridor shall be carried out under recommendations made by the street/neighborhood-scale master plan. While the master plan lays out the suggested overall method (e.g. dry-floodproofing, or interior elevation) and key streetscape parameters of retrofitting design, individual property owners and architects will still have say on most details of the project.

Streetscape mitigation should be a key consideration in the flood retrofitting design of individual historic structures. The streetscape-sensitive design guidelines developed in [Report 03](#) may be consulted as a reference; if a structure is listed under local or Federal historic designation, its flood retrofitting design should also abide by

design guidelines published by the local preservation agency, or nationwide guidelines such as [The Secretary of the Interior’s Standards for the Treatment of Historic Properties](#) or the NPS [Guidelines on Flood Adaptation for Rehabilitating Historic Buildings](#) (2021).

Stage 3 | Design Review and Other Permit Procedures

After the completion of the flood retrofitting design, historic structures with local landmark designation or located in local historic districts will need to go through LPC design reviews for project approval. As flood retrofitting often involves extensive reworking of a building’s physical fabric (e.g. the dry-floodproofing of walls) and significant spatial changes (e.g. structural elevation, interior elevation and rooftop addition) that wouldn’t normally be accepted by general preservation standards, flood retrofitting projects on historic structures may encounter difficulties getting permission. While a number of cities across the U.S. have set specific design review guidelines for the flood retrofitting of historic structures, New York City’s permit guidelines are still largely focused on small-scaled interventions (such as door/window restoration and storefront replacement), and generally excludes major spatial changes. Extensive flood retrofitting policy-making expanded from LPC’s existing technical guidelines on [equipment relocation](#) and [flood shield installation](#) are needed to guide flood retrofitting interventions on historic structures, and remove policy barriers that hinder the implementation of such interventions.

Besides local preservation design review, other forms of review and permit procedures may also be required. Historic buildings that are retrofitted with FEMA/NPS funding may need to go through the [Section 106 Review](#); as suggested by NYCDCP’s *Retrofitting* report (NYCDCP 2014, 92), dry-floodproofing enclosures on sidewalk space may require a revocable consent from local Department of Transportation (DOT). As local-level preservation and transportation review procedures for flood retrofitting projects still remain largely unclear, they should be developed jointly by city authorities in respective fields in the near future.

Connecting neighborhood-scale adaptation planning and building-scale design intervention, the planning — design — review process introduced above may enable the flood adaptation of historic street corridors in a way that respects local social-spatial characters and historic urban forms. Ideally, such planning process shall be incorporated into NYC Landmarks Preservation Commission’s existing [historic district master plan](#) system; however, this would require the historic district master plan system itself to change as well, since current rules in historic district master plans are still very much focused on specific treatments on individual architectural elements, without a scenario planning approach that establishes a more sophisticated understanding of the broader social-spatial values of historic urban environment.

04

Policy Reflections & Policy-Making Agendas

Policy-Making Agendas

Agenda 1

Incorporate Flood Resilience Standards for Historic Buildings into the City's Building Code and Preservation Guidelines.

Agenda 2

Develop an Integrated GIS System that Maps the Flood Threat Faced by New York City's Historic Built Environment.

Agenda 3

Revise Local Building Code and Flood Zoning to Further Address the Challenges and Needs Associated with Urban Building Types.

Agenda 4

Develop Design & Policy Guidelines for the Flood Retrofitting of Historic Structures, with an Emphasis on Urban Form Change and Streetscape Design.

Agenda 5

Embrace and Incentivize Partial or Incremental Retrofitting on Existing Structures.

Agenda 6

Incorporate Neighborhood-Scale Thinking in Local Resilience Planning.

Agenda 7

Increased Investment and Enhanced Inter-Agency Coordination.

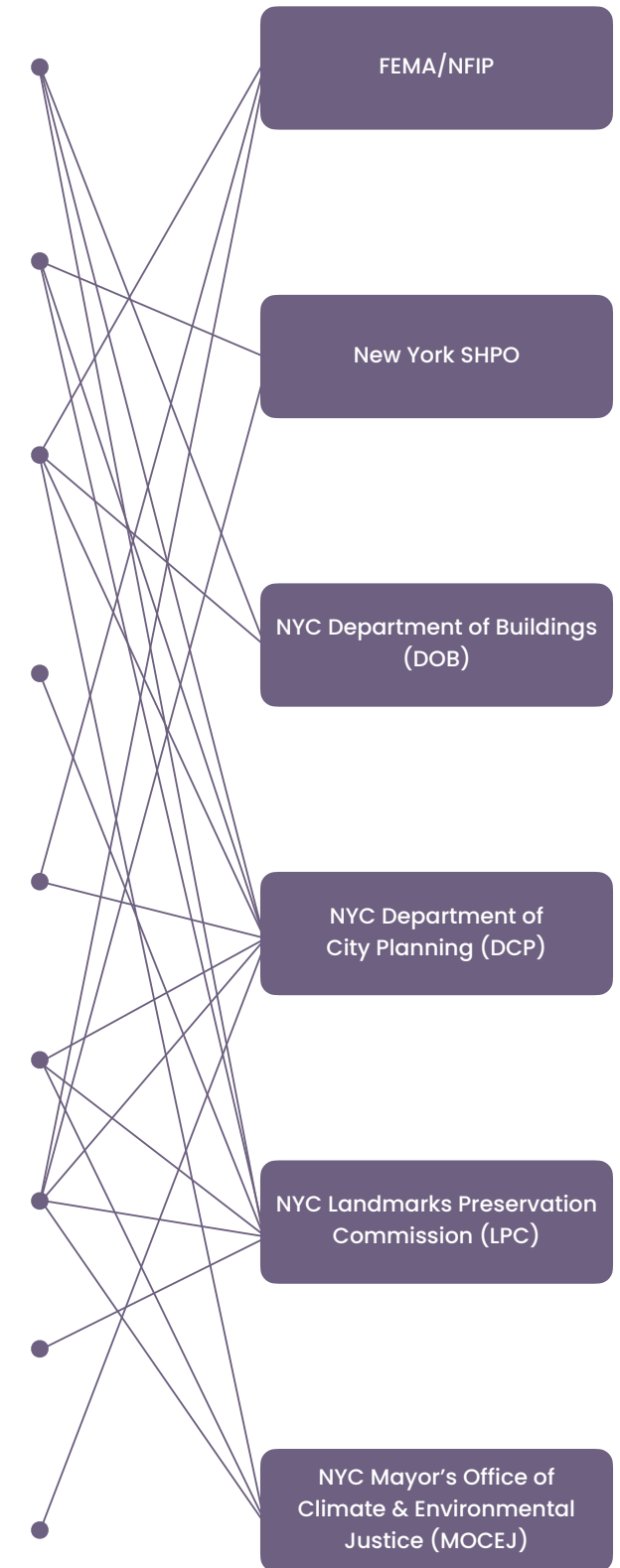
Agenda 8

Develop a Consolidated Platform to Share Information on Heritage Resilience with the Public.

Agenda 9

Connect Flood Retrofitting with Other Climate Resilience Undertakings.

Institutional Actors



Design solutions and policy issues are closely intertwined in the discourses of flood adaptation and historic preservation. In Report 03, based upon streetscape-sensitive design strategies identified for New York City's flood-threatened historic buildings and neighborhoods, the author identified the needs for local flood regulation reform and historic preservation policy-making in order to better accommodate streetscape-sensitive design strategies, address unique challenges associated with urban building types, embrace incremental retrofitting, incorporate neighborhood-scale thinking, and guide the whole flood adaptation process of historic urban environment.

However, New York City's policy-making at the intersection of flood adaptation and historic preservation shouldn't stop at simply providing design guidelines for flood-threatened historic buildings; other policy-making and heritage management actions regarding building code reform, retrofitting mandate establishment, heritage mapping, information sharing, and financial incentives are just as important and relevant in the cause of transforming the city's historic built environment towards flood resilience. While this project has made explorations on some of the fronts just mentioned, real-world changes must be supported by more systematic and large-scale policy-making efforts undertaken by the city's preservation and planning agencies. Furthermore, although flood adaptation is largely regulated on the municipal level across U.S. cities, some Federal-level standards (for example, FEMA's "substantial improvement" mandate and floodplain management regulations) still serve to set a baseline for local policies. Therefore, some local policy reforms deemed necessary by this project (and other research reports such as NYCDPC's *Resilient Retail* published in 2016) would require Federal-level policies to reform accordingly or provide more flexibility.

Based on these observations, this Chapter summarizes all needs for policy reform and policy-making identified throughout this research project into specific policy-making agendas. These agendas are developed in New York City's context, based on both Digital Reports 01-05, and suggestions and opinions extracted from the Policy-Maker & Stakeholder Interview series carried out as part of the project. Full transcripts of interviews with preservationists, urban planners, architects, contractors, homeowners and community stakeholders are published at <https://www.livingabovestreet.nyc/interviews>. To envision how these policy-making agendas may be carried out in the real world, the author identifies FEMA/NFIP, New York SHPO, NYC Department of Buildings (DOB), NYC Department of City Planning (DCP), NYC Landmarks Preservation Commission (LPC), and NYC Mayor's Office of Climate and Environmental Justice (MOCEJ) as key institutional actors capable of shaping or influencing the city's heritage resilience policies, and pairs each policy-making agenda with one or more key institutional actors.

A total of 9 policy reform and policy-making agendas are identified as the conclusion to the whole research project. They are illustrated on p. 17, and discussed as follows:

Agenda 1 | Incorporate Flood Resilience Standards for Historic Buildings into the City's Building Code and Preservation Guidelines.

Key Institutional Actors: NYCDOB; NYCDPC; NYCLPC.

As Digital Report 01 has revealed, NFIP's floodplain management standard offers two options for local communities to regulate the flood retrofitting of historic buildings: Communities can either exempt all designated historic buildings from the retrofitting mandates set out by the "substantial improvement" provision, or include them under the mandate, while allowing historic buildings to acquire FEMA Variances in their retrofitting projects. Currently, some local and State-level building codes (e.g. those of Charleston, SC and Florida) have already positioned historic buildings under flood resistance standards (whether through the "substantial improvement" standard set out by FEMA or locally-made rules), and included variance-granting procedures; however, New York City still only exempts historic buildings from the substantial improvement mandate, without placing a local flood resilience standard applicable for historic buildings. Such exemption perpetuates the vulnerability of historic buildings under physical flood risks, and delays the development of the city's heritage resilience policies. On this front, the following reforms are suggested:

- The City's Building Code should incorporate flood resilience standards for historic buildings, either by placing them under the substantial improvement mandates, or establishing an independent system of requirements. Such policy change should be accompanied by the establishment of variance-granting procedures, as well as corresponding provisions on urban design and floor area calculation provided by the city's Flood Zoning.
- Once flood resistance standards are established for historic buildings in the floodplain, the city's historic preservation agency (LPC) shall publish technical guides to delineate the review, permit, and variance-granting processes for flood retrofitting projects on locally designated historic buildings. The agency's current *Permit Guidebook* should also be revised to incorporate flood resilience recommendations. Miami-Dade County's *Resilient Rehab* guideline (2021) – where resilience considerations are analyzed for each architectural element as an addition to other design recommendations and regulations – would be a great example. The incorporation of flood resilience standards and considerations into existing permit guides will not only serve to inform wholesale retrofitting projects, but also encourage incremental resilience-building through small-scaled repairs and updates.
- On Federal level, current NFIP regulations allow Federally designated historic structures to enjoy subsidized flood insurance rates regardless of whether they're flood retrofitted or not (FEMA 2008, 8-9). Further updates in the flood insurance policies may be made to encourage flood retrofitting projects on historic properties by financially differentiating retrofitted historic buildings with those without flood resilience measures.

Agenda 2 | Develop an Integrated GIS System that Maps the Flood Threat Faced by New York City's Historic Built Environment.

Key Institutional Actors: NYCDTCP; NYCLPC; NYSHPO.

With a myriad of urban data collected, organized, and published for public use, New York City is commonly seen as a leader in data-driven decision-making and public-oriented data sharing. The city's [ZoLa \(Zoning & Land Use Map\) platform](#) is one of the several publicly accessible online platforms nationwide where floodplain boundary and local historic designation are visualized in the same map interface (for similar platforms developed by other cities, see for example, City of Newport, RI's [GIS Portal](#), and St. Augustine, FL's [GIS Portal](#)). However, local historic designation data remain only a supporting layer within the ZoLa system, and haven't been integrated into the city's flood hazard visualization platforms such as NYC [Flood Hazard Mapper](#). Furthermore, given the various historic assets present in New York City's floodplain, local designation alone may not be sufficiently able to represent the flood risks faced by New York City's historic built environment. The extensive data collection and survey efforts taken by agencies such as New York SHPO (through its Hurricane Sandy Historic Resource Survey of Select Waterfront Communities) and NYCDTCP (through its PLUTO and flood hazard mapper programs) should be combined with NYCLPC's local designation data, and developed into a more comprehensive geographic information system that facilitates a better understanding of the profiles of various types of historic assets located within the floodplain. Specifically, the following actions are recommended:

- To facilitate heritage resilience policy-making and harness public awareness, the Landmarks Preservation Commission shall take the lead in developing an integrated flood risk map platform that showcases the flood risk faced by New York City's historic assets, whether they are individual landmarks or historic districts, designated under local Landmark Law or Federal/State register. Currently available National/State register and floodplain data as well as other general urban data may be linked into the system through coordination with other agencies such as New York SHPO, FEMA, and NYCDTCP.
- Local and Federal/State historic designations, as well as other buildings, facilities, and neighborhoods of high value or vulnerability, shall be included into New York City's online flood map portal — NYC Flood Hazard Mapper — as supporting layers.

Agenda 3 | Revise Local Building Code and Flood Zoning to Further Address the Challenges and Needs Associated with Urban Building Types.

Key Institutional Actors: FEMA; NYCDOB; NYCDTCP; MOCEJ.

It is observed throughout this study that NFIP's floodplain management requirements, premium reduction

standards, state and local-level retrofitting guidelines and existing built cases are all to a great extent concentrated on detached single homes. However, as this research project and a number of NYCDTCP's planning studies (see for example, the *Retrofitting* report of 2014 and the *Resilient Retail* report of 2016) have revealed, the high density, mixed use, multi tenants, narrow lots, active basement use, and attached construction of New York City's high-density floodplain building types call for floodproofing and flood retrofitting strategies that are not supported or acknowledged by the current Federal and local flood regulations. Treatments such as the "mix-and-match" of multiple floodproofing strategies or the continued use of floodproofed below-grade spaces are not only contributing to the streetscape discourse of historic buildings, but also necessary for a greater stock of floodplain buildings to reach flood resistance without losing the capability of normal operation. To address the mismatch between urban building types and flood resistance standards designed largely for detached residential homes, Federal and city-level policy-making entities should further research the retrofitting challenges and strategies associated with high-density urban building types, and put forward construction standards, insurance policies, zoning rules and streetscape design guidelines that offer more flexibility and encourage streetscape-sensitive flood retrofitting projects on high-density urban building stock. Specifically, the following policy-making actions are needed:

- Local building and planning agency (NYCDOB & NYCDTCP) should continue to publish research reports that lay out suitable retrofitting strategies for high-density urban building types, and connect with FEMA/NFIP for the prospect of updating Federal-level regulations that often undergird the inflexibility of local Building Codes. Key potential areas of Building Code reform include:
 - Allowing the "mix-and-match" of dry-floodproofing and wet-floodproofing on the same structure;
 - Allowing the continued existence of basements, cellars and other below-grade spaces on condition that they are properly floodproofed or drained;
 - Recognizing dry-floodproofing on residential buildings with attached construction;
 - Allowing limited, active retail lobby use in mixed-use structures where the interior first floor is raised;
 - Acknowledging and encouraging creative access design strategies proposed in the city's existing retrofitting design reports, such as dry-floodproofing enclosures with egress stairs or the rerouting of dry-floodproofed retail egress through residential lobbies (see Section 4.5 of Report 03 for details).
- Besides Building Code reforms, the city's planning agency (NYCDTCP) should continue to produce updated zoning standards and incentives, as well as streetscape design regulations to assist the flood adaptation of waterfront built environment. Changes in NFIP strategies may also be needed to recognize the retrofitting strategies that are currently not eligible for premium reduction.
- Given the fact that a number of creative design strategies proposed in the city's existing retrofitting design

reports don't have many built-out cases, the city's Department of City Planning and Mayor's Office of Climate and Environmental Justice (MOCEJ) may launch grant programs to assist pilot retrofitting projects on New York City's specific urban building types such as Semi-Attached/Attached Mixed-Use.

Agenda 4 | Develop Design & Policy Guidance for the Flood Retrofitting of Historic Structures, with an Emphasis on Urban Form Change and Streetscape Design.

Key Institutional Actor: NYCLPC.

Responding to the flood risks of New York City's historic buildings and the extensive spatial changes that flood retrofitting interventions may cause, LPC has in recent years published two technical guidelines on equipment relocation and flood shield installation for locally designated historic structures. These guidelines echo this project's finding that dry floodproofing may be a strategy beneficial to the preservation of historic characters and streetscape relationships for certain building types (e.g. row houses and semi-attached/attached residential structures); however, dry-floodproofing may not be the best solution for every building type, and these individual interventions are only a small part of the array of flood retrofitting actions that could be taken on historic buildings. Therefore, extensive policy-making by LPC is still urgently needed to further guide the whole flood retrofitting process of local historic buildings. With streetscape change identified as the key area of tension by both this project and a number of existing nationwide retrofitting guidelines on historic structures (e.g. Charleston's *Design Guidelines for Elevating Historic Buildings* and Miami Beach's *Buoyant City*), New York City's future design guidelines should emphasize on regulating streetscape expression and coordinating urban form change. Specifically, the city's design & policy guidelines on the flood retrofitting of historic structures shall be able to address the following issues:

- It should be developed based on similar existing guidelines across the country, and target New York City's floodplain historic building stock. It should be able to cover a wide range of applicable flood adaptation interventions, as well as the resilience planning process where property owners and architects choose the most suitable retrofitting method for flood-threatened structures.
- It should delineate design review processes both for individual flood retrofitting projects, and for a group of properties in historic districts that bear the same design.
- It should be able to address the potential conflicts between flood retrofitting guidelines for historic buildings and the city's general Building Code and preservation standards, and indicate which set of regulations will prevail when these conflicts are present.
- Upon consulting other city agencies (e.g. NYCDOT, NYCDOB, and NYCDCP), rules should be made regarding

how adaptation strategies that may involve intervention on sidewalk space (e.g. implementation of dry-floodproofing enclosures; see Report 03, 52-53; NYCDCP 2014, 90-93) shall be permitted and executed.

- The city's flood retrofitting guidelines for historic buildings shall also establish a preservation philosophy that embraces appropriately carried-out flood retrofitting interventions as new layers of architectural features that supplement the character and significance of historic structures.

Since flood retrofitting projects often involve more substantial formal, spatial, and material changes than normally accepted by general preservation standards, a set of dedicated flood retrofitting design guidelines for historic buildings are crucial for the real-world implementation of flood retrofitting on designated historic structures. It is recommended that the LPC take the lead in developing such policy and design guides, as a supplement to its current *Rules* and *Permit Guidebook*.

Agenda 5 | Embrace and Incentivize Partial or Incremental Retrofitting on Existing Structures.

Key Institutional Actors: NYCDCP; FEMA.

Flood resilience and regulation compliance aren't always achieved at once through total overhaul or large-scale renovation; a more feasible approach for property owners would be to gradually incorporate flood resilience measures in a piecemeal manner. This is especially true for high-density urban building types: since the once-and-for-all structural elevation option is generally excluded for these building types, many of their recommended design schemes can be divided into smaller steps. For example, the "Interior Elevation and Wet-Floodproofing" scheme proposed in Digital Report 03 may be achieved by first relocating critical equipments up to the rooftop, then replacing existing materials below DFE with flood-resistant ones during repair or maintenance, and finally, wet-floodproofing and elevating the whole interior retail floor plate.

However, neither the city's Building Code nor NFIP's premium reduction standard currently recognizes these partial retrofitting solutions, nor grants them lower flood insurance premiums (see NYCDCP 2016, 4). Such exclusion fails to incentivize property owners to carry out incremental flood adaptation undertakings; many of which are streetscape-sensitive design strategies identified in this study, that are not totally compliant with the city's current Building Codes and therefore may only be considered as partial retrofitting treatments.

These situations call for the recognition of partial and incremental retrofitting treatments by NFIP and local flood zoning. It is recommended that the city's Department of Planning work with FEMA/NFIP to continue to develop financial incentives and zoning bonuses rewarding partial retrofitting actions — especially those friendly to historic streetscapes — based on the several existing zoning bonus provisions set out in the city's 2019-2021 Flood Zoning (see NYCDCP 2019, 77-99).

Agenda 6 | Incorporate Neighborhood-Scale Thinking in Local Resilience Planning.

Key Institutional Actors: NYCLPC; NYCDPC; MOCEJ.

As adaptation design studies featured in Digital Reports 04 & 05 and the “planning – design – review” procedure proposed in Chapter 03 have demonstrated, street/neighborhood-scale adaptation planning is crucial for the streetscape-sensitive transformation of urban historic built environment towards flood resilience. The street/neighborhood-scale adaptation master plan is not only able to coordinate urban form changes between different structures and the street space, but also sets clear adaptation goals and parameters for local homeowners and community stakeholders, as well as provides key information and recommendations that would aid individual flood retrofitting projects. However, the street/neighborhood-scale master plan is only one of the ways in which neighborhood-scale thinking should be incorporated into the heritage resilience discourse: to preserve urban forms and link flood adaptation actions on multiple scales, local resilience planning must also acknowledge existing neighborhood-scale resilience infrastructure projects, encompass more social justice considerations, and explore a more thorough understanding of the social-spatial values of historic streetscapes and urban space. Specifically, the following actions are suggested:

- Incorporate the street/neighborhood-scale flood adaptation master plan process developed in Chapter 03 into NYCLPC’s existing historic district master plan system, or NYCDPC’s Resilient Neighborhood studies. It is observed that historic districts and neighborhoods have been largely left out of the city’s flood resilience discourse: there hasn’t been a study dedicated to the preservation and adaptation of a historic neighborhood within DCP’s Resilient Neighborhood series, and LPC’s existing historic district master plans are still largely focused on preservation design provisions for particular architectural elements. By integrating neighborhood-scale flood adaptation master plan into these two systems, resilience goals and parameters can be feasibly established leveraging existing policy-making mechanisms.
- Acknowledge neighborhood-scaled resilience infrastructure projects taking place in the city’s waterfront communities. As introduced in Digital Report 03, New York City is currently executing a collection of neighborhood-scaled resilience infrastructure projects that seek to form a continuous flood barrier surrounding Lower Manhattan and take waterfront neighborhoods out of the floodplain. However, the city’s current flood zoning and Building Code don’t differentiate buildings in communities with neighborhood-scaled resilience measures, against those not protected by these measures. More detailed policy-making that acknowledges large-scale resilience infrastructure projects will potentially relieve the burden of building retrofitting in Lower Manhattan neighborhoods, and indirectly help preserve the fabrics of historic districts and neighborhoods in the area.
- Invest in pilot neighborhood-scale adaptation projects targeted at New York City’s historic districts and neighborhoods. Paralleling the large-scale waterfront flood defense system being carried out by the city, the

LPC, DCP and MOCEJ shall launch and support pilot neighborhood adaptation projects in the city’s waterfront historic communities, focusing on interventions on buildings and street space that may supplement waterfront infrastructure construction. Actions and projects that can be taken within these neighborhood adaptation projects may include adaptation planning, rain gardens, permeable ground surface, building retrofitting, and updated drainage systems.

- Further integrate social justice considerations into neighborhood resilience planning. It can be easily seen that most of the city’s current resilience infrastructure projects are concentrated on neighborhoods in Lower Manhattan, and it’s learned from this project’s interview series that some other communities vulnerable to flood risk – such as East Harlem – haven’t been able to gain the same attention, assistance or investment in their neighborhood resilience planning processes. While current resilience infrastructure projects (such as those under the Lower Manhattan Climate Resiliency initiative) are largely experimental and pilot in nature, neighborhoods with high flood risk and indicators of social vulnerability (e.g. low-income, high immigrant or BIPOC population) shall be further prioritized by MOCEJ when they get extended into citywide communities.
- Establish a more comprehensive understanding of the social-spatial values of historic streetscape and urban space. As the “Adaptive Streetscape” framework demonstrates, the flood adaptation of urban historic streetscapes needs to build on a thorough understanding of the various resilience, heritage, and economic goals and values associated with historic streetscapes and urban space. However, as today’s preservation standards are largely focused on architectural elements that reflect building-level historic significance, the understanding of broader social-spatial values of street and urban space remains relatively preliminary. Based on LPC’s historic district designation program and existing streetscape theories made by urban scholars and researchers (see Section 3.1 of Digital Report 02), it is recommended that LPC carry out studies to explore a more comprehensive value assessment procedure for historic urban spaces and streetscapes, which may aid preservationists and planners to balance conflicting values in the neighborhood resilience planning process.
- Explore flood adaptation strategies on medium-scaled urban complexes, such as NYCHA campuses. While some adaptation strategies have been discussed on both the building scale and the neighborhood scale, medium-scaled urban complex – such as NYCHA campuses – may be a type of asset that is easily overlooked by planners and preservationists. Specific campus-scaled design strategies developed for these complexes may bring about more adaptation choices and opportunities as compared to the traditional building-by-building approach of flood retrofitting; furthermore, as 37 NYCHA properties are listed or eligible for listing on the National Register, the flood adaptation of NYCHA campuses (and other complexes) is also of close preservation relevance. It is recommended that NYCHA together with NYSHPO and DCP continue to develop campus-level adaptation strategies, based on existing pilot studies and projects such as the Red Hook Houses Resiliency Project and the recovery & resiliency project at Coney Island Sites.

Agenda 7 | Increased Investment and Enhanced Inter-Agency Coordination.

Key Institutional Actors: FEMA; NYCLPC; NYCDPC; NYSHPO; MOCEJ.

Many interviewees in this study's interview series — regardless of their roles in the flood resilience and historic preservation fields — stressed the crucial importance of financial incentives (e.g. grants, tax credits and flood insurance premium reduction) in taking flood retrofitting projects into reality. While reductions in flood insurance premium serve as a major motivation for property owners to retrofit their buildings, many neighborhood businesses and cultural institutions struck by past flooding events such as Hurricane Sandy wouldn't have survived without grants from government agencies and neighborhood development associations.

However, it is indicated from the interviews that property owners often have great difficulty securing governmental grants, due to limited available funding, prolonged application and review processes, as well as specific threshold regulations (e.g. FEMA's Severe Repetitive Loss (SRL) definition and Cost-Benefit Analysis (CBA) procedure) that may not match on-the-ground situations in certain urban areas. Even if a property owner — especially a historic homeowner — succeeds in securing governmental funding, it would still be difficult and burdensome for them to navigate the multiple regulatory systems and review processes that accompany their retrofitting project. When a higher-level governmental agency (e.g. SHPO) overrides review decisions made by local regulatory agency (e.g. local historic preservation commission), the flood retrofitting project may be further delayed.

Based on these observations, the following actions are recommended:

- FEMA, National Park Service/NYSHPO, and New York City (MOCEJ) shall expand their existing hazard mitigation and climate resilience grant programs to better benefit individual homeowners and property owners. Since not many historic preservation grant opportunities are targeted at or applicable to flood retrofitting projects, retrofitting projects on historic buildings are often either financed by property owners or supported by FEMA grants; therefore, it would also be critical that Federal, State and local-level governments and preservation agencies continue to develop financial incentives and tax credits that support flood resilience undertakings on historic buildings in a more targeted manner.
- NYCLPC, New York SHPO, and FEMA should develop streamlined project review and approval procedures for the flood retrofitting of historic buildings with local or Federal/State designation. Redesigned workflows will reduce the back-and-forths in the application and review procedure; design review sessions with representatives of multiple regulatory entities present may help to expedite project approval.

Agenda 8 | Develop a Consolidated Platform to Share Information on Heritage Resilience with the Public.

Key Institutional Actor: NYCLPC.

Heritage resilience is a complicated and interdisciplinary field in nature. Therefore, homeowners and property owners often need to acquire various pieces of information and regulation (e.g. floodplain designation, design review guidelines, building code, flood zoning, insurance standards, technical guides, and available financial aids) from discrete regulatory entities on Federal, State, and local levels when they intend to carry out flood retrofitting projects on historic structures. Since it's often inconvenient to find or access these scattered information, property owners may likely be unaware of all the design, technical and financial resources available to them. A consolidated platform — similar to the [Interactive Map](#) developed as part of this project — that shares these resources with the public is a critical measure that would make heritage resilience policies better understood and flood retrofitting undertakings more feasible.

In New York City's context, it is recommended that LPC develops such an information-sharing platform for historic homeowners and property owners. The platform shall not only list LPC's own policy-making on flood retrofitting, but also include relevant funding, technical standards, and design guidelines on State and Federal levels.

Agenda 9 | Connect Flood Retrofitting with Other Climate Resilience Undertakings.

Key Institutional Actors: NYCDPC; NYCLPC.

Flood retrofitting is a form of mostly building-scaled flood adaptation undertaking that falls under the matrix of climate resilience measures. As several existing heritage resilience guidelines (e.g. Boston's [Resilient, Historic Buildings Design Guide](#) and Miami-Dade County's [Resilient Rehab](#)) have suggested, flood retrofitting interventions can actually be combined with other climate adaptation (e.g. rain garden or permeable surface) undertakings as well as climate mitigation (e.g. green roofs and energy retrofitting) measures, for additional efficiency and potentially a wider array of funding opportunities.

In New York City's context, flood retrofitting can be situated under a larger framework of climate resilience for both general existing buildings and designated historic buildings. It is recommended that the DCP launch an overarching initiative to connect its recently created [Zoning for Coastal Flood Resilience](#) with the [Zoning for Zero Carbon](#) and other similar resilience zonings currently under development; LPC may continue to develop a wider array of design and technical guidance for various resilience and sustainability undertakings, based on the brief guides it has published on flood retrofitting and [passive house](#).

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