This mixed-use attached example is a five-story unreinforced masonry building with ground-floor retail, a residential lobby and residential units above. Because the structure is so heavy and in such close proximity to the neighboring building, it is unsuitable for elevation. Retrofit strategies that will result in partial NFIP reduction in flood insurance premiums and full NYC Construction Code compliance involve dry floodproofing all areas below the DFE through structural reinforcement and the use of flood shields at the commercial façade. Where flood shields are used egress is provided through the residential lobby. At the residential lobby wet floodproofing is used and requires reconfiguration of the layout to accommodate for engineering requirements of the flood vents as well as egress from the commercial unit. Existing federal regulations do not foresee the co-existence of residential spaces or lobbies and commercial spaces on the same floor, which complicates retrofit strategies for mixed-use buildings. Alternative adaptation strategies, currently not recognized by FEMA and NFIP, include leaving existing commercial uses on the ground-floor as is or wet floodproofing.

**KEY CHARACTERISTICS**

**FLOOD RISK**
- Flood Zone/BFE: AE +11’
- Grade Elevation: +7’ at sidewalk, +2’ at rear property
- Design Flood Elevation (DFE): +12’ (5’ above sidewalk grade)
- Lowest Occupiable Floor: +8’ (1’ above sidewalk grade)
- Cellar Elevation: +1’ (6’ below sidewalk grade)
- Critical Systems Location: Cellar

**TYPOLGY**
- Lot Size: 23’ x 83’
- Building Size: 23’ x 54’
- Yards: 5’ front, 30’ rear
- Construction Type: Masonry with wood joists
- Foundation Type: Rubble
- Year Built: 1900
- Stories: 5 + cellar
- Residential Floor Area: 4,800 s.f. total
- Residential Units: 8
- Commercial Floor Area: 1,000 s.f. total
- Commercial Units: 1

**SITE CONDITIONS**
- Sidewalk Width: 12’
- Roadbed Width: 45’
- Zoning District: RTA + C1-5 Overlay, Mixed Use

**SITE & BUILDING CONDITIONS**

**SITE CONDITIONS**
- Sites with narrow lot size and shallow rear yard depth. Rear yards typically range from 0 to 6 feet below the sidewalk grade. No side yards are provided. Standard width public streets and standard to wide sidewalk widths are typical of this commercial corridor typology.

**BUILDING TYPOLOGY**
- Commercial and residential use is located at the ground floor with residential use above. Buildings are four to six-story masonry party-walls with wood joists and a rubble foundation. Vertical circulation is provided by stairs and egress is provided by fire escapes. Critical systems are located in the basement/ceellar. Entrances located above and below the sidewalk and property grade.
EXISTING CONDITIONS

FLOOD ELEVATION
12' DFE = BFE + freeboard
= 4' above lowest occupiable floor
= 10' above lowest property grade

ZONING ENVELOPE
The allowable building height is measured from the DFE.
The building is built to the maximum allowable floor area.
In compliance with zoning, the floor area below the DFE can be relocated within the adjusted bulk envelope.

STRUCTURAL SYSTEMS
Five story combustible construction with unreinforced masonry bearing party walls and wood joists on a rubble foundation.

CRITICAL SYSTEMS
All systems are located in a mechanical room in the basement.

ACCESS
Building access is provided at two front locations - one for commercial use and one residential lobby, both 1' above the sidewalk grade.
The building access at the rear yard is provided at two locations, one 5' above rear yard grade and the other 3' below the rear yard grade.

ILLUSTRATIVE RETROFIT STRATEGY

DRY & WET FLOODPROOF
Dry floodproofing cellar and commercial use below the DFE.
Reinforce slabs, foundation walls and exterior walls below the DFE to withstand hydrodynamic and hydrostatic forces.
Install deployable flood gates at commercial building frontage.
Wet floodproof residential lobby area below the DFE by installing flood vents located at exterior and interior walls and replacing all windows, doors, structure and finishes with flood damage resistant materials.
While in full compliance with NYC Construction Code, dry floodproofing commercial uses below the DFE may not receive NFIP premium reduction.

STRUCTURAL SYSTEMS
Systems to remain in place within dry floodproofed cellar.
Provide new interior access to cellar.
When deployable flood shields are in use all egress paths must be provided via temporary stairs up and over the gates. Obtain DOT permit as required.

CRITICAL SYSTEMS
Reconfigure residential lobby per wet floodproofing requirements.
Prepare new interior access to cellar.
Replace access hatch at sidewalk with floodproof compliant model.

ACCESS
Maximize commercial use with new addition at rear.
There is a total gain of 700 s.f. of commercial use.

USE
Maximize commercial use with new addition at rear.

5' front setback
15'
80'
building max. height
65'
street wall max. height
12'
DFE
8'
lower occupiable floor
7'
grade
1'
cellar
30' rear yard
30'
front yard
5'
Residential
Units 7-4
Residential
Units 5-6
Residential
Units 1-2
Commerical
Unit
Residential
Units 7-8
Residential
Units 5-6
Commercial
Unit
Residential
Units 3-4
Residential
Units 1-2
Residential
Units 7-8
Residential
Units 5-6
Residential
Units 3-4
Residential
Units 1-2
Residential
Units 7-8
Residential
Units 5-6
Residential
Units 3-4
Residential
Units 1-2
Residential
Units 7-8
Residential
Units 5-6
Residential
Units 3-4
Residential
Units 1-2
Residential
Units 7-8
Residential
Units 5-6
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Units 3-4
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Units 1-2
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Units 7-8
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Units 5-6
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Units 3-4
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Units 1-2
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Units 7-8
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Units 5-6
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Units 3-4
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Units 1-2
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Units 7-8
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Units 5-6
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Units 3-4
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Units 1-2
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Units 7-8
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Units 5-6
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Units 3-4
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Units 1-2
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Units 3-4
Residential
Units 1-2
Residential
Units 7-8
Residential
Units 5-6
Residential
Units 3-4
Residential
Units 1-2

8'
lower occcupiable floor
5'
front yard
30' rear yard

12' DFE
8'
lower occupiable floor
7'
grade
1'
cellar

DRY FLOODPROOF

Maximize commercial use with new addition at rear.
There is a total gain of 700 s.f. of commercial use.

WET FLOODPROOF

Reconfigure residential lobby per wet floodproofing requirements.
Provide new stair access from commercial space.
Locate remote emergency shut-off above the DFE.
Install waterproof damper at the combustible air intake in mechanical room.

Residential and commercial storefront entries to remain.
Deployable flood shields and temporary stairs installed per DOT revocable consent regulations.

FLOOD ELEVATION

MIXED-USE

MID-RISE WALK-UP

CASE STUDIES
RETROFITTING BUILDINGS FOR FLOOD RISK
**Non-substantially improved buildings within the floodplain are not required to comply with Appendix G of the NYC Building Code. This allows for greater flexibility in adapting buildings for flood resiliency. The alternatives illustrated below lower the risk for buildings and provide practical pathways for adaptation. Under current NFIP regulations, these measures may not lower insurance premiums.**

The blue icons below illustrate adaptive measures that receive full reduction of NFIP premiums. Icons in gray indicate strategies that improve building resilience, but receive no or partial reduction of NFIP premiums.

If the lowest occupiable floor is left below the DFE, life safety must be considered. Residents should always follow evacuation procedures.