



This row house example is a reinforced masonry structure with party-walls, concrete foundation and a garage, recreational room and half bathroom on the ground floor. This structure has two shared bearing walls and is not suitable for structural elevation.

Retrofit strategies that will result in full NFIP reduction in flood insurance premiums require filling the basement/cellar to the lowest adjacent grade, and wet floodproofing the ground floor below the DFE, which results in substantial loss of residential square footage. The amount of lost usable square footage can increase if the ground floor use is not counted towards the floor area, as it is often the case in this typology, since it cannot be relocated. If it is counted towards floor area there may be opportunities to replace a portion of this lost space in a new addition on the roof.

KEY CHARACTERISTICS

FLOOD RISK

Flood Zone/BFE	AE +10'
Grade Elevation	+5' at sidewalk, +3' at rear property
Design Flood Elevation (DFE)	+12' (7' above sidewalk grade)
Lowest Occupiable Floor	+3' (2' below sidewalk grade)
Cellar Elevation	-4' (9' below sidewalk grade)
Critical Systems Location	Cellar

TYOLOGY

Lot Size	20' x 100'
Building Size	20' x 50'
Yards	24' front; 30' rear
Construction Type	Masonry with Wood Joists
Foundation Type	Concrete
Year Built	1965
Stories	2 + basement and cellar
Residential Floor Area	2000 s.f. total
Residential Units	2
Elevator	N/A

SITE CONDITIONS

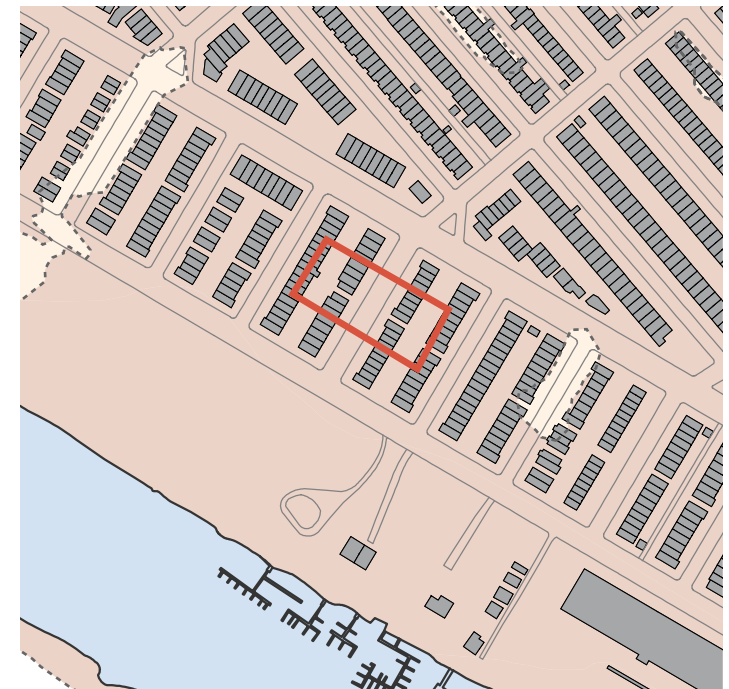
Sidewalk Width	8'
Roadbed Width	34'
Zoning District	R5, Residential

Filling the cellar to the lowest adjacent grade requires foundation, party-wall and slab reinforcement as well as structural interventions that will protect the party-walls. Critical systems can be relocated on the roof or in the backyard in an enclosure if clearance is provided but may incur loss of habitable space if location blocks a window.

Alternative adaptation strategies, currently not recognized by NFIP, include leaving existing residential uses on the ground floor, enclosing critical systems in the cellar within a floodproof enclosure, and dry floodproofing below the DFE.

Partial adaptation could be limited to elevating the critical systems.

All floodproofing solutions require assessment of the building's structural integrity and the implications of changes on the neighboring buildings.



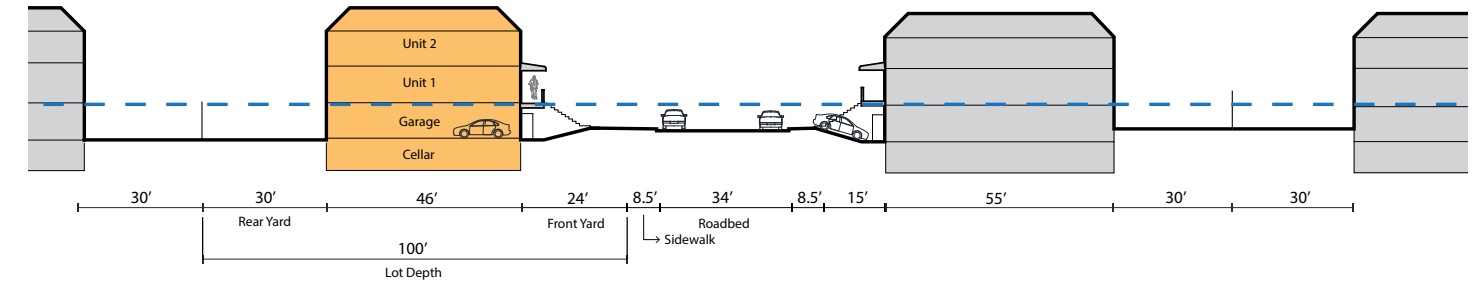
SITE & BUILDING CONDITIONS

SITE CONDITIONS

Sites with standard lot size and rear yards that are 0 to 6 feet below sidewalk grade, and front yard sloping down to sub-grade garage level. No side yards are provided. Streets and sidewalks are typically of standard width.

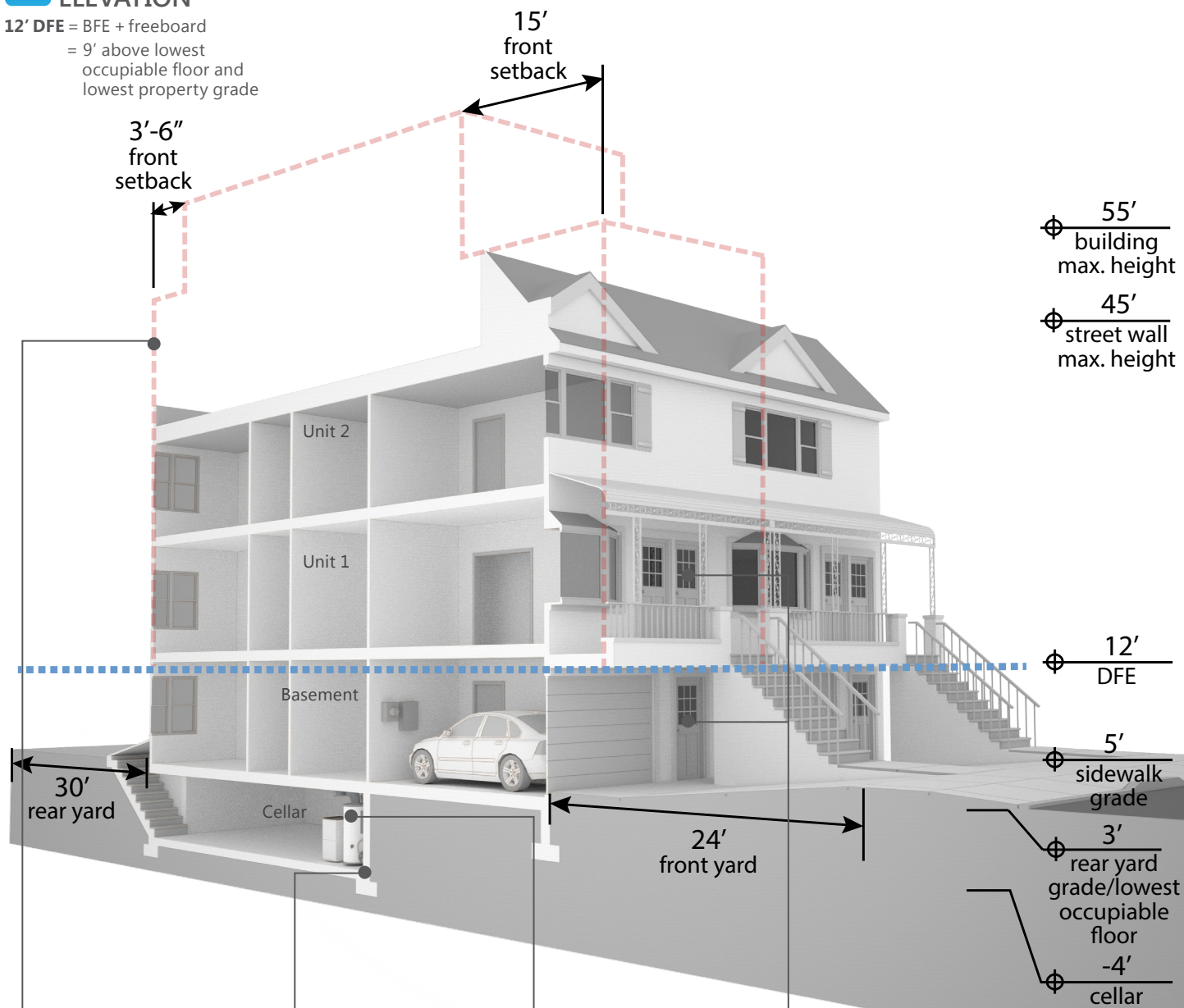
BUILDING TYPOLOGY

Buildings are two to four-story masonry party-walls with wood joists and concrete foundation. Critical systems are located in the basement or cellar. Entrances are located above and below the sidewalk and property grade.



EXISTING CONDITIONS

FLOOD ELEVATION
 12' DFE = BFE + freeboard
 = 9' above lowest occupiable floor and lowest property grade



ZONING ENVELOPE

The allowable building height is measured from the DFE. The building is fully compliant with zoning regulations. The building is built to the maximum allowable floor area, but the ground floor was exempted from floor area due to its use as garage and recreational room. This prevents the ability to relocate this floor area above the DFE within the adjusted bulk envelope.

STRUCTURAL SYSTEMS

Three-story combustible construction with masonry bearing party-walls and wood joists on a concrete foundation.

CRITICAL SYSTEMS

All systems are located in the cellar with the exception of the electrical panels which are located in the garage.

ACCESS

Building access is provided at two front entrances; one located 8' above sidewalk grade and the second located 2' below sidewalk grade. The building access at the rear yard is provided at two locations, both at rear yard grade. Garage access provided at front 2' below the sidewalk grade.

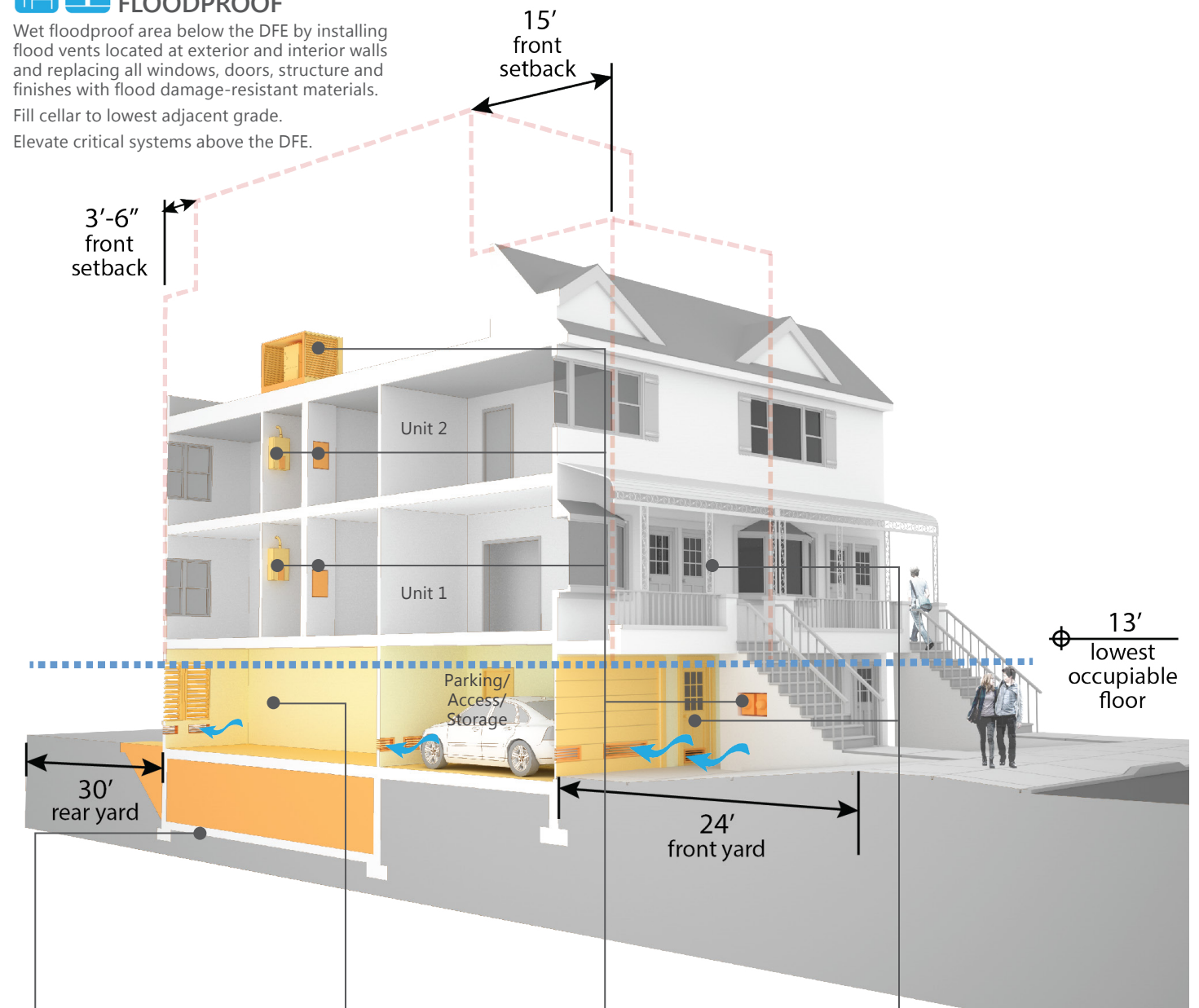
ILLUSTRATIVE RETROFIT STRATEGY

ATTACHED



ELEVATE & WET FLOODPROOF

Wet floodproof 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. Fill cellar to lowest adjacent grade. Elevate critical systems above the DFE.



STRUCTURAL SYSTEMS

Fill the cellar and the rear yard access opening to the lowest adjacent grade. Reinforce the foundation walls and modify the slab in the cellar where fill is added. Tie ground floor structure to walls. If adjacent properties are not infilling their shared party-wall areas reinforce the foundation walls to account for new load. Add reinforcement under relocated critical systems.

USE

Garage level to be converted to storage where the existing use of vehicular parking or access is not programmed. Approximately 600 s.f. of usable space cannot be relocated because the ground floor area was not accounted for as floor area and the building is at the maximum allowable floor area.

CRITICAL SYSTEMS

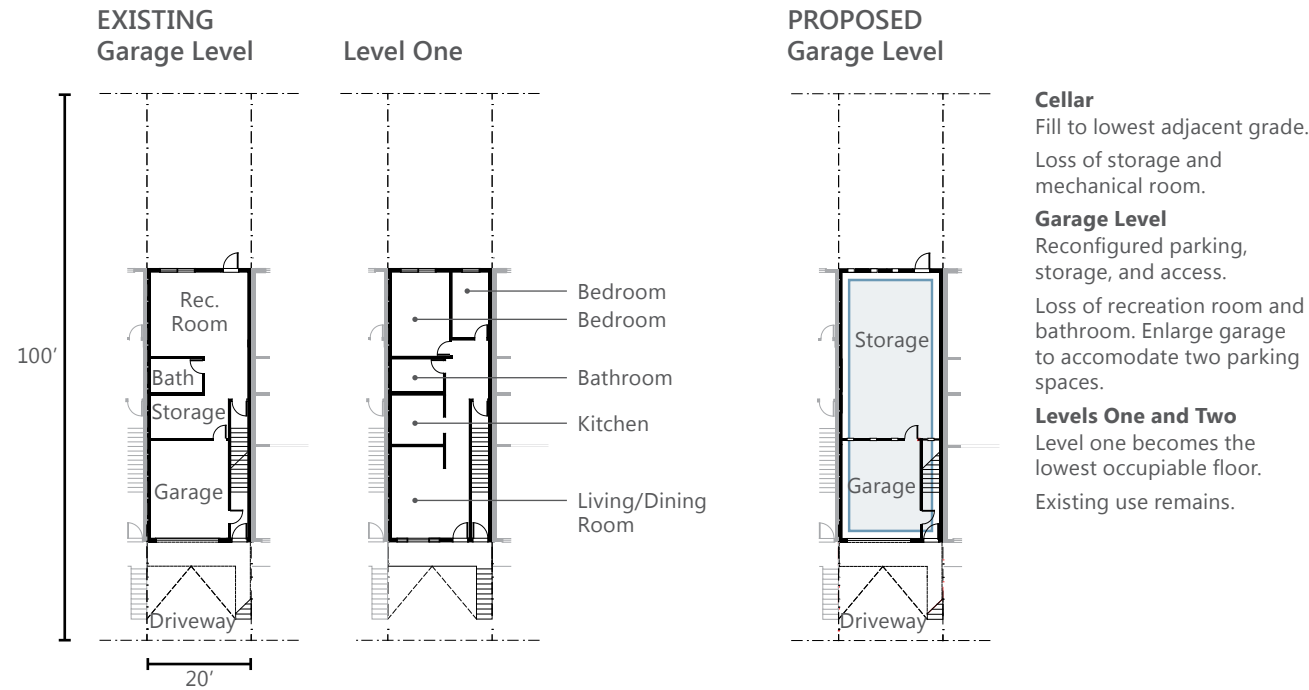
Install individual compact in-unit hot water systems. Elevate partial systems to roof within fireproof and vented enclosure. Isolation and/or vibration pads may be required. Relocate utility services to front yard within encapsulated enclosure. Re-route apartment feeders and branch circuits accordingly.

ACCESS

All doors below the DFE are required to be wet floodproofed by installation of flood vents. Remove cellar hatch at the rear yard access. Existing entrances above the DFE to remain.



CHANGE OF USE



ADAPTATION CONSIDERATIONS

CRITICAL SYSTEMS

When encapsulating electrical equipment stainless steel enclosures provide a certain degree of flood protection for equipment below the DFE. This is temporary protection intended for a flood event. The wiring should be encased in a non-corrosive metal or plastic conduit when allowed by code.



Tank-less water heaters are located adjacent to the fixture that requires heating. They work instantaneously but have little storage capacity, and therefore take up less space making it easier to retrofit buildings using these systems. Natural gas systems require little work for conversion, though electrical systems may require upgrades to provide more power for the system.



NON-SUBSTANTIAL DAMAGE/IMPROVEMENT STRATEGIES

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.

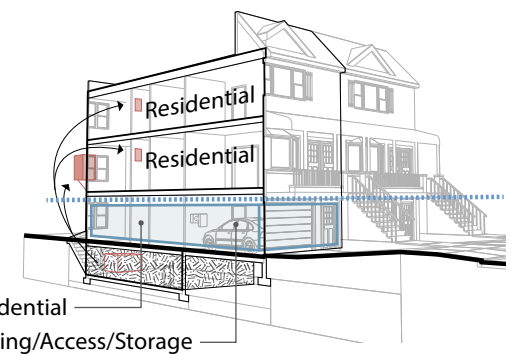
The blue icons below illustrate adaptive measures that receive full reduction of NFIP premiums. Icons in gray indicate strategies that improve building resilience, but receive no or partial reduction of NFIP premiums.

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

- Occupied Space
- Critical Systems
- Dry Floodproof
- Wet Floodproof
- Open Structure
- NFIP Premium Reduction

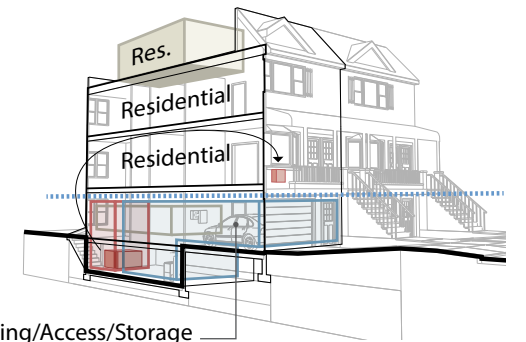
- Elevate the critical systems above the DFE. Fill the structure to the lowest adjacent grade.
- Wet floodproof garage level. Install flood vents and replace all windows, doors and finishes with flood damage-resistant materials.
- Existing residential use remains with exception of loss of use at the cellar.
- Fill cellar to the lowest adjacent grade. Add reinforcement to foundation walls. Ensure changes to party-walls do not impact neighboring property's structural integrity.
- Elevate the systems above the DFE within a fire-rated and vented enclosure in the rear yard. Install in-unit hot water systems.

No or partial reduction in NFIP premiums. Residential use remains located below the DFE. Lowest occupiable floor is below the DFE.



- Elevate the lowest occupiable floor above the DFE.
- Wet floodproof partial garage level. Install flood vents and replace all windows, doors, and finishes with flood damage-resistant materials.
- Dry floodproof cellar and partial garage level below the DFE by strengthening the foundation, floors and walls and sealing all penetrations. Provide temporary flood shields at windows and doors.
- If floor area at the garage level is within allowable floor area, relocate to addition on the roof. Restrict uses at wet floodproofed areas to parking, crawl space, access, and storage.
- Add reinforcement to roof, party-walls, exterior walls, and foundation walls and slab. Ensure changes to party-walls do not impact neighboring property's structural integrity.
- Critical systems to remain in place within dry floodproofed mechanical room. Provide emergency shut off above the DFE. Elevate electrical utilities above the DFE.

No or partial reduction in NFIP premiums. Critical systems remain located below the DFE. Existing cellar use remains. Dry floodproofing is not permitted at residential use.



No or partial reduction in NFIP premiums. Critical systems and residential use remain located below the DFE. Existing cellar use remains. Dry floodproofing is not permitted at residential use. Lowest occupiable floor is below the DFE.

