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## **Regulatory Environment Influencing Industrial Resiliency**

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Government regulations and programs related to floodplain management, building construction, land use, flood insurance, and the storage of hazardous materials are important drivers of industrial resiliency. This chapter describes key city, state, and federal regulatory programs that require, encourage, or constrain actions by private industry to reduce flood risk in New York City.



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## Floodplain Regulations

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Floodplain regulation in New York City is tied to Flood Insurance Rate Maps and flood resistant construction standards developed by the Federal Emergency Management Agency (FEMA) and incorporated into the NYC Building Code.

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## Flood Insurance Rate Maps

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FEMA's Flood Insurance Rate Maps (FIRMs) are the official flood maps referenced in New York City's Building Code and Zoning Resolution. They are also used to set flood insurance premiums under the National Flood Insurance Program. Floodplains shown on FIRMs are classified according to levels of risk, with each zone indicating the severity or type of flooding.

Properties located in the V Zone, Coastal A Zone, or A Zone are in the 1 percent annual chance floodplain and are considered at high risk of flooding. The X Zone represents the 0.2 percent annual chance floodplain, areas that are considered to be at moderate risk of flooding and may also benefit from strategies that enhance flood resiliency. The FIRMs also convey the projected flood elevation of the 1 percent annual chance storm at most locations, known as the Base Flood Elevation.

New York City adopted its first FIRMs and floodplain regulations in 1983. Because many buildings predate these original FIRMs, floodplain regulations and NYC Building Code requirements distinguish between pre-FIRM buildings constructed before official flood maps were created, and post-FIRM buildings constructed after the City adopted these flood maps.

**The average construction year of industrial buildings in the 1 percent annual chance floodplain is 1946, and 87 percent are pre-FIRM buildings.**

**Flooding of industrial facilities during Hurricane Sandy in Maspeth, Queens.**

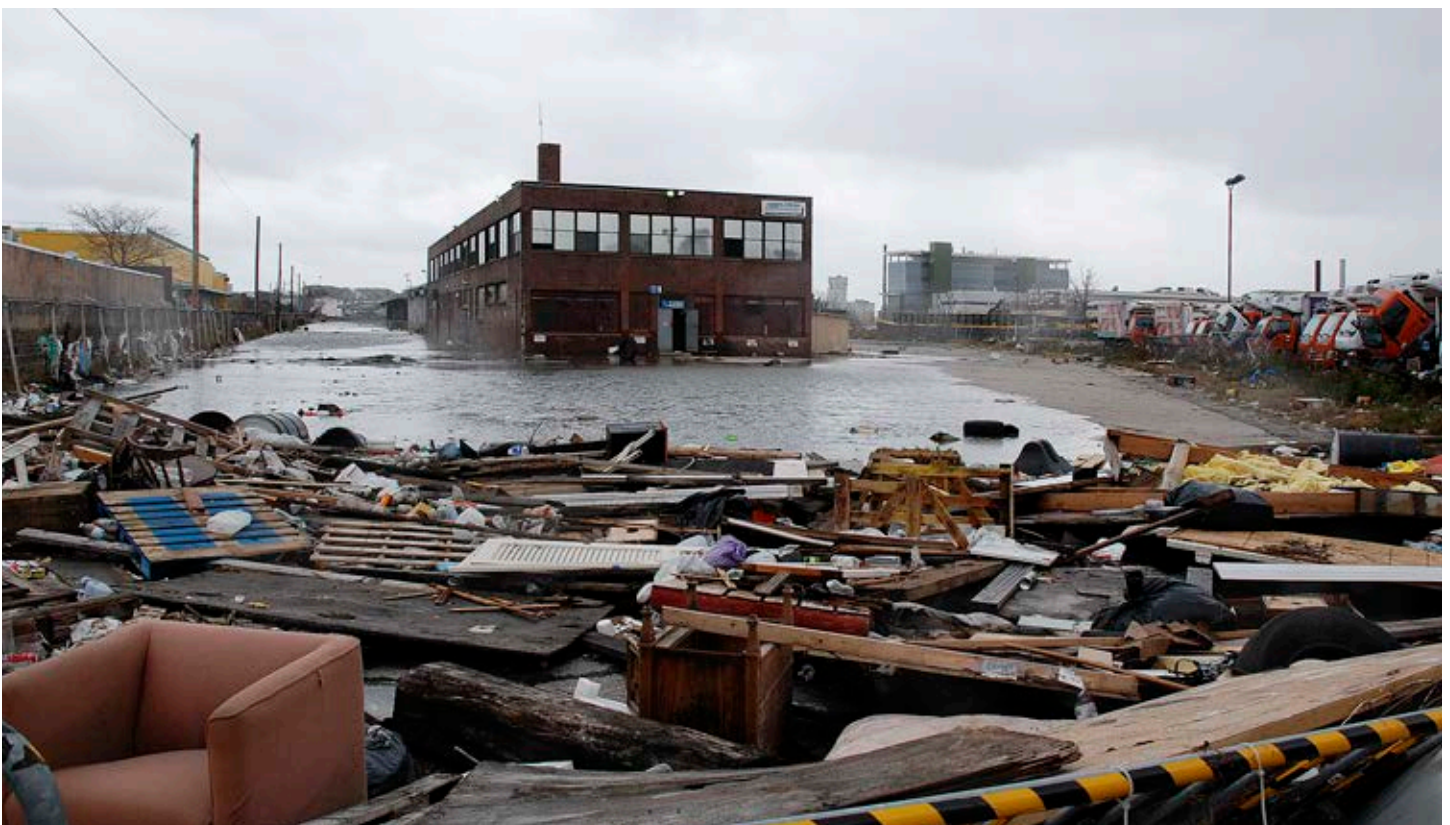
## **Flood-Resistant Construction Standards**

Design and construction of new buildings and major alterations in the floodplain are regulated in large part by FEMA, which establishes FIRMs and references the American Society of Civil Engineers (ASCE 24) as a minimum standard for floodplain construction. The NYC Department of Buildings is designated as the Floodplain Administrator and is tasked with enforcing Appendix G of the NYC Building Code, the section that prescribes standards for construction in the floodplain. Appendix G applies to post-FIRM buildings—those completed on or after the City adopted its first floodplain regulations—November 13, 1983. Appendix G also applies to pre-FIRM buildings where the footprint is being increased or where alterations to the building increase the degree of noncompliance with regard to flood-resiliency.

The flood-resistant construction standards in Appendix G also apply to structures that undergo Substantial Improvements, meaning that the cost of rehabilitation, addition, or improvement to a building equals or exceeds 50 percent of its

market value before the improvement starts. Similarly, repairs to structures that experience Substantial Damage, where the cost of restoring the structure to its pre-storm condition would equal or exceed 50 percent of the market value of the structure before the damage occurred, must also comply with Appendix G. If the building falls within either of these definitions it must be brought to current flood-resistant construction standards, in addition to other NYC Building Code requirements.

In reality, many industrial buildings in the city are not required to comply with requirements set forth in Appendix G. The majority of industrial buildings are existing pre-FIRM buildings, and where alterations or repairs do not trigger Appendix G applicability, such as Substantial Damage or Substantial Improvements, compliance with current flood-resistant construction standards is not required. The average construction year of industrial buildings in the 1 percent annual chance floodplain is 1946, and 87 percent are pre-FIRM buildings. For this reason, many industrial facilities continue to operate in facilities that are less flood-resilient than current NYC Building Code standards require for new construction.





## Efforts should be made to create consistent design standards for flood resiliency across local, state, and federal programs.

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### Freeboard Requirements

To ensure that buildings are sufficiently resilient with regard to expected flooding, Appendix G requires developments to provide an additional margin of safety above the FEMA-designated BFE. This additional margin of safety is known as “freeboard,” and varies depending on which flood zone the property is in, as well as the use of the building. For example, some industrial businesses that are considered critical facilities, such as bulk petroleum distribution, that are located in the A Zone have a freeboard requirement of two feet above the BFE, while other non-critical industrial uses may only have a freeboard requirement of one foot above the BFE.

The elevation of the BFE plus freeboard is called the Design Flood Elevation (DFE). As of 2017, these standards apply to the floodplain shown on FEMA’s Preliminary FIRMs or the 2007 Effective FIRMs, whichever of the two is more restrictive. To determine the freeboard requirement for a specific industrial use, consult Appendix G of the NYC Building Code.

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### State Freeboard Standards

New York State is in the process of developing guidance on flood risk management as it implements the Community Risk and Resiliency Act (CRRA) with the goal of ensuring that state funding and permits include consideration of the effects of climate risks and extreme-weather events. At present, the design standards are not entirely consistent among local, state, and federal frameworks. For example, after the CRRA is implemented, critical infrastructure in the A Zone that receives state funding may need to include three feet of freeboard or take into account climate change, while the same project without state funding may only need to include one or two feet of freeboard to comply with the NYC Building Code. Efforts should be made to create consistent design standards for flood resiliency across local, state, and federal programs.

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### Fully Compliant Mitigation Strategies

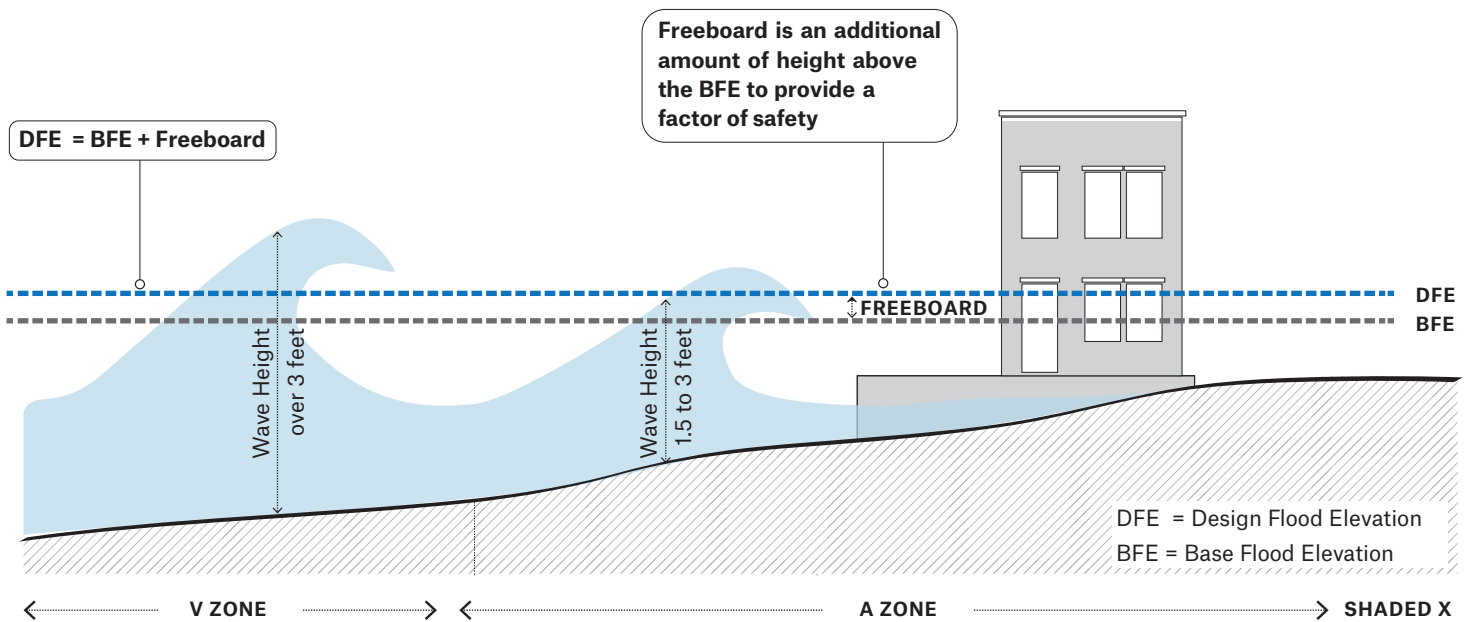
To be fully compliant with Appendix G, nonresidential structures in the 1 percent annual chance floodplain can pursue one of two options:

1. Elevate the lowest floor to the DFE or higher, with limited wet floodproofed spaces permitted below.
2. Dry floodproof to the DFE or higher.

Nonresidential buildings that are not Substantially Damaged or Substantially Improved are not required to meet NFIP and Appendix G requirements as long as changes to the building do not increase the degree of noncompliance. However, an owner and operator may voluntarily choose to take steps to reduce the building’s vulnerability to flooding to lower risk to the business, enable the building to be reoccupied more quickly in the aftermath of a storm, and in some cases reduce flood insurance premiums.

All new nonresidential development in the 1 percent annual chance floodplain is required to comply with Appendix G of the NYC Building Code, by dry floodproofing to a height equal to or exceeding the DFE. If the building is elevated, the area below the DFE can be used only for parking, building access or minor storage. If dry floodproofing is used to comply with Appendix G, the lowest occupiable floor may be located below the DFE and any nonresidential use is permitted in the dry floodproofed area below the DFE.

Within the V Zone, the 1 percent annual chance floodplain where wave heights are likely to exceed three feet, dry floodproofing is not permitted as an Appendix G compliant strategy for any structures. Buildings in Coastal A Zones, where expected waves heights during flood events are between 1.5 and 3 feet, are likely to have similar requirements to V Zones. However, Coastal A Zones have not yet been incorporated into the final FIRMs for New York City.



	ELEVATE	WET FLOODPROOF	DRY FLOODPROOF
	Open Structure Eg. Open Lattice	Water to run in/run out Eg. Flood Vents	Watertight Structure Eg. Flood Shields
GROUND FLOOR CONFIGURATION	<p>Open Structure</p> <p>Bottom of lowest structural member to be at or above Design Flood Elevation</p>	<p>1 inch of net open area per 1 sq.ft of enclosed area</p> <p>Lowest occupiable floor To be at or above Design Flood Elevation. (Not permitted for non-residential buildings that are substantially damaged/improved)</p>	<p>Flood shields prevent water from entering</p> <p>Lowest occupiable floor Allowed to be excavated below grade. (Not permitted for residential buildings)</p>
PERMITTED USES BELOW THE DFE	<input checked="" type="checkbox"/> Parking <input checked="" type="checkbox"/> Access <input checked="" type="checkbox"/> Storage <input checked="" type="checkbox"/> Non-Residential <input checked="" type="checkbox"/> Residential	<input checked="" type="checkbox"/> Parking <input checked="" type="checkbox"/> Access <input checked="" type="checkbox"/> Storage <input checked="" type="checkbox"/> Non-Residential <input checked="" type="checkbox"/> Residential	<input checked="" type="checkbox"/> Parking <input checked="" type="checkbox"/> Access <input checked="" type="checkbox"/> Storage <input checked="" type="checkbox"/> Non-Residential <input checked="" type="checkbox"/> Residential



**Example of a large industrial building in Gowanus, Brooklyn where structural elevation would be impractical and exorbitantly costly.**

## **Challenges to NFIP Compliance for Industrial Buildings**

Elevating industrial buildings can be accomplished by either lifting the existing structure or by relocating the lowest floor above the DFE if the floor-to-ceiling clearance is sufficient. When elevating a building, areas below the DFE can be left open, or they can be wet floodproofed and used only for parking, building access, crawl space, or minor storage. Equipment, utility connections, and all interior utility systems including ductwork must also be relocated above the DFE.

Within New York City, there are many practical, economic, and structural challenges associated with elevating industrial buildings, particularly for retrofits of existing buildings. Because

many industrial buildings have large footprints and are designed to accommodate heavy loads, elevating the entire structure is often prohibitively costly. Where businesses occupy space in attached buildings with shared walls, elevation typically requires coordination with and disruption to adjacent businesses, creating an additional barrier for individual property owners wishing to retrofit.

Efficient access for truck loading is an essential component of many industrial spaces, and elevation may require a reconfiguration of loading docks. Where elevations are very high, truck-dependent businesses may experience reduced operational efficiency from having active spaces located far above grade, or be required to invest in lifts or conveyor systems to overcome these barriers.

**Businesses with shared walls would also need to ensure that interior walls are watertight and reinforced should the adjacent business flood.**

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## **Non-Structural Elevation**

An alternative to structural elevation of buildings is the relocation of active uses above the DFE rather than physically lifting the superstructure to an appropriate elevation. Non-structural elevation in industrial buildings can be achieved by filling below grade space, such as existing basements or cellars, and abandoning the remaining occupiable floor(s) below the DFE. If this strategy is taken, all enclosed spaces below the DFE must be wet floodproofed and remain only as space for vehicular parking, building access, crawl space, and minor storage.

The tendency for industrial buildings to have high floor-to-ceiling heights makes non-structural elevation a viable option for some businesses. This is especially true for buildings with a low DFE, where access to loading docks and the street would not be significantly impacted by raising the level of the floor.

Industrial property owners that elevate-in-place must ensure that the superstructure and the foundation are able to adequately withstand flood related forces, including the pressure of wave action and flowing flood water (hydrodynamic), as well as the pressure exerted by pooled or standing water (hydrostatic) that are expected during flood events. By wet floodproofing the area below the DFE, flood waters are able to flow in and out of the building, which helps to equally distribute pressure.

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## **Dry Floodproofing**

The other NFIP-compliant resiliency option for industrial buildings is to dry floodproof by constructing or retrofitting building walls and foundations to be impermeable to water. When dry floodproofing a building, the superstructure and the foundation must be able to withstand the hydrodynamic and hydrostatic pressures expected during flood events. Other flood-related debris impacts and drainage considerations must also be taken into account when designing dry floodproofing measures to ensure that the building's load-bearing and structural integrity is maintained throughout a flood event.

Dry floodproofing treatments must ensure that a building remains watertight below the DFE and substantially impermeable to the passage of flood water. According to FEMA, dry floodproofing should not result in the accumulation of more than 4 inches of water depth during a 24-hour period. Additionally, sump pumps are required to be installed to control water seepage. Building material must also be flood resistant and all critical building systems must be designed or situated in such a way as to prevent water from entering during a flood event. FEMA also stresses that dry floodproofing is not a recommended strategy when the Base Flood Elevation exceed three feet or if flooding is expected to persist for more than 12 hours.

Floodproofing, including sealing any commercial uses below the DFE, enables businesses to remain at street level, an important consideration for many businesses that rely on access to trucks or forklifts for loading. However, due to the large perimeter of many industrial buildings, and the reality that many existing industrial buildings need structural reinforcement to effectively dry floodproof, this approach is often prohibitively costly. Additionally, businesses with shared walls would also need to ensure that interior walls are watertight and reinforced should the adjacent business flood. Dry floodproofing requires that basements be filled or protected against water entry.



## Installation of Floodproofing Technologies

Floodproofing technologies require periodic maintenance and, in many cases, require active installation in advance of a storm. Dry floodproofing strategies that are not passive or self-deploying require warning time to activate, install, or deploy. This can include time for evacuating residents and employees, coordinating with building personnel, transporting equipment from off-site storage facilities to the site, as well as time and resources required for the installation of flood panels and staircases for required egress. Some components must have a continuous source of electricity if required to operate during a flood event, including alternate power where primary power cannot be guaranteed. Effective dry floodproofing requires that all critical building systems, including electrical, plumbing, heating and ventilation or air conditioning systems be designed or situated in such a way as to prevent water from entering during flooding. Because waterproof doors require maintenance to remain reliable, some businesses may choose to invest in submarine rated doors in locations where the door is not needed for heavy daily use.

## Partial Mitigation Strategies

In addition to the NFIP-recognized strategies of elevation or dry floodproofing described previously, there are several partial mitigation strategies that business and property owners may implement to reduce damages. For example, elevating electrical systems within an existing building, without simultaneously elevating or dry floodproofing, can be described as partial mitigation. These strategies are described as “partial” because they would help mitigate flood risks for specific systems or portions of a building, but the building would still not meet the current flood-resistant construction standards. For this reason, they generally would not decrease insurance premiums through the NFIP. Despite these regulatory constraints and lack of incentives for partial floodproofing, this strategy can be an attainable, cost-effective, and practical solution for many businesses seeking to reduce flood risk by providing an increased level of protection for their existing buildings and their contents.

**Generator elevated above the DFE at a maritime facility in Red Hook, Brooklyn.**

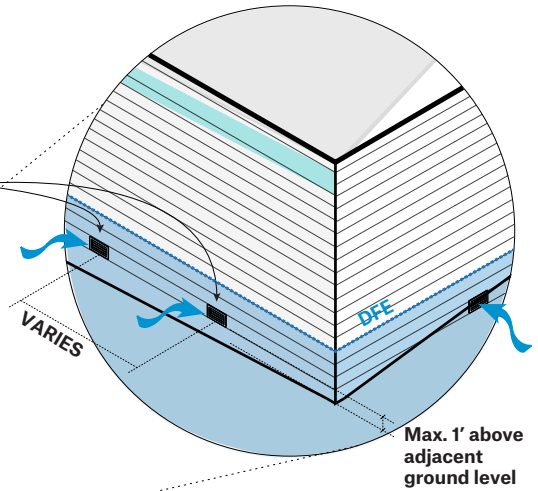
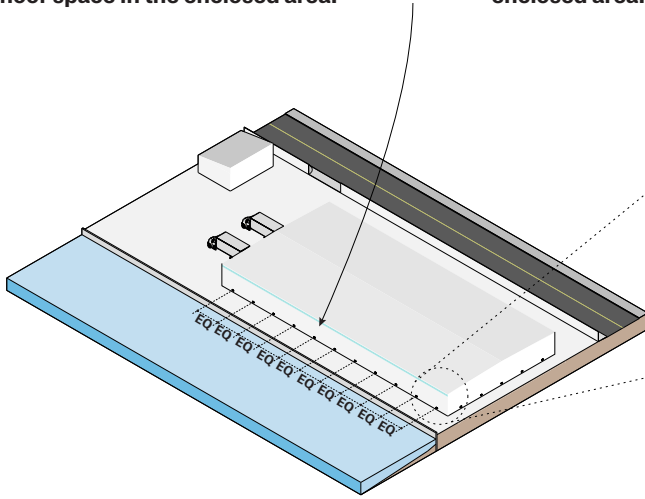
**DFE**





Flood vents provide openings for flood water to enter and exit a building at the same rate as flood waters outside. At least two wall openings on separate walls must be provided for each enclosed area. The total size of openings must be equal to at least 1 square inch for every square foot of floor space in the enclosed area.

NYC Flood-Resistant Construction regulations require a minimum of two openings on different sides of each enclosed area.



### Wet Floodproofing Industrial Space

Wet floodproofing is a technique to prevent or reduce damage from flooding by intentionally allowing water to enter the structure during a storm or flood event. This involves the use of flood-damage resistant materials and installation of flood vents in areas of the building below the DFE. Although the NFIP and Appendix G of the NYC Building Code only allow wet floodproofing for building access, parking or minor storage, existing businesses in nonresidential buildings may choose to pursue this technique in regularly occupied spaces to minimize flood damage with fewer costs and less significant structural modifications.

While cellars and other below-grade spaces may still need to be filled, businesses can remain active on the ground floor by incorporating designs that elevate or seal shut outlets, electrical equipment, and sensitive inventory above the DFE. If the NFIP provided options for wet floodproofed nonresidential space as a means to minimize losses from floods, business owners may have a greater incentive to develop the creative solutions necessary to lower flood risk while maintaining functional industrial operations.

### Protecting Mechanical and Electrical Systems

One of the most significant sources of loss for many industrial businesses during Hurricane Sandy was damage to electrical and mechanical systems, including electrical substations, electrical panels, boilers, heating and air conditioning systems, and mechanical equipment used for industrial production.

If elevation or dry floodproofing options are not feasible, businesses may choose to prioritize flood protection for mechanical and electrical systems, such as enclosing electrical substations in reinforced concrete rooms with waterproof doors, elevating generators on concrete pads or steel platforms, or relocating HVAC systems to higher floors or the roof.

As noted earlier, local floodplain regulations, based on federal codes, require such systems to be elevated to at least the DFE as part of an NFIP-compliant strategy. If businesses do elevate mechanical systems, this action alone will not generally provide flood insurance reductions. Due to the constraints of full NFIP compliance and the benefits of these partial floodproofing strategies that protect core components of the building and business operations, these alternatives should be recognized for partial insurance credit and floodplain compliance.



**Post-Sandy claims suggest that the limit for coverage may be insufficient for many industrial businesses and that efforts to reduce content damage may be particularly valuable in reducing overall losses.**

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## National Flood Insurance Program

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The NFIP is intended to reduce the consequences of flooding by providing insurance to property owners and by encouraging communities to adopt and enforce floodplain management regulations to prevent losses. Flood insurance has the potential to be an important driver of resiliency, both as a way of minimizing long-term financial impacts for businesses and, if structured properly, as a way to create incentives to spur resilient construction and retrofits.

According to NFIP Damage Claim Data provided by FEMA in 2015, nonresidential NFIP policy holders, which include industrial businesses, were heavily impacted by Hurricane Sandy, with nearly \$215 million in reported building damage and \$60 million in content losses. Citywide, nonresidential building and content damage was compensated at a lower rate by NFIP than residential properties, suggesting that the federal flood insurance program is less equipped to meet the needs of many industrial and commercial businesses.

Nonresidential NFIP policies, which include industrial businesses, limit coverage to \$500,000 for structural damage to the building and \$500,000 for damage to contents. Notably, business tenants who rent space are only able to purchase content coverage. Businesses in manufacturing districts with active NFIP policies prior to Hurricane Sandy generally had building coverage up the limit of \$500,000, and claims were generally below this limit. In contrast, content coverage for nonresidential property in industrial areas tended to be purchased below the \$500,000 limit, with an average of \$288,000. However, claims for contents were much more variable and in many cases exceeded the \$500,000 limit. These post-Sandy claims suggest that the limit for coverage may be insufficient for many industrial businesses and efforts to reduce content damage are particularly valuable in reducing overall losses.

Some industrial businesses are able to self-insure by setting aside funds that may be used during floods or other disruptions. In some instances, larger companies may choose to purchase flood insurance from private insurance or reinsurance markets. However, private insurance policies are typically available only to companies with significant assets, and generally have deductibles of \$500,000.

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## Zoning

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Zoning is the City's primary mechanism to regulate the bulk, use, and location of development. Zoning influences the subtle variations in building size and shape that help define a neighborhood's character and allows for the development of compatible uses alongside one another.

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### Zoning and Industrial Policy

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The city is divided into three basic zoning districts: residential (R), commercial (C), and manufacturing (M). Manufacturing districts allow for a range of industrial activities important to New York City's economy—from warehouse and distribution centers, construction yards, and manufacturing businesses to film production studios, ferry and ship terminals, and essential municipal facilities like sewage treatment plants, train yards, and sanitation garages. In addition to these traditional and emerging industrial uses, manufacturing districts allow many commercial uses and, with some limitations, certain community facilities, such as ambulatory health care and houses of worship.

Industrial uses are permitted in the three manufacturing districts—M1, M2, and M3—according to the characteristics of their operations. Performance standards are tied to each district, limiting the

amount and type of industrial nuisances permitted within each district. Light manufacturing uses are permitted in all manufacturing districts, and uses that have the potential to be more noxious are generally limited to M3 districts, but may also locate in M1 and M2 districts if they comply with the higher performance standards of those districts.

The NYC Zoning Resolution separates industrial and residential areas to insulate residential communities from adverse impacts of industrial activities, such as noise or dust. Although new residences are not permitted in manufacturing districts, many existing residences remain in predominantly industrial areas because of historic land use patterns that predate the Zoning Resolution.

Consistent with the historical development of the city's industrial economy along the waterfront, zoning has codified many waterfront areas as manufacturing districts. Maintaining a thriving industrial sector in these waterfront areas requires zoning provisions that allow for innovative solutions to protect industrial operations against flood risk. Given the high proportion of existing, pre-FIRM industrial buildings in these areas and growing flood risks associated with climate change, zoning should not constrain, and where possible, encourage retrofits that reduce flood risk and strengthen the long-term viability of the city's industrial sector.

**M1-2 zoning district  
in Greenpoint,  
Brooklyn.**





## Flood Resilience Zoning Text Amendment

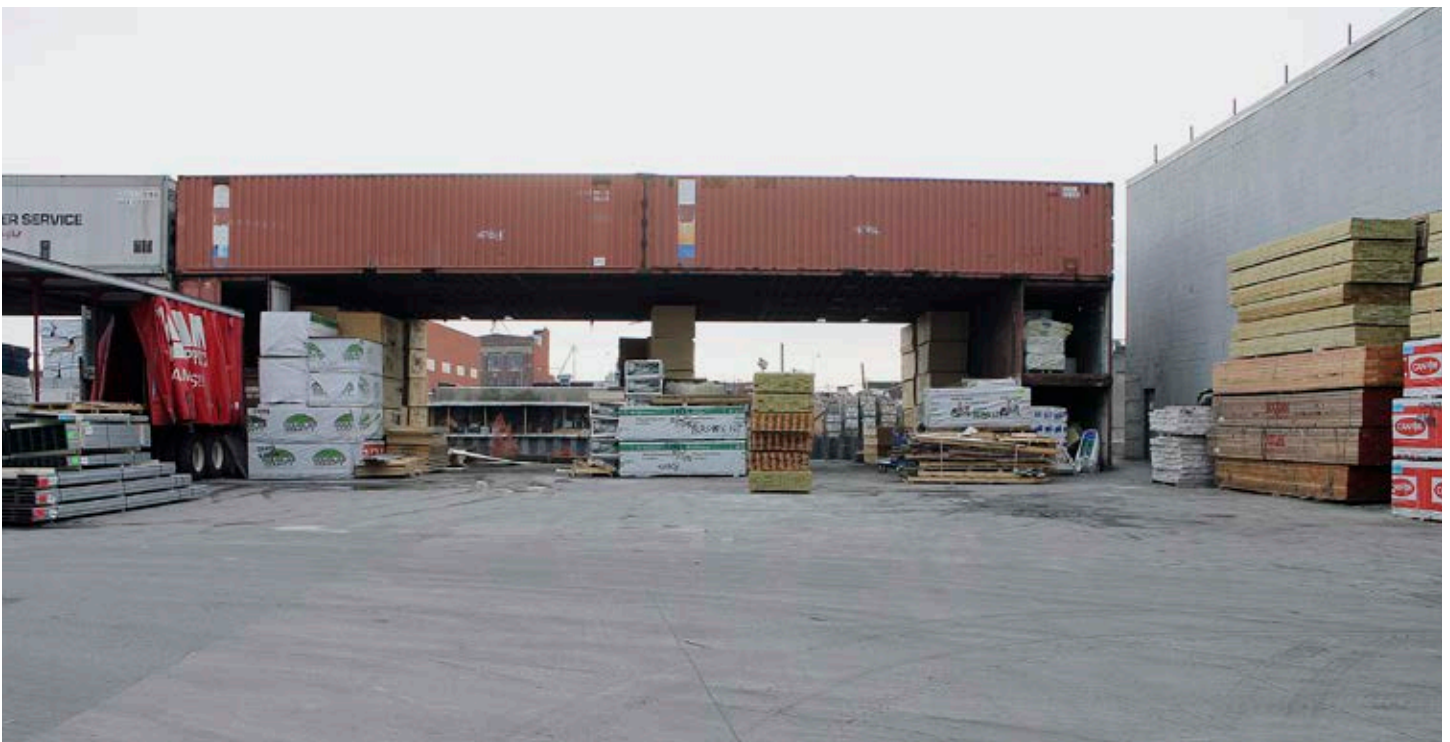
As a means to facilitate more resilient development and reconstruction in the 1 percent annual chance floodplain following Hurricane Sandy, the NYC Department of City Planning adopted a zoning text amendment to address flood resilience in October 2013, codified in Article VI, Chapter 4 of the Zoning Resolution: Special Regulations Applying in Flood Hazard Areas. The zoning text amendment was designed to encourage flood-resilient construction throughout designated floodplains by removing regulatory barriers that hinder or prevent the reconstruction of storm-damaged properties. It also enables new and existing buildings to comply with new, higher flood elevations issued by FEMA, and to comply with new requirements in the NYC Building Code.

The Special Regulations Applying in Flood Hazard Areas text amendment was an emergency action to enable construction based on the best available flood hazard data. The proposed text amendment is scheduled to sunset within one year of the adoption of new, final FIRMs. This provision is designed to ensure that the NYC Department of City Planning pursues a long-term zoning solution based on the officially adopted maps.

The text amendment provides additional flexibility in building height, floor area, and other elements of zoning, and mostly applies to buildings that come into compliance with flood-resistant construction standards, as defined by Appendix G of the NYC Building Code. For example, nonresidential buildings that choose to retrofit and come into compliance with flood-resistant construction standards are able to measure building height from the DFE. Similarly, these provisions allow nonresidential buildings to exempt floor area that is dry floodproofed or used for entryways below the DFE, and provide more flexibility to locate mechanical equipment on the roof of buildings or in rear yards.

For many industrial businesses, the high cost of the necessary improvements to come into full compliance with Appendix G of the NYC Building Code makes it unlikely that many industrial property owners would take advantage of the zoning flexibility designed to encourage retrofits that enhance resiliency. Options that reduce zoning barriers to resilient retrofits, even if the building is not fully compliant with the NYC Building Code, would further encourage flood mitigation within the city's industrial floodplain.

**Construction materials distributor located in the floodplain.**





**Petrochemical facility along Newtown Creek in North Brooklyn.**

## Hazardous Material in the Floodplain

Many industrial processes pose hazards to public safety or environmental quality. Of the estimated 1,700 industrial businesses located in the city's 1 percent annual chance floodplain, many are in sectors that regularly store and use hazardous substances, such as auto repair, metal fabrication, waste management, and telecommunications. In addition to the inherent risks from stillwater flooding, the industrial businesses located within the V Zone and Coastal A Zone face the added risk of impacts from wave action during storm surge.<sup>8</sup>

## Community Right-to-Know

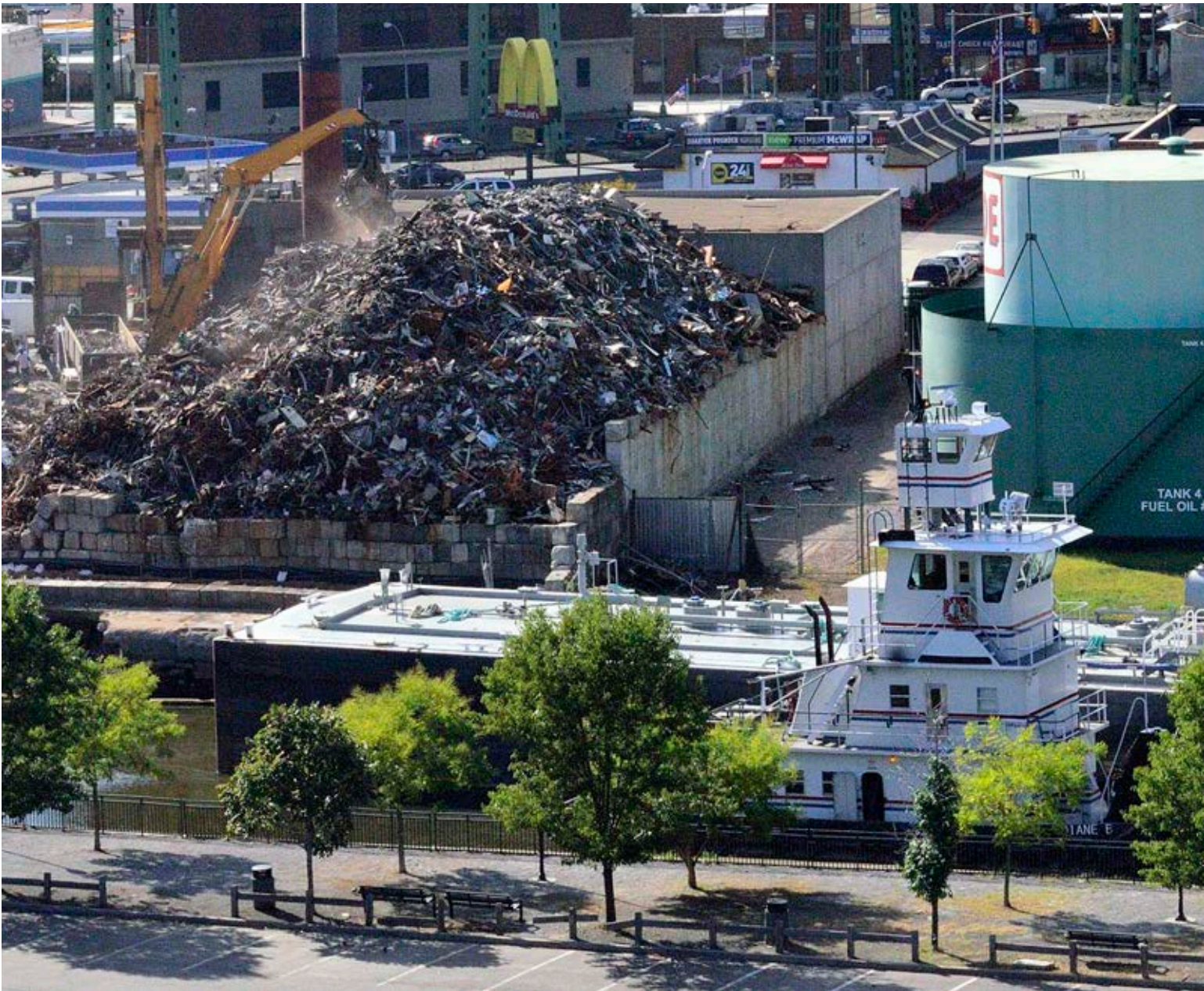
The Community Right-to-Know (RTK) Law requires the City to regulate the storage, use, and handling of hazardous substances. As part of the law, the NYC Department of Environmental Protection (DEP) oversees the use and storage of hazardous substances that pose a threat to public health and the environment in the city. The RTK program requires each business to annually file a report detailing the quantity, location, and chemical nature of every hazardous substances stored within their facility. In addition to maintaining a database of hazardous materials, DEP conducts inspections of facilities that store hazardous substances to ensure compliance under the RTK Law. In Fiscal Year 2016, DEP conducted over 11,000 of these inspections.<sup>9</sup>

Based on reporting of damage and spills following Hurricane Sandy, approximately 11 percent of all facilities within the RTK database were affected by the storm, and 18 facilities reported spills caused by Hurricane Sandy. To reduce the potential for future spills, DEP released recommendations in the wake of Hurricane Sandy about chemical safety and spill prevention during flood events.<sup>10</sup> During inspections of facilities located in the floodplain, DEP now recommends that business owners, operators, and managers take precautions to reduce chemical spills.

### Recommendations for Spill Prevention During Flooding Events

- Use appropriate storage containers
- Properly label all containers
- Segregate chemicals
- Minimize the amount of chemicals on site
- Properly elevate all materials
- Schedule pick-ups and deliveries appropriately
- Ensure inventory records are current
- Check weather forecasts regularly
- Review and implement emergency procedures if a Risk Management Plan is required for your facility





**The New York City Panel on Climate Change projects that rising sea levels will progressively expand the future 1% annual chance floodplain to include, among other things, an increasing number of industrial businesses.**





**Photo Credit:**  
**Steven Pisano<sup>11</sup>**

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## **Minimizing Hazardous Material Risks**

The NYC Special Initiative for Rebuilding and Resiliency (SIRR) Report, released in the aftermath of Hurricane Sandy, noted the importance of having facilities that store hazardous materials take into account the FEMA floodplain and identified a range of flood resiliency measures for mitigating flood risk in existing buildings.

The New York City Panel on Climate Change (NPCC) projects that rising sea levels will progressively expand the future 1% annual chance floodplain to include, among other things, increasing numbers of industrial businesses, while flooding

will likely become more frequent in some areas already subject to 100-year flood events.

Following Hurricane Sandy, DEP developed recommendations for the storage of hazardous materials in the floodplain and makes these available to businesses through the Community Right-to-Know Program. The City continues to work with industrial businesses to reduce the likelihood of future hazardous material leaks and spills due to flooding and other impacts of climate change.



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## Chemical and Petroleum Bulk Storage Program

The New York State Department of Environmental Conservation (DEC) implements the Chemical Bulk Storage and Petroleum Bulk Storage programs to establish requirements and conduct inspections to ensure safe storage and handling of large quantities of hazardous substances. DEC also implements a number of other programs related to the use and storage of hazardous substances, including Federal Underground Tank Regulations, the Major Oil Storage Facility Program, and the Liquefied Natural Gas Program.

These programs provide important regulations for hazardous substances in the city, and DEC inspection programs are active in the city to reduce the likelihood of spills or leaks. However, many of the industrial businesses in New York City's floodplain are small- and medium-sized establishments that do not meet the threshold to be regulated and inspected by DEC. In these cases, the Community RTK Program plays an important role in providing guidance and standards for the appropriate storage of hazardous materials in the floodplain.





**Petrochemical facility along Newtown Creek in Greenpoint, Brooklyn.**

**Vegetated shoreline along Arthur Kill in Staten Island.**

## **Brownfield Remediation**

New York City has more than 7,000 properties subject to mandatory environmental study and management, and approximately 40 percent of these may be brownfield sites. Brownfield cleanup and redevelopment offers an important opportunity to more effectively use the existing stock of land in the city while reducing environmental contamination. Because brownfields in New York City and across the country are disproportionately located in low-income communities, brownfield remediation also plays an important role in alleviating social and environmental inequality. Brownfields can contain a wide variety of pollutants, including heavy metals and organic solvents, which remain from the city's legacy of industrial land uses and once lax pollution management practices that predated modern environmental and business standards.

DEC created the Brownfield Opportunity Areas (BOA) program in 2003 to provide municipalities and community-based organizations with assistance, up to 90 percent of the eligible project costs, to complete revitalization plans and implementation strategies for areas or communities affected by the presence of

brownfield sites, and site assessments for strategic brownfield sites.

Building on the state's BOA program, New York City initiated the nation's first municipal brownfield cleanup program in 2007—the NYC Voluntary Cleanup Program. OneNYC expanded the City's commitment to brownfield cleanup, including a goal to clean up 750 properties within four years, broader support of community brownfield planning efforts, and an increased effort to facilitate cleanup of properties in the floodplain to reduce environmental risks from storm surge and erosion.

To accelerate cleanup of flood-prone brownfield areas, new small grants are being offered through the Voluntary Cleanup Program. Additionally, the City has established new regulations to strengthen standards for cleanup of industrial waterfront properties, which are intended to lessen the environmental impact of future storm surge and flooding events on communities in and near the city's industrial floodplain. Finally, the City has established four new community brownfield planning areas in neighborhoods heavily impacted by flooding during Hurricane Sandy.



