



Hunts Point Food Distribution Center, Bronx, NY

# Other Critical Networks

# Food Supply

**One of the least-known but most important rituals in New York takes place every night in the South Bronx at the Hunts Point Food Distribution Center (FDC).** There, in striking abundance, delicacies from around the state, country, and the world are bought and sold—cabbage from New York, oranges from California, blueberries from Chile, bell peppers from the Netherlands, beef from Australia, and fish from Nova Scotia. All around the Hunts Point FDC, and in dozens and dozens of nearby buildings, everything from international food to alcoholic beverages is packaged, warehoused, and sold—sold to supermarkets, sold to bodegas, sold to street vendors, sold to restaurants. Its customer base also includes schools as well as the food banks, soup kitchens, and pantries that serve New York’s most vulnerable populations.

Unfortunately, the Hunts Point neighborhood is not just critically important, it is also vulnerable. It sits on a peninsula with the East River on two sides, and the Bronx River on the third. Meanwhile, close to 28 percent of the site is at risk of flooding, meaning that approximately 93 acres of the 329-acre site lies within the 100-year floodplain (the area that has a 1 percent or greater chance of flooding in any given year) as set forth in the Preliminary Work Maps (PWMs) produced by the Federal Emergency Management Agency (FEMA).

Sandy spared Hunts Point the worst of its impacts largely because it hit New York at low tide in the Long Island Sound. However,

complacency in the wake of Sandy would be a mistake, as the food supply system may not escape significant impacts in the next extreme weather event. That is why this plan seeks to protect the Hunts Point neighborhood and the various elements of the food supply system found across the city and its surrounding region from climate change-related impacts, while seeking to strengthen the ability of that system to bounce back when, from time to time, impacts do occur.

Although initiatives outlined in several other chapters of this report are important contributors to the overall resiliency of the food supply network (see Chapter 6, *Utilities*; Chapter 7, *Liquid Fuels*; and Chapter 10, *Transportation*), the City also will pursue a series of food-specific efforts, targeting the most significant concentrations of both wholesale distribution and retail access.

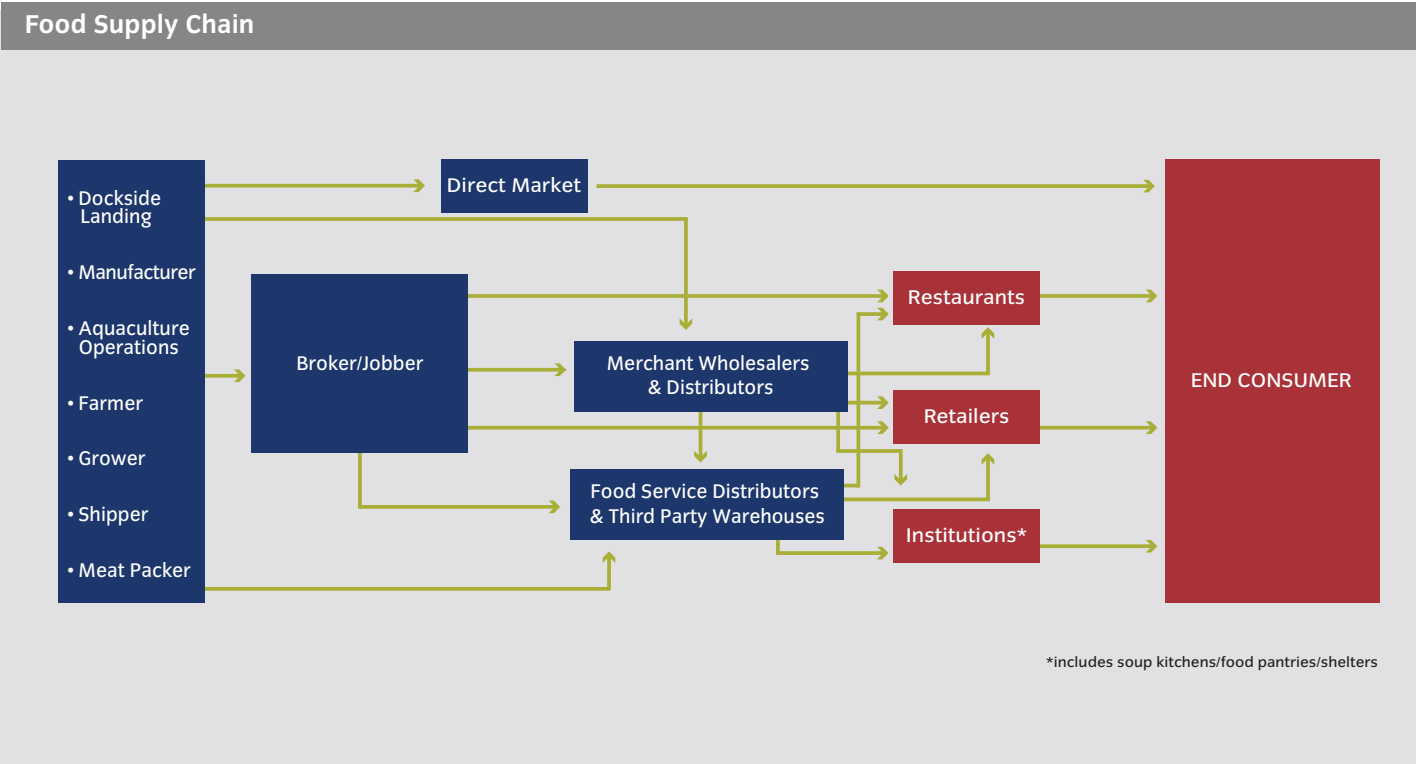
How the Food Supply System Works

Each year, more than 5.7 million tons of both domestic and international food shipments flow into New York City, snaking their way over sea, rail, and road from farms, fisheries, and factories to the city’s retailers and restaurants. The system that has developed to carry this bounty to consumers is multilayered and interdependent. It begins, for the purposes of this analysis, in the city and the surrounding region, with wholesalers that take in shipments from around the world and then repack and distribute them for retail sale.

Large, national distributors such as Sysco, General Trading, White Rose, and C&S stock a wide variety of products and distribute them via trucks primarily to large retailers, such as grocery stores, and institutions, such as hospitals and universities. Their warehouses generally are dispersed outside of the city’s boundaries—including a large concentration in New Jersey and smaller concentrations in Connecticut and Upstate New York—though some facilities are located within the Bronx and other parts of the five boroughs.

Certain large retailers such as Whole Foods, meanwhile, rely upon in-house distribution facilities and trucks. Regardless of whether retailers are serviced by third-party distributors or their own distribution systems, virtually all also receive certain specialty products (such as branded snacks and soft drinks) from vendors via direct store delivery. (See diagram: *Food Supply Chain*)

When it comes to smaller stores, restaurants and other retail outlets, many rely heavily on the markets in Hunts Point—especially the public wholesale markets. In fact, about 60 percent of the city’s produce and about half of the city’s meat and fish passes through Hunts Point for sale and distribution to retailers and consumers. Additional major meat markets exist in Sunset Park, Brooklyn and in Manhattan’s Meat Packing District, with smaller, wholesale clusters for the distribution of specialized foods found in Maspeth, Queens and the Lower East Side and Chinatown in Lower Manhattan.



\*includes soup kitchens/food pantries/shelters





Hunts Point Food Distribution Center

Karsten Moran/The New York Times

From wholesalers and distributors, much of the city's food supply makes its way to retailers such as grocery stores—including both smaller stores and “full-line” grocers, which, in New York City, generally are greater than 6,000 square feet, as defined by the City's Food Retail Expansion to Support Health (FRESH) program. About a quarter of food retail outlets are full-line grocery stores, while close to three-quarters are smaller markets and convenience stores such as bodegas. The New York State Department of Agriculture and Markets (NYSDAM) licenses these food retail outlets (those with less than 50 percent of space dedicated to selling prepared foods).

Despite the presence of approximately 10,000 stores in New York City that sell perishable food, there are many underserved neighborhoods that lack sufficient access to full-line grocers, which provide the most diverse range of products, including fresh produce and proteins (meat, fish, and dairy). These areas often are served by smaller stores that provide only basic staples and lack nutritious, affordable fresh food. In many of these neighborhoods, there are higher rates of diet-related diseases and obesity.

Since 2009, the City has used financial incentives and its zoning authority to encourage the development of full-line grocers in underserved areas, through the FRESH program. To date, 13 FRESH-supported projects

will lead to the creation of 340,000 square feet of new, renovated or expanded retail space in previously retail-deficient neighborhoods.

Besides shopping at grocery stores, New Yorkers also purchase food from a variety of other retailers, including delivery services, farmers markets, and food carts—in addition, of course, to the city's dizzying array of more than 24,000 restaurants.

However, individual residents are not the only purchasers of food. Elderly and disabled populations may rely upon meal delivery services provided by nonprofits, many of which receive government funding. Furthermore, a variety of other private, nonprofit, and public institutions—including hospitals, schools, and senior centers—are huge buyers of food. The Department of City-wide Administrative Services (DCAS) purchases food on behalf several City agencies, including the Department of Corrections (DOC), the Human Resources Administration (HRA), and the Division of Youth and Family Justice (DYFJ). The Department of Education (DOE) serves about 180 million meals and snacks per year, while the Health and Hospitals Corporation (HHC), responsible for managing all City-owned health facilities, provides 10 million meals and snacks annually. Additionally, non-governmental hospitals and universities supply meals to various populations.

The food supply system is not only highly complex. It is also highly dependent on other networks such as power, transportation, liquid fuels, and—to a lesser degree—telecommunications.

Electricity is vital for the food supply system, particularly because it enables the refrigeration necessary to keep perishable food—especially produce, meat, and fish—fresh and edible for longer periods. Refrigeration is power-intensive, typically responsible for about 43 percent of electricity use at a full-line grocer. Power supports other functions as well—including lights, air conditioning, information technology (for tracking inventory), and cash registers. Consumers also rely on power to store and prepare their in-home food supplies since, for example, unrefrigerated raw chicken spoils within two hours at room temperature.

The transportation network is similarly, if not even more, important. Approximately 95 percent of the city's food travels into New York City by truck, via a limited number of access points (mainly bridges). In fact, nearly 30 percent of the truck traffic over the George-Washington Bridge on any given day is believed to be carrying food. Every day, almost 13,000 trucks travel into and out of the Hunts Point FDC alone—and, of course, those trucks are wholly reliant on the availability of liquid fuels.

## Risk Assessment: Impact of Climate Change on Food Supply

Major Risk Moderate Risk Minor Risk

Hazard	Scale of Impact			Comments
	Today	2020s	2050s	
<b>Gradual</b>				
Sea level rise				Minimal impact
Increased precipitation				Minimal impact
Higher average temperature				Minimal impact
<b>Extreme Events</b>				
Storm surge				Direct damage possible to Hunts Point and retailers in the floodplain; possible interruptions to supporting systems (e.g., utilities, liquid fuels, and transportation) Power outages could lead to failures across supply chain
Heavy downpour				Minimal impact
Heat wave				Power outages could lead to failures at both distributors and retailers
High winds				Minimal impact

Telecommunications capabilities, meanwhile, enable the continued operation of payment systems at retailers—including credit card transactions as well as transactions using Electronic Benefit Transfer (EBT) cards, through which the City distributes funds for purchasing food to low-income residents, as part of the Supplemental Nutrition Assistance Program (SNAP, formerly called food stamps). The United States Department of Agriculture (USDA) oversees SNAP, while the City and its Human Resources Administration (HRA) are responsible for administering these Federal benefits to New Yorkers. Retailers also use the telecommunications network to communicate with distributors and wholesalers to help keep them adequately stocked.

Finally, in the event of a disruption in the food supply system, the City's Office of Emergency Management (OEM) has in place response procedures that include emergency feeding plans, commodity distribution plans, and coordination of emergency food programs for vulnerable populations. OEM works with nonprofits, private organizations, and other governmental agencies in developing its emergency preparations.

### What Happened During Sandy

During Sandy, wholesale warehouses and distribution facilities in the city and in surrounding areas were largely unaffected, with the exception of wholesalers located in directly impacted areas such as the Gansevoort Meat Market in Southern Manhattan and the in-house distribution fleets of Fresh Direct and City Harvest in Long Island City, Queens. Facilities owned by the largest wholesalers proved to be highly resilient, thanks to redundant power systems as well as multiple locations. For example, the American Red Cross, which is responsible for certain emergency feeding operations under contract with the City, was able to rely on uninterrupted supply from US Foods, thanks to the company's diffuse sites and backup power systems.

Distribution impacts did occur, however, largely due to delays in truck-based freight. Incoming trucks to Hunts Point and elsewhere, for example, encountered restrictions or delays at major bridge crossings due to single-occupancy vehicle restrictions, since most freight trucks have just a driver and no passengers. Distributors also faced challenges sourcing fuel for their fleets due to supply shortages (see Chapter 7).

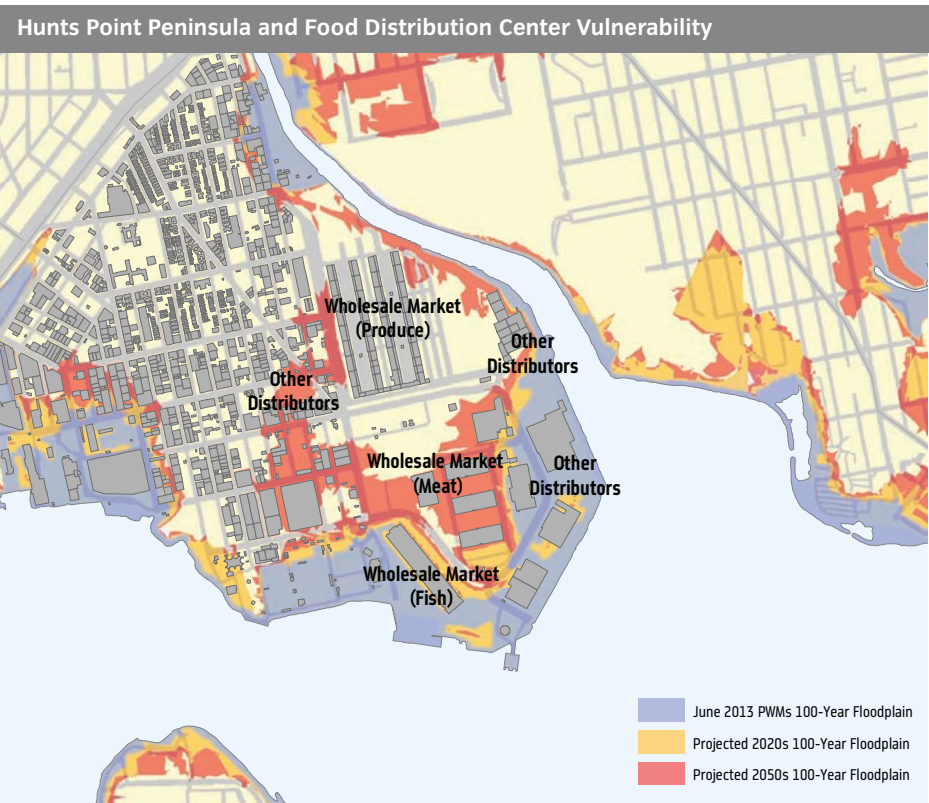
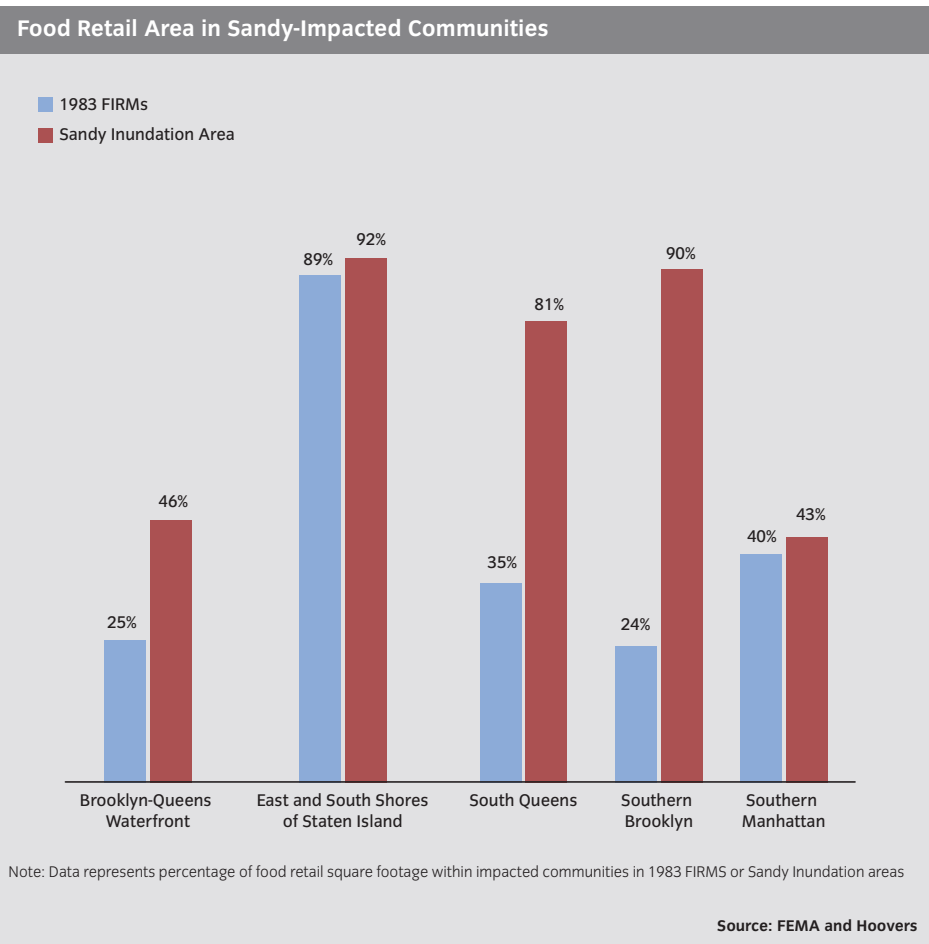
In impacted neighborhoods, retailers were hit harder than expected. The maps used to predict where floodwaters would hit, the 1983 Flood Insurance Rate Maps (FIRMs), proved to fall short of much of the Sandy Inundation Zone. Retailers suffered both direct damage from flooding and indirect losses due to power outage. Floodwaters damaged building systems and fixtures, and destroyed significant quantities of inventory—including nonperishable or shelf-stable goods that were left close to the ground. Power outages resulted in additional inventory loss due to spoilage of perishables and also prevented stores from conducting credit card or EBT transactions (even where the telecommunications network was working). Because these impacts were concentrated within inundation areas, whole neighborhoods found themselves with limited or no retail food access. Transportation breakdowns meant that the problems of residents of these neighborhoods were compounded, because they frequently had limited ability to travel to other areas to find functioning retailers. However, in many areas, unimpacted retailers were sufficiently close that physically able residents could walk to alternative locations.

Another impact resulted from the fact that families without electricity were unable to keep perishable foods or cook (for those with electric stoves). Some emergency food providers such

as food pantries and soup kitchens—the very entities that often are called up to provide emergency food assistance—were inundated and so, in some cases, were unable to provide service in the days and weeks immediately following Sandy. While there were sustained power outages affecting entire neighborhoods, retailers big and small eventually found ways to recover. This included pumping out water or waiting for waters to recede, sourcing backup power, cleaning, rebuilding, and restocking. For example, one retailer in Coney Island used dry ice to provide temporary refrigeration for produce, while another in East Harlem hired a bus service to bring in stranded employees.

Despite these and other efforts by local retailers, some communities were forced to rely upon emergency food distribution measures. In a matter of days, the City and its partners in the State and Federal governments and the nonprofit sector developed and implemented the largest emergency feeding operation in New York history. Thanks to both in-place and emergency contracts and with support from the National Guard and others, through January 31, the City and others distributed over 2.1 million shelf-stable meals, over 700,000 prepared meals, and almost 280,000 meals from food trucks. Many of these meals were served through 17 City-run “pop-up” sites across the impacted areas.

In addition, by the first week of November, HRA had worked with the State and Federal government to replace SNAP benefits equaling 50 percent of a recipient’s October benefit, as well as manually processed requests for full reimbursement. These two efforts alone ensured that more than \$66 million in purchasing power was available to particularly vulnerable populations affected by the storm. Combined with almost \$6 million in additional benefits provided in December 2012 through the Disaster Food Stamp program, a total of more than \$72 million in additional SNAP benefits reached impacted communities. The Mayor’s Fund to Advance New York City provided additional support, while the DOE received Federal approval to provide additional free school meals in Sandy-impacted areas through March. Nonprofit feeding operations continued in some neighborhoods into the spring. For example, City Harvest delivered over 7 million pounds more food than during the same October-to-March period the previous year.





## What Could Happen in the Future

As a diffuse system reliant on many different facilities, the city's food supply system is generally quite resilient. However, the Hunts Point FDC, a major link in the city's food supply chain, presents a major vulnerability to storm surge. Additionally, neighborhood-level retail impacts could be significant across the five boroughs. (See chart: *Food Retail Area in Sandy-Impacted Communities*)

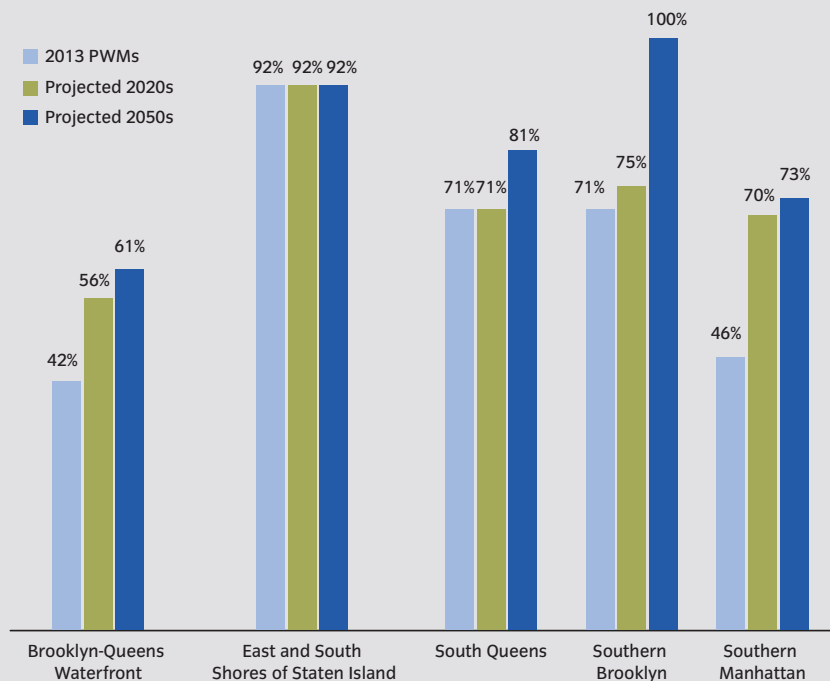
### Major Risks

The most significant risk to the food supply system is the threat of storm surge, particularly as rising sea levels increase the City's 100-year floodplain. Much of this risk is attributable to the vulnerability of the Hunts Point area, which lies within the 100-year floodplain as mapped on FEMA's Preliminary Work Maps (PWMs). As mentioned earlier, the vulnerability at Hunts Point includes public markets, as well as a variety of major private distributors. As described in Chapter 2 (*Climate Analysis*), if Sandy had taken a different path or arrived at a slightly different time (i.e., high tide in Long Island Sound), the Hunts Point area might have flooded, lost power and significant inventory, and suffered from major operational interruptions. Also, because Hunts Point supplies a disproportionate share of the food wholesaling needs of low-income neighborhoods in New York, the impacts of damage in that area would be felt most dramatically in the communities with the fewest retail food alternatives. (See map: *Hunts Point Peninsula and Food Distribution Center Vulnerability*)

Storm surge is also a significant threat to neighborhood-level retail access in coastal communities, as Sandy demonstrated. There are almost 700 food retail markets in the PWM-defined 100-year floodplain, representing over 10 percent of the city's food retail space. By the 2020s, the projected 100-year floodplain will have expanded to include nearly 155 more existing food stores, the majority of which are smaller markets which almost exclusively serve low-income and vulnerable neighborhoods. By the 2050s, almost 200 additional existing stores will be found in the projected 100-year floodplain—bringing the total of at-risk retail floor area to over 15 percent of the city's total food retail space, and close to 1030 total stores. (See chart: *Food Retail Area in the 100-Year Floodplain in Sandy-Impacted Communities*)

While most of New York's food retail square footage will not be at risk of surge, the buildings that are at risk are concentrated in low-income communities. Indeed, the top four at-risk community districts—which are projected to have

Food Retail Area in the 100-Year Floodplain in Sandy-Impacted Communities



Note: Data represents percentage of food retail square footage within impacted communities in each 100-Year floodplain scenario.

Source: FEMA, CUNY Institute for Sustainable Cities and Hoovers

more than 75 percent of their food retail floor area in a floodplain by the 2050s—are all areas with high levels of low-income populations. This includes Coney Island, the Rockaways, Throgs Neck/Co-Op City, and East Harlem.

Certain City government food programs also will be at risk of storm surge-related impacts. This is because some of the City's food procurement, which is managed by DCAS, is made through smaller, less-resilient distributors with fewer resources to invest in resiliency measures. In fact, it is believed that relatively less-resilient distributors currently constitute most of the contracted suppliers for DCAS procurements on behalf of agencies such as the Administration for Children's Services, HRA, DOC, and OEM.

Storm surge creates additional risks for the food supply system to the extent that it threatens the city's power, liquid fuels, and transportation networks. Power network dependency for food storage and business operations means that basic continued business operations could be at risk in the event of a significant disruption to the power grid. Many functions of the food supply system also depend on access to fuel needed for food transport or to power backup generators. Additionally, the food supply system's dependence on truck-carried freight means that

transportation impacts from storm surge could have a cascading effect on food availability.

### Other Risks

Heat waves that result in power losses threaten the operations of wholesale and retail facilities, where backup power is not available. The loss of refrigeration capabilities may result in the spoilage of large amounts of perishable goods, while retailers also could lose the ability to process electronic payments, including the EBT purchases that are so critical to low-income populations. Power losses also impact consumer access to food by interrupting in-home refrigeration and cooking. The initiatives outlined in Chapter 6 are meant to address these challenges. Chronic sea level rise (when no coastal storms are present) is unlikely to impact the food supply system as a whole, since it is spread broadly across a diverse geographic area. Similarly, heavy downpours and high winds should not cause impacts on the broader network or consumer access, though isolated distribution or retail sites could suffer localized impacts.



This chapter contains a series of initiatives that are designed to mitigate the impacts of climate change on New York's food supply system. In many cases, these initiatives are ready to proceed and have identified funding sources assigned to cover their costs. With respect to these initiatives, the City intends to proceed with them as quickly as practicable, upon the receipt of identified funding.

Meanwhile, in the case of certain other initiatives described in this chapter, though these initiatives may be ready to proceed, they still do not have specific sources of funding assigned to them. In Chapter 19 (*Funding*), the City describes additional funding sources, which, if secured, would be sufficient to fund the full first phase of projects and programs described in this document over a 10-year period. The City will work aggressively on securing this funding and any necessary third-party approvals required in connection therewith (i.e., from the Federal or State governments). However, until such time as these sources are secured, the City will proceed only with those initiatives for which it has adequate funding.

Careful implementation of the utility, liquid fuels, and transportation recommendations in Chapters 6, 7, and 10 of this plan will help to protect the food supply network by increasing access to the energy and freight capabilities needed to maintain operations. Additional measures will identify and address vulnerabilities at the wholesale and retail levels.

### **Strategy: Enable continued operations of supporting systems upon which the food system depends**

Recognizing that the food system depends on power, liquid fuel, and transportation networks, the City's food supply efforts inextricably are linked to initiatives described in detail elsewhere in this report. For example, the food supply network will benefit from a variety of initiatives that seek to encourage utility-led, cost-effective resiliency measures to protect the power grid and enable it to recover quickly in the event of impacts (see Chapter 6).

Similarly, the City will work towards maintaining a sufficient fuel supply to meet the needs of the truck fleets on which the food system depends. As part of its fuel supply resiliency efforts, the City will work with government and private entities to harden liquid fuel supply infrastructure and improve the system, and to prepare it to bounce back quickly from supply chain breaks with both off-the-shelf regulatory waivers and emergency fueling capabilities. For more information on these strategies, see Chapter 7.

Finally, the City will implement measures so that the critical road networks identified in Chapter 10 include critical food supply corridors that would benefit from additional resiliency investments. As part of its transportation resiliency efforts, the City also may prioritize certain categories of food supply trucks during periods of restricted access (for example, during periods when single-occupant vehicles are not permitted to use river crossings). Building on initiatives outlined in Chapter 10 and as part of the food distribution study outlined below, the City will work with large wholesalers to identify alternative modes—such as rail or barge—of bringing in large-scale food supply in the event that truck-based routes become wholly or partially unavailable.

### **Strategy: Identify and harden critical food distribution assets**

To help the food system to withstand direct and indirect risks, the City will study the system for prospective vulnerabilities and develop a more refined plan for long-term protections. In the short term, the City has identified critical vulnerabilities that it will seek to address. Most notably, in Chapter 3 (*Coastal Protection*), the City proposes the construction of an integrated flood protection system to enhance protection of the Hunts Point peninsula, including the Hunts Point FDC, as part of the proposed Phase I Initiatives. Additional food supply-specific initiatives can help to implement multilayered defenses to protect the system.

#### **Initiative 1**

##### **Study the food distribution system to identify other prospective vulnerabilities**

Sandy showed New York's food supply system to be highly resilient, but a deeper analysis of the interactions between the different segments of the supply chain is necessary to refine this understanding. Subject to available funding, the City will commission a study of New York's food distribution system, to identify vulnerabilities and develop a plan to protect the system from those vulnerabilities in the long term. As an outgrowth of this study and building upon the 2011 update to PlaNYC, the Office of Long-Term Planning and Sustainability (OLTPS) will identify key distribution assets in surrounding jurisdictions (including major wholesale distributors that supply the New York market), and will work with those jurisdictions and the owners of those assets to identify and address risks. The study also would seek to improve food-related disaster preparedness at the community level in order to augment and inform efforts already underway at OEM. Through the study, the City would create a comprehensive plan to identify and integrate City resources, alternative food providers, community-based organizations, and other providers into its emergency feeding response plans. The goal is to begin this study in the next six months.

#### **Initiative 2**

##### **Expand upon prior energy studies to explore options for cost-effective, continuous power for the Hunts Point Food Distribution Center**

In order to enable continued operation, refrigerated storage capacity, and an uninterrupted supply chain to most of the city, strengthening the resiliency of the power supply at the Hunts Point FDC is critical. The City will work with

tenants at the Hunts Point FDC to put in place options to enable such a continuous power supply. The options could include expanding existing tenant-led efforts to procure and install backup generators, or raising power lines and utility infrastructure in place. New York City Economic Development Corporation (NYCEDC) will lead this cooperative effort in 2013, leveraging a prior City study that examined the feasibility of installing a combined heat and power system for the entire Hunts Point FDC.

## Strategy: Improve the resiliency of consumer access

Sandy exposed the vulnerabilities consumers face in accessing food through normal channels after a major storm. Initiatives to harden retail access points and diversify City procurement of food will improve the resiliency of this segment of the supply chain. These efforts will draw on the recommended Core Flood Resiliency Measures outlined in Chapter 4 (*Buildings*), as well as a buildings incentive program that seeks to help 70 percent of New York's floor area—including retail—to become more resilient by 2030.

### Initiative 3

**Call on New York State to issue preparedness guidelines to retailers in anticipation of extreme weather events**

Proper preparedness can enable retailers to protect more of their inventory, even during significant flooding events. The City will call on New York State Department of Agriculture and Markets, the regulatory authority that licenses food retail establishments, to develop and issue preparedness guidelines for retailers at-risk of climate impacts, such as flooding and storm surges. These guidelines would help retailers protect packaged foods, maintain ample stocks, and protect retail space, allowing for rapid reopening of retail outlets following an extreme weather event. OLTPS and OEM will work with NYSDAM to disseminate these State-issued preparedness guidelines to New York City retailers in 2013.

### Initiative 4

**Call on the State Legislature to pass City-sponsored legislation mandating electric generators for food retailers**

Even retailers with shelf-stable inventory need electrical power to operate lights and cash registers and to process credit, debit, and EBT cards. The City will call on the State legislature to pass a law to require certain retailers to either install a transfer switch to enable quick connection to a generator, or to maintain a backup generator on site. The proposed

legislation will aim to require that back-up power be capable of powering retailers' basic systems necessary for operations. The legislation, would not, however, require capacity to power refrigeration equipment, which is extremely power-intensive. The proposed legislation will aim to require stores to initiate backup power systems within 24 hours of power outages and would apply to stores of 20,000 square feet or more of floor space, or those having 60 or more employees (full- or part-time). OEM will work with the City's State Legislative Affairs Office to advance this legislation.

### Initiative 5

**Continue to support the FRESH program to increase the number of full-line grocers in underserved neighborhoods**

Low-income neighborhoods are particularly vulnerable to retail outages as many are in vulnerable locations and, even without extreme weather conditions, lack adequate retail access options. As part of its continuing efforts to encourage the development of full-line grocery stores in underserved neighborhoods, the City, through NYCEDC and the Department of City Planning, will continue to support the FRESH program to provide multilayered benefits to encourage full-line grocery developers to locate in these underserved neighborhoods.

In parallel to the FRESH program, the New York Healthy Food & Healthy Communities Fund and New York State will work to facilitate the development of healthy food markets in underserved communities throughout New York State. This partnership will immediately provide pre-development grants and loans to new full-line grocery store projects in these communities.

## Food Supply Initiative 6

**Expand DCAS food procurement pilots towards contracts with larger, more resilient distributors that have active New York operations**

The City currently procures food for several key agencies using a number of single-supplier, item-specific contracts that provide no alternative sources when a designated supplier is unable to deliver needed product. The City will expand current pilots to backstop DCAS food procurement to strengthen resiliency and redundancy in case of future climate hazards. DCAS will work so that its supplier contracts for DOC, DYFJ, and HRA (food pantries and soup kitchens) have backstops in place by the end of 2013.

### Initiative 7

**Implement preparedness measures for continued availability of SNAP benefits for vulnerable consumers following large-scale power outages**

Power outages can affect the ability of consumers to store fresh food and produce, and can spoil food already in the refrigerators of households. Consumers who depend on SNAP benefits depend on the availability of these funds to replenish their food supply. The City, through HRA, will prepare waiver requests for immediate submittal to the Federal government, specifically the USDA, for the automatic mass replacement of benefits in the event of a large-scale power disruption. This is the fastest way to get food purchasing power back into the hands of low-income New Yorkers, and it will free up critical City resources and reduce administrative burden on City agencies, when these resources are needed most. HRA, as administrator of Federal SNAP benefits for New Yorkers, will initiate these preparations in 2013.



Key Food, Coney Island

# Solid Waste



Every morning before dawn, nearly a thousand Department of Sanitation (DSNY) collection trucks roll out of garages located around the city to begin their daily rounds. By the time most people wake up, DSNY employees—“New York’s Strongest”—already are well on their way to collecting their daily haul of over 12,000 tons of waste and recyclables from residential buildings, schools, hospitals, and other institutions. The remainder of the city’s daily intake of 50,000 tons is generated by businesses or construction sites and is collected by private haulers.

In ordinary times, garbage collection fades into the background of the city’s life. The collection of solid waste, though critical to the functioning of the city, is so orderly and predictable that it becomes almost invisible to most New Yorkers.

In extraordinary times, however, DSNY’s fleet of more than 2,000 collection vehicles and more than 9,000-person army of sanitation workers and support employees suddenly attract the spotlight. Never was this truer than in the aftermath of Sandy. Under the direction of the City-activated Debris Removal Task Force and with the participation of other City, State, and Federal agencies, DSNY employees worked 12-hour shifts around the clock, seven days a week, to collect more than 400,000 tons of Sandy-related debris, including downed trees.

The massive debris clean-up after Sandy demonstrated the resiliency of the City’s solid waste capabilities. But the next time could be different. A storm pattern different from that of Sandy could affect more DSNY facilities more seriously. As the City’s solid waste collection network shifts towards more environmentally friendly marine routes, it will rely increasingly on waterfront facilities that must be protected. And since the City’s solid waste disposal network extends well beyond the five boroughs and the City’s control, it will require coordination among multiple parties.

The commercial solid waste collection system served by private haulers is closely intertwined with the DSNY system, which is the focus of this chapter. Although the commercial system may suffer some unique climate impacts, it is expected that DSNY will be capable of collecting excess debris in the wake of an extreme weather event—as was demonstrated after Sandy.

In keeping with the broad goals of this report—to minimize disruptions from climate hazards and ensure New York can bounce back quickly if damage is sustained—the City will enhance the resiliency of the solid waste system. This will include hardening critical City-owned solid waste



DSNY workers and collection truck

Credit: Emilee McGovern

assets to protect them from storm impacts while also seeking to ensure that the broader solid waste network—both City- and third-party owned—is sufficiently resilient to enable the system to resume operations quickly should disruptions occur.

## How the Solid Waste System Works

DSNY’s distinctive white collection trucks are the most visible component of a vast, multi-modal system that must not only collect garbage from streets but also dispose of it safely. It involves City employees, garages, and specialized vehicles, as well as a far-flung network of private haulers, transfer stations, rail lines, and disposal companies that extends well beyond the borders of the five boroughs. Significant changes are underway to make the system more efficient and environmentally friendly.

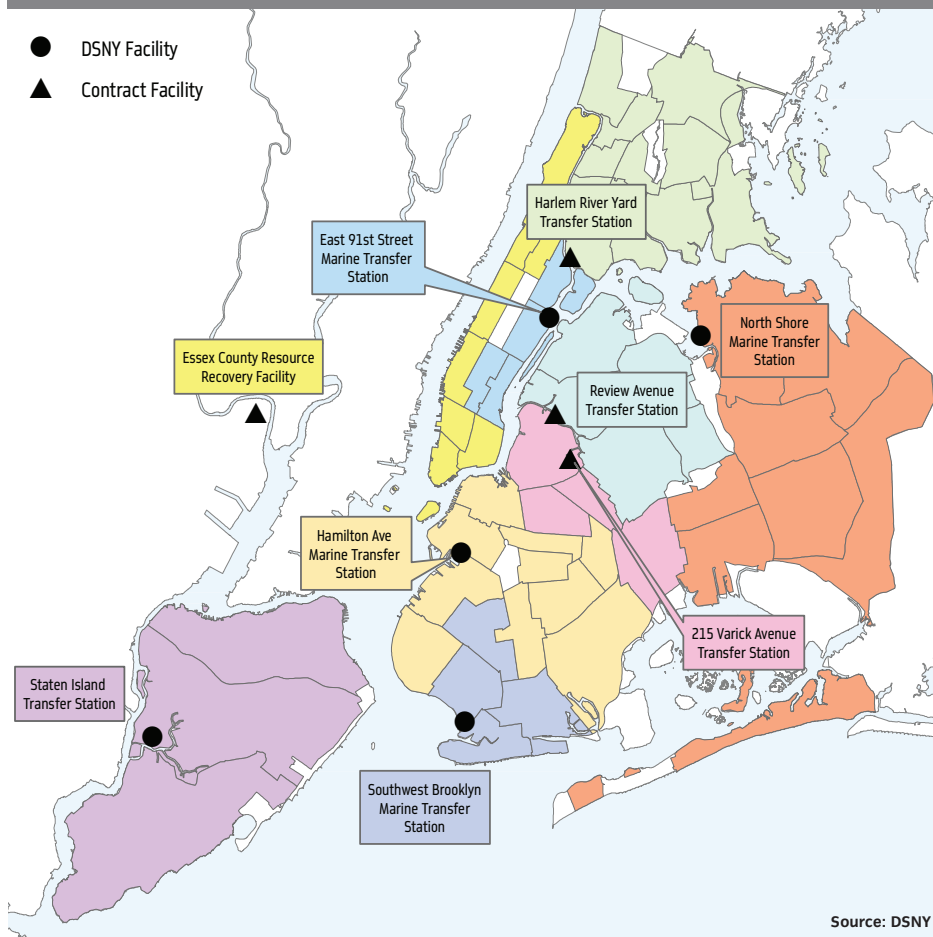
Today, collection trucks from garages in 59 separate sanitation districts carry approximately 90 percent of the city’s residential and institutional waste to one of over 30 transfer stations. Then waste is moved to larger commercial tractor-trailers, also called “transfer trailers” (responsible for about 50 percent of the total), or railcars (responsible for about 40 percent of the total). Via truck or rail, the waste is then transported to disposal sites outside the city—as far afield as Pennsylvania, Ohio, and South Carolina. The approximately 10 percent remaining is carried directly by collection trucks to the Essex County Resource Recovery Facility in New Jersey, a privately operated waste-to-energy facility that combusts more than 1,000 tons per day of municipal solid waste from the city to generate electricity.

Private haulers collect commercially-generated waste, construction and demolition waste (sheetrock, wood, tiles), and fill material (dirt, rock). Most solid waste collected by DSNY and private haulers is processed at the same network of private transfer stations located in the city. Private solid waste haulers rely primarily on trucks to remove solid waste for transport to landfills and incinerators.

The closure of the Fresh Kills Landfill in Staten Island in 2001 created the need for this primarily truck-based system to begin exporting solid waste. In 2006, however, the City released the Comprehensive Solid Waste Management Plan (SWMP), a framework designed to eliminate New York’s reliance on a network of land-based transfer stations and long-haul trucking to export residential waste. Once fully implemented, the SWMP will achieve a dramatic reduction in DSNY’s number of truck trips and miles driven—and therefore the environmental and health impacts—in connection with the disposal of New York City’s waste.

The SWMP outlined a plan to create four marine transfer stations that will be operational by 2018. Together, the four facilities—to be located on Gravesend Bay in Southwest Brooklyn; on the North Shore in Flushing Bay; along the East River in Manhattan; and along the Gowanus Canal—will enable DSNY to move approximately 50 percent of New York’s non-commercial solid waste via barge and then onto rail. In so doing, the plan is expected to reduce annual DSNY collection truck travel by 2.8 million miles and reduce commercial tractor-trailer miles driven within the city by another 2.8 million vehicle miles. (See map: *DSNY Facilities and Sanitation Districts*)

## DSNY Facilities and Sanitation Districts



operations halted in Staten Island and the Bronx for five days as vendors inspected flooded railcars and restored them to service. During that time, DSNY safely stored excess waste in containers to await restored rail service or shipped it via transfer trailer.

Although none of the four new marine transfer stations is yet operational, one of the two sites that are under construction—at Hamilton Avenue in Brooklyn—did see water levels exceed the pier elevation, though the waters remained well below the height at which solid waste will be stored once the station is completed.

Overall, DSNY found no indication that solid waste from any of its facilities was washed into the city's waterways. While the former Fresh Kills Landfill sustained light damage to its pollution control infrastructure, it appears there were minimal environmental impacts.

## What Could Happen in the Future

Although the solid waste system showed itself to be relatively resilient during Sandy, it nonetheless faces risks associated with climate change.

### Major Risks

Given the dispersed nature of the city's solid waste network, its reliance on largely movable equipment, and the resiliency measures built into the new marine transfer stations, it is not expected that climate changes will present major risks to that network in the foreseeable future.

### Other Risks

With a number of facilities such as garages located along the waterfront as well as four new marine transfer stations scheduled to begin operations in the next four years, the solid waste system is most vulnerable to storm surge (particularly as sea levels rise), although only moderately so. Many of DSNY's facilities and that of its third-party providers are critical to the degree they house vehicles, but those

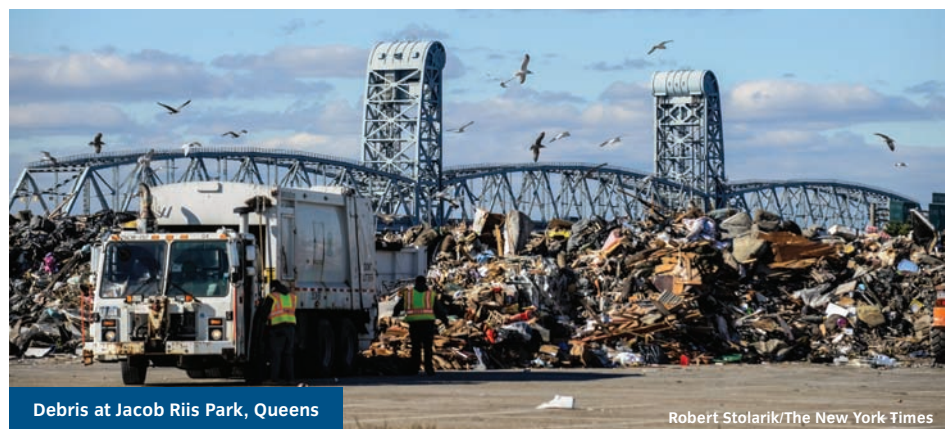
## What Happened During Sandy

Despite the scale of Sandy's impact, New York's solid waste collection and disposal system generally proved to be quite resilient, though some issues did materialize. Sandy strained the solid waste disposal network, exceeding storage capacity, disabling transportation, and requiring emergency resources such as containers and vehicles.

Amazingly, DSNY's normal collection services were affected only minimally, and neighborhoods typically missed at most just one regularly scheduled pickup, with curbside recycling resuming less than two weeks after Sandy. Although more than 60 DSNY facilities sustained some damage, including almost 50 garages, the impact was minor due in part to the fact that the facilities housed vehicles that were, in most cases, moved out of the storm surge inundation area. Nonetheless, 44 heavy-duty and 31 light- and medium-duty vehicles were damaged or destroyed by floodwaters. This damage did not prevent DSNY from carrying out its regular tasks—or from completing its massive post-Sandy cleanup efforts.

The larger waste disposal system, however, was affected by Sandy. Most significantly, one day before the storm, the Essex County Resource Recovery Facility preemptively shut down its boilers. The facility then experienced significant inundation which knocked it out of operation for a subsequent two weeks. With the loss of over 10 percent of its disposal capacity, DSNY was forced to enter into emergency disposal contracts with vendors.

The rail transport network used for waste disposal also was affected by Sandy, with



Debris at Jacob Riis Park, Queens

Robert Stolarik/The New York Times



## Risk Assessment: Impact of Climate Change on Solid Waste

Major Risk Moderate Risk Minor Risk

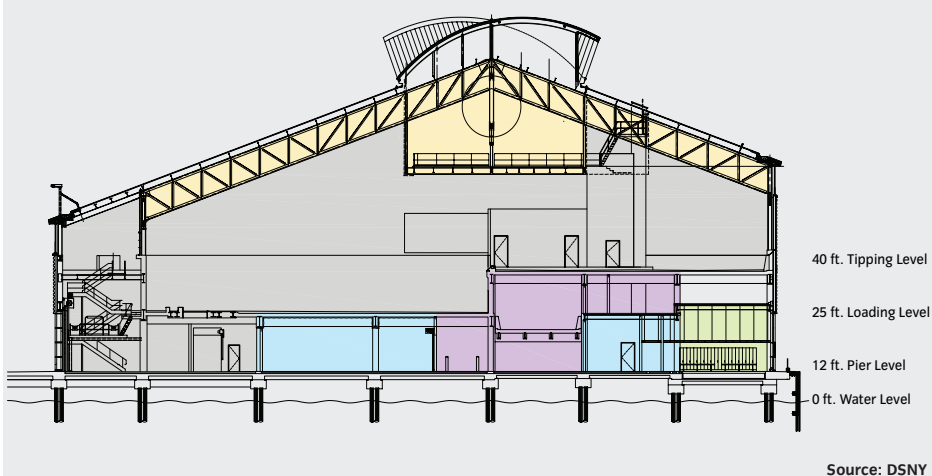
Hazard	Scale of Impact			Comments
	Today	2020s	2050s	
<b>Gradual</b>				
Sea level rise	Minor Risk	Minor Risk	Minor Risk	Minimal impact
Increased precipitation	Minor Risk	Minor Risk	Minor Risk	Minimal impact
Higher average temperature	Minor Risk	Minor Risk	Minor Risk	Minimal impact
<b>Extreme Events</b>				
Storm surge	Minor Risk	Moderate Risk	Moderate Risk	Disruptions to garbage collection could result from flooding of transportation networks Marine transfer stations could experience limited damage Excess debris could be generated due to property damage
Heavy downpour	Minor Risk	Minor Risk	Minor Risk	Minimal impact
Heat wave	Minor Risk	Minor Risk	Minor Risk	Minimal impact
High winds	Minor Risk	Minor Risk	Minor Risk	Minimal impact

vehicles can easily be moved out of the floodplain to other facilities and locations, as needed.

The four planned marine transfer stations are designed not only to be environmentally friendly, but also highly resilient and, therefore, are not expected to be at significant risk. Marine transfer stations will have three levels. The uppermost level will be a so-called “tipping floor,” from which collection vehicles will discharge solid waste onto the middle level or loading floor. On the loading floor, front-end loaders will manage the waste and push it through slots in the floor into waterproof sealable containers. These containers then will be placed onto barges for waterborne export. The loading floors, where loose waste will be found, generally will be located approximately 16 feet above the Base Flood Elevation, or the height to which floodwaters are expected to rise during a 100-year flood (i.e., a flood with a 1 percent or greater chance of occurring in any given year). This means that the risk of loose waste being washed away by inundation—even in an extreme weather event—will be extremely limited. (See image: *Marine Transfer Station Cross-Section*)

Meanwhile, disruptions to vendor operations, including rail networks, might affect the capac-

Marine Transfer Station Cross-Section



ity to remove bulk waste from the city both today and in the future. However, as Sandy showed, DSNY has a number of alternatives for redirecting waste, including a network of vendors and backup equipment such as storage containers.

None of the other identified extreme risks (such as heavy downpour, heat wave, and high winds)

or chronic impacts (such as sea level rise, increased precipitation, or higher average temperatures) is expected to create any direct risk to the city's solid waste network. However, the solid waste system is exposed to indirect impacts of climate change to the extent that, for example, the city's liquid fuel supply is threatened. This risk and proposed strategies are addressed in Chapter 7 (*Liquid Fuels*).



This chapter contains a series of initiatives that are designed to mitigate the impacts of climate change on the solid waste disposal system. In many cases, these initiatives are both ready to proceed and have identified funding sources assigned to cover their costs. With respect to these initiatives, the City intends to proceed with them as quickly as practicable, upon the receipt of identified funding.

Meanwhile, in the case of certain other initiatives described in this chapter, though these initiatives may be ready to proceed, they still do not have specific sources of funding assigned to them. In Chapter 19 (*Funding*), the City describes additional funding sources, which, if secured, would be sufficient to fund the full first phase of projects and programs described in this document over a 10-year period. The City will work aggressively on securing this funding and any necessary third-party approvals required in connection therewith (i.e., from the Federal or State governments). However, until such time as these sources are secured, the City will only proceed with those initiatives for which it has adequate funding.

New York City's solid waste disposal system—inside and outside of the city, public and private—is designed to collect waste and recyclables and dispose of both safely through continuous operation when possible or through fast restoration.

## Strategy: Protect solid waste facilities and disposal networks

Fixed solid waste collection and disposal assets, including critical facilities, roads, and railways, typically were not built with flood protection or other climate change risks in mind. To address the potential risks to the solid waste network, the City will harden its waste collection and disposal facilities and work within its extended third-party-owned solid waste network to ensure that practical resiliency measures are in place for future extreme weather events.

### Initiative 1 Harden critical City-owned facilities

Although storm surge is not a major risk to the solid waste system, selected key assets could suffer limited impacts in the event of a significant storm. Subject to available funding, the City will harden equipment at four marine transfer stations, garages, and other vulnerable facilities to prepare for the impacts of future storm surge and to minimize future service disruptions. These efforts will include resiliency projects such as raising and flood-proofing equipment at nearly 70 facilities that will be prioritized based on their flood risk. In addition to physical measures such as raising elevation

levels of switches and pumps to keep them out of harm's way and installing bulkhead doors to keep water out, DSNY will develop operational protocols to prepare its facilities and equipment for extreme weather more effectively.

In so doing, the City not only will ensure continued waste collection and disposal during future events, but also will minimize impacts that might otherwise result from flooding of facilities that store loose waste. Additionally, by ensuring the continued operation of marine transfer stations, the City also will ensure that additional trucks are not needed on New York's roads during storm recovery, thereby easing congestion and minimizing impacts to transportation and fuel networks. DSNY will complete a detailed assessment of protection measures for at-risk facilities by the end of 2013. The goal is to implement these measures as part of Sandy reconstruction and other planned construction and capital projects through 2018.

### Initiative 2 Work with third-party owners to protect critical assets and networks

Many of the disruptions to the solid waste disposal process that occurred during Sandy—and that could occur in the future—were due to affected assets owned by third parties. These assets are essential to DSNY waste disposal efforts and to the removal of commercial waste by private haulers. The City will work with its network of vendors and rail operators to identify priority resiliency measures and to encourage them to provide redundant and alternative capacity. For instance, DSNY will request or require, as appropriate, that its vendors maintain additional railcars and storage containers in safe, accessible locations in advance of storm events. DSNY also will direct its vendors to secure agreements for additional tractor-trailer capacity in the event that a rail disruption exceeds storage capacity and to provide dumping capacity at alternate company-owned transfer stations.

DSNY further will work to ensure that critical solid waste facilities that are not under its jurisdiction are incorporating storm surge risk and sea level rise projections into their design. This includes developing an inventory of critical system vulnerabilities and working with vendors, rail operators, and private transfer stations to catalogue known risks and develop contingency plans. These measures will limit the potential for disruptions to solid waste collection and disposal. DSNY's coordination and planning efforts are anticipated to occur within the next year, with implementation expected to commence immediately thereafter.



The future Sims Municipal Recycling Facility, located at the South Brooklyn Marine Terminal, will be elevated above the Base Flood Elevation





Credit: Kirsten Luce/The New York Times