STUDY GOALS

• **Reduce flood hazards** for businesses and residents in the City’s industrial flood zones

• Identify appropriate **emergency preparedness** guidelines for businesses in industrial flood zones

• Promote cost-effective **physical and operational strategies** to protect businesses and the environment

• Identify **financial and insurance** challenges unique to businesses in industrial flood zones
Industrial property and businesses occupy much of the FEMA flood zone

<table>
<thead>
<tr>
<th>District</th>
<th>Acres in Floodplain (X, A, V)</th>
<th>% of Citywide Manufacturing Districts</th>
</tr>
</thead>
<tbody>
<tr>
<td>C8</td>
<td>438</td>
<td>19%</td>
</tr>
<tr>
<td>M1</td>
<td>7,265</td>
<td>41%</td>
</tr>
<tr>
<td>M2</td>
<td>2,365</td>
<td>72%</td>
</tr>
<tr>
<td>M3</td>
<td>5,495</td>
<td>69%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15,564</strong></td>
<td><strong>50%</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flood Zone</th>
<th>Acres in Manufacturing District</th>
<th>% of Floodplain</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>5,173</td>
<td>41%</td>
</tr>
<tr>
<td>A</td>
<td>8,047</td>
<td>27%</td>
</tr>
<tr>
<td>V</td>
<td>2,343</td>
<td>11%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15,564</strong></td>
<td><strong>24%</strong></td>
</tr>
</tbody>
</table>

Analysis based on Preliminary FIRMs
### RISK ASSESSMENT OVERVIEW

Businesses in NYC Industrial Areas within the 1% Annual Chance Floodplain

<table>
<thead>
<tr>
<th>Sector</th>
<th># Businesses</th>
<th># Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial</td>
<td>1,683</td>
<td>45,697</td>
</tr>
<tr>
<td>Transportation and Warehousing</td>
<td>268</td>
<td>21,178</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>503</td>
<td>8,066</td>
</tr>
<tr>
<td>Construction</td>
<td>316</td>
<td>6,136</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>285</td>
<td>6,119</td>
</tr>
<tr>
<td>Motion Picture and Sound Recording / Telecommunications</td>
<td>83</td>
<td>1,819</td>
</tr>
<tr>
<td>Waste Management and Remediation Services</td>
<td>22</td>
<td>808</td>
</tr>
<tr>
<td>Repair and Maintenance</td>
<td>150</td>
<td>779</td>
</tr>
<tr>
<td>Motor Vehicle and Parts Dealers / Gasoline Stations</td>
<td>48</td>
<td>512</td>
</tr>
<tr>
<td>Utilities</td>
<td>8</td>
<td>280</td>
</tr>
<tr>
<td>Non-Industrial</td>
<td>1,955</td>
<td>41,719</td>
</tr>
<tr>
<td><strong>GRAND TOTAL</strong></td>
<td><strong>3,638</strong></td>
<td><strong>87,416</strong></td>
</tr>
</tbody>
</table>

Source: NYSDOL QCEW 2014 3rd Quarter, FEMA Preliminary FIRM

Analysis includes all M and C8 Districts except airports
In the Sandy Inundation Area there were...

- **370 Food Distribution Businesses**
- **400 Firms in Transportation Support Services**
- **20% of the City’s Fuel Distribution Facilities**

**Sandy Inundation Area:**
- 5,500 Industrial Buildings
- Average Year Built: 1940
- 92% Predate Floodplain Regs.

**1% Annual Chance Floodplain:**
- 7,500 Industrial Buildings
- Average Year Built: 1946
- 87% Predate Floodplain Regs.
PROTOTYPICAL SITE ANALYSIS | Selection Criteria

Building
- Construction materials
- Building height
- Floor-to-floor height
- Year Built
- Assessed Value

Site
- Lot size
- Parking
- Lot coverage
- Design Flood Elevation
- Drainage
- Adjacent land use
- Shoreline conditions

Use
- Wholesale
- Transportation / Warehousing
- Manufacturing
- Construction
- TV and Film
- Maritime Support
PROTOTYPICAL SITE ANALYSIS

FOOD DISTRIBUTION  MICROBREWERY  FILM STUDIO  CONSTRUCTION YARD

AUTO DISMANTLER  MARITIME SUPPORT  DRY CLEANER  BROOKLYN NAVY YARD
PROTOTYPICAL SITE ANALYSIS | Interview Topics

• General business information
• Physical layout
• Ownership / lease details
• Insurance coverage
• Flooding and recovery history
• Physical resiliency strategies
• Operational resiliency strategies
CONSTRUCTION MATERIALS DISTRIBUTOR: Sector Profile

- Positive construction market conditions expected to support industry growth nationally
- In NYC, employment in the building material and supply sector grew 6.8% between 2010 and 2014 within the City’s Manufacturing Districts

### Construction-Related Industries

<table>
<thead>
<tr>
<th></th>
<th># Firms</th>
<th># Jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citywide</td>
<td>2,421</td>
<td>44,782</td>
</tr>
<tr>
<td>500 year floodplain</td>
<td>690</td>
<td>13,883</td>
</tr>
<tr>
<td>100 year floodplain</td>
<td>380</td>
<td>7,409</td>
</tr>
</tbody>
</table>

Source: NYSDOL QCEW 2014 3rd quarter

Analysis includes businesses in M-Districts outside of Manhattan, excluding paired-M-Districts and airports.

Includes NAICS Industry Sectors and Groups: Construction (23), Construction-Related Manufacturing (321, 327, 332, 333), Building Material Retail (444), Wholesale of Hardware, Plumbing & Heating Materials (4233), Lumber and Other Construction Materials (4237), Metal & Mineral Merchant Wholesale (4235)
CONSTRUCTION MATERIALS DISTRIBUTOR: Business Profile

- Construction materials distributor with multiple locations on the East Coast.
- Majority of business is from distributing construction materials to contractors at job sites rather than on-site pickup.
- Maintain fleet of dozens of commercial trucks.
- 50-100 employees operating 24 hours/day.
CONSTRUCTION MATERIALS DISTRIBUTOR: Operational Flow

1. Sales team sells construction products to contractors.
2. Inventory is delivered via rail or truck.
3. Staff receives material, performs quality checks & inspections and stores on-site.
4. Some products are cut to size for custom orders.
5. Packaging team assembles orders and loads materials for shipment.
6. Delivery to clients.

resilient industries
CONSTRUCTION MATERIALS DISTRIBUTOR : Resiliency Challenges

1. Open uses and inventory stored improperly may be damaged
2. Machinery left below the DFE may be damaged during a flood
3. Exposed openings may allow water into the building
4. Reliance on bridge / road infrastructure may put productivity at risk
5. Poor bulkhead conditions can lead to erosion & major flood damage
WIND may damage inventory that is not properly anchored to outdoor storage systems.

Inventory such as wood, metal, liquid substances (hazardous materials) are highly susceptible to the effects of flooding.

Shelving is not anchored to ground.
Hazardous materials can put workers and neighboring communities in danger when flooding occurs.

Protection from leakages and spills should be a high priority.
Materials stored outdoors and unenclosed are subject to uplift and displacement.
CONSTRUCTION MATERIALS DISTRIBUTOR: Resiliency Challenges

Flood waters can corrode key components of machinery

Electrical equipment, fixtures and conduits are very vulnerable to flood damage when below the DFE
Work stations and unanchored ancillary structures constructed with lightweight building materials are vulnerable to displacement.
CONSTRUCTION MATERIALS DISTRIBUTOR: Resiliency Challenges

Essential business operations may be halted if equipment is damaged from flooding.
CONSTRUCTION MATERIALS DISTRIBUTOR: Resiliency Challenges

- Sliding door
- Buildings with loading docks and openings below the DFE may be vulnerable to seepage if openings are not sealed properly
- Loading ramp
CONSTRUCTION MATERIALS DISTRIBUTOR: Resiliency Challenges

- Water filtrates from below and saturates soil
- Saturated soil puts pressure on the rear side of wall and causes it to fail
- Permeability of wall allows water to horizontally pass through and leaves bulkhead at risk of collapsing
- Lack of structural foundation allows water to flow underneath the toe of wall
- Interior & exterior storage is left vulnerable to erosion
- Downward force of saturated soil causes void in structural base and surface begins to collapse. Waterfront spaces become unusable
- Potential contaminants may seep into water
- Sedimentation occurs at creekbed making water-based activity less feasible due to shallow depth
1. Proper anchoring to keep storage equipment in tact
2. Catchment facilities to prevent hazardous materials spillage
3. Create mechanisms to move fueling tanks to higher ground
4. Water-tight storage to protect valuable inventory
5. Elevate mechanical equipment
6. Protect openings for loading
7. Bulkhead reconstruction for maritime access
8. Green infrastructure to treat stormwater runoff
CONSTRUCTION MATERIALS DISTRIBUTOR: Resiliency Measures

Before

Straps to tie down materials can help mitigate wind damage

After

Heavy duty systems that employ enhanced joinery connections and braces at corners can help mitigate wind damage

Outdoor shelving designed with base plates anchored to ground can mitigate flood damage
Containment bunds with perforated grid may be used to contain spills and leakages.

Fastening to ground could prevent uplift during a flood.
Fuel tanks and other equipment may be mounted on wheels to be moved to high ground.
CONSTRUCTION MATERIALS DISTRIBUTOR: Resiliency Measures

Sealed containers cost $2400 - $2800

Before

After

Containers that are designed with water-tight doors can ensure safer storage of materials.
Mechanical equipment may be elevated above flood elevations to appropriate construction standards.
Worker stations and tool sheds may be elevated above flood levels. Areas below elevation may be used to store tools and essentials, but should be relocated before a flood.

Before

After
Flood shields installed around openings will help prevent floodwaters from entering. The building must be structurally reinforced to withstand hydrostatic/hydrodynamic forces.
CONSTRUCTION MATERIALS DISTRIBUTOR: Resiliency Measures

**Before**

- Structural reinforcement designed for industrial-grade load capability
- Crushed aggregate allows for drainage capacity
- Reinforced concrete slab to hold shoreline and prevent erosion
- Reinforced concrete with steel tie rod
- Steel sheetpiling driven deep enough to prevent water seepage

**After**

- Provide appropriately designed mooring capacity to support maritime activities
- Provide fender system to protect ships and infrastructure
- Textured surfaces enhance habitat for small aquatic creatures
- Maintain water depths for maritime use through maintenance dredging
CONSTRUCTION MATERIALS DISTRIBUTOR: Resiliency Measures

* State permitting challenges are prevalent when building past original shoreline or bulkhead

Stone revetments provide erosion protection and shoreline stabilization. Sloped edges can disperse wave energy. By incorporating vegetation, they can also increase habitat and biodiversity.

Planting at a 3:1 Max Slope

Bioswales and other green infrastructure can retain and treat stormwater runoff

Topsoil; needed to establish plantings 2:1 Max Slope

Stone aggregate must extend to toe to prevent scour

Before

After
## CONSTRUCTION MATERIALS DISTRIBUTOR: Preparedness Strategies

### Ongoing: Business Continuity Planning

- Identify and prioritize the protection of critical systems and high-value items.
- Back up and store critical documents and files off-site.
- Fully understand insurance coverage and limitations.
- Assign business continuity responsibilities to employees and document after-hour communication methods.
- Pre-script communication with customers about potential delivery changes.

### 36-72 hours

- Relocate, elevate or secure in-place inventory and critical equipment.
- Store fuel and hazardous materials out of floodplain and/or off-site.
- Install flood barriers if present. At minimum, consider emergency measures such as sandbags.
- Inspect backup power supply.
- Contact insurance broker or agent.

### Within 36 hours

- If potential exists for wind damage, remove supplies from upper shelves or secure in-place.
- Move trucks and other vehicles to higher ground parking.
- Store propane in cages according to FDNY permits.
- Ensure employees are aware of announced evacuations as well as road and tunnel closures.
- Activate emergency shut off for critical systems.
POLICY CONSIDERATIONS

Information
- Forecasts and alert systems
- Technical assistance

Insurance
- Coverage
- NFIP flexibility

Physical Improvements
- Bulkheads and shoreline improvements
- Hazardous material storage

Commercial Vehicles
- Locations for commercial truck parking

Land use
- Zoning constraints to resiliency improvements
- Resiliency measures specific to V and/or coastal A zones
National Flood Insurance Program: Claims from Hurricane Sandy

Content damage often exceeded coverage limit

Nonresidential NFIP Claims: **Buildings**

<table>
<thead>
<tr>
<th>Zone</th>
<th>Coverage</th>
<th>Damage</th>
<th>Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A Zone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X Zone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outside X</td>
<td></td>
<td></td>
<td></td>
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Nonresidential NFIP Claims: **Contents**

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<td></td>
</tr>
<tr>
<td>Outside X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
INSURANCE SUMMARY

• NFIP **coverage limit is insufficient** for many industrial businesses.

• NFIP provides **little flexibility for partial floodproofing**

• Premium reductions are unavailable for a range of mitigation strategies

• Single story industrial buildings are particularly constrained in terms of the options available to them under the NFIP

• Elevation certificates may help businesses take advantage of partial floodproofing

• Tenant businesses cannot insure the building for flood damage, making it difficult to invest in structural resiliency measures
QUESTIONS AND DISCUSSION