

**ASTORIA GENERATING COMPANY,  
L.P.**

**GOWANUS SOUTH PIER  
IMPROVEMENT PROJECT**

Minimum Flood Design Level of  
Protection

May 1, 2013





A handwritten signature in black ink, appearing to read "Carly Foster".

---

Carly Foster  
Planner

A handwritten signature in black ink, appearing to read "Hugh J. Roberts".

---

Hugh J. Roberts, PE  
Principal Engineer

A handwritten signature in blue ink, appearing to read "Steven M. Feldman".

---

Steven M. Feldman  
Project Manager

**Gowanus South Pier  
Improvement Project**

Minimum Flood Design Level of  
Protection

Prepared for:  
Astoria Generating Company, L.P.

Prepared by:  
ARCADIS of New York, Inc.  
Two Huntington Quadrangle  
Suite 1S10  
Melville  
New York 11747  
Tel 631 249 7600  
Fax 631 249 7610

Our Ref.:  
NY001366.0027

Date:  
May 1, 2013

*This document is intended only for the use of the individual or entity for which it was prepared and may contain information that is privileged, confidential and exempt from disclosure under applicable law. Any dissemination, distribution or copying of this document is strictly prohibited.*

<b>Introduction</b>	<b>1</b>
<b>Part I Policy</b>	<b>3</b>
Requirements of the Building Code	3
Greater Policy Context	3
(a) The National Flood Insurance Program	3
(b) The American Society of Civil Engineers 24-05	4
(c) The New York State Building Code	4
<b>Part II Flood Map</b>	<b>5</b>
Determination of Flood Zone	5
Appropriate Flood Map	6
(d) Mayoral Executive Order 233	6
(e) New York City Building Department Guidance	7
(f) Biggert-Waters Flood Insurance Reform Act of 2012	8
<b>Part III Additional Considerations</b>	<b>9</b>
Design Guidance for Critical Facilities	9
Climate Change Considerations	9
Developing a Design Level of Protection	10
<b>Part IV Results Summary</b>	<b>11</b>

**Tables**

- Table 1. Classification of Structures for Flood-Resistant Design and Construction.
- Table 2. Minimum Elevations Relative to the Base Flood Elevation (BFE) – A and V-Zones.
- Table 3. Minimum Elevation, Relative to Design Flood Elevation (DFE), Below Which Flood-Damage Resistant Materials Shall Be Used, and Minimum Elevation of Utilities and Equipment – A and V-Zones.
- Table 4. FEMA Flood Elevation Sources, 2007 Flood Insurance Study and 2013 Advisory Maps (NAVD88).
- Table 5. Identified Minimum Levels of Protection Based on the New York City Building Code and FEMA ABFE Flood Maps.
- Table 6. Projections of Climate Change for New York City Based on the Climaid Report.
- Table 7. Incremental Design Elevation for Flood Protection for a Category IV Facility in the V-Zone.

**Figures** Error! Bookmark not defined.

- Figure 1 Site Map
- Figure 2 Location Map of Proposed Gowanus Power Generating Station
- Figure 3 Effective Flood Insurance Rate Map
- Figure 4 Fema Advisory Base Flood Elevation Map

**Appendices**

- A Mayoral Executive Order 233
- B 1 Rules of The City of New York §3606-04 (Emergency Rule)
- C Highlights of ASCE 24-05

**Acronyms and Abbreviations**

<b>ABFE</b>	Advisory Base Flood Elevation
<b>ASCE</b>	American Society of Civil Engineers
<b>BFE</b>	Base Flood Elevation
<b>FEMA</b>	Federal Emergency Management Agency
<b>FIRM</b>	Flood Insurance Rate Map
<b>NAVD88</b>	North American Vertical Datum of 1988
<b>NGVD29</b>	National Geodetic Vertical Datum of 1929
<b>NFIP</b>	National Flood Insurance Program
<b>USACE</b>	U.S Army Corps of Engineers



## **Introduction**

Astoria Generating Company, L.P. (AGC) is seeking a recommendation regarding the minimum required flood design level of protection for the Gowanus South Pier Improvement Project (SPIP) located at 29<sup>th</sup> Street and 2<sup>nd</sup> Avenue in Brooklyn, New York. The project involves the addition of several new structures to the pier, as identified in *Figure 1*. The proposed Gowanus SPIP site is in a port area in the east section of Gowanus Bay in Upper New York Bay, Kings County, New York near Governors Island (*Figure 2*).

A minimum required level of protection is identified based on three principal steps:

- 1) Identification of the specific policy or set of policies that govern new construction at the site. This policy provides the freeboard (safety factor) requirements appropriate to the facility category.
- 2) Identification of the appropriate flood maps. These maps identify the flood zone for the property and provide the base flood elevations.
- 3) Identification of the flood zone that the site lies within. Flood zone impacts design requirements at the site appropriate to the facility category.

Additional considerations may impact the level of protection that AGC ultimately determines is both compliant and practicable. These considerations include the upcoming release of new flood insurance rate maps (FIRMs) to supplant existing and advisory maps, anticipated sea level rise, design guidance for critical facilities (such as that provided by FEMA), as well as engineering and construction feasibility and associated costs.

In determining a design level of protection, especially for mitigation purposes, a typical practice is to identify the minimum required and goal levels of protection, then conduct multiple alternatives evaluation and benefit cost analysis to arrive at a definitive figure.

As such, this document is structured to not only identify a minimum required level of protection for the site, but also considerations regarding factors that may affect design level of protection for the Gowanus SPIP.



The document is structured in four parts, as follows:

- Part I Policy: Provides guidance regarding the governing policy for the site, as well as an overview of policy contributing to the greater policy context surrounding minimum design levels of protection against flood.
- Part II Flood Map: Provides guidance regarding the required flood map and special considerations regarding use of this map.
- Part III Additional Considerations: Provides guidance regarding additional considerations AGC may wish to incorporate into the final determination regarding a design level of protection.
- Part IV Results Summary

Findings of the report indicate that AGS should adhere to the New York City Building Code for free-board guidance and FEMA's Advisory Base Flood Elevation map (ABFE) for the site regarding the minimum level of protection for its classification of facility (*Table 5*). This would require a minimum elevation of 14 feet (ft) in the North American Vertical Datum of 1988 (NAVD88), assuming that the site consists of Category III facilities based on the New York City Building Code (*Table 1*). Nevertheless, additional considerations may alter the ultimate design level of protection that AGC determines adequate for construction. Incremental increases in protection based on these considerations are presented in *Table 7*. The recommended design level of protection for critical infrastructure according to *FEMA 543 Design Guide for Critical Facilities in the Floodplain* is the 500-year flood elevation. The 500-year flood elevation for the site is at an elevation of 18 ft NAVD88.



## **Part I Policy**

AGC is required to adhere to the New York City Building Code. This code is in line with the New York State Building Code and references the American Society of Civil Engineers 24 (ASCE 24) standard for flood protection.

### **Requirements of the Building Code**

The building code identifies flood protection requirements by building category. According to the New York City Building Code, the Gowanus SPIP is classified as Structural Occupancy Category III (*Table 1*). Nevertheless, if the station is required as emergency back-up facilities for Structural Occupancy Category IV structure, then the Structural Occupancy Category IV minimum elevations should be employed. For the purposes of this analysis, requirements for Category IV classification are also considered.

Minimum flood resistant design elevations for Structural Occupancy Categories III and IV are provided in *Table 2* and *Table 3*.

### **Greater Policy Context**

AGC expressed a desire to understand the greater policy context surrounding minimum level of protection at the site and, as such, certain relevant items are described below.<sup>1</sup>

- (a) The National Flood Insurance Program

The National Flood Insurance Program (NFIP) is administered by Federal Emergency Management Agency (FEMA) and has three main elements: Hazard Identification and Mapping; Floodplain Management Criteria for Development; and Flood Insurance. The minimum flood design requirements of the NFIP are set forth in 44 CFR Part 60. These requirements have been integrated into the New York State and New York City Building Codes.

---

<sup>1</sup> Mayoral Executive Order 233 is described within Part II of this document.





(b) The American Society of Civil Engineers 24-05

The American Society of Civil Engineers 24-05 (ASCE 24-05) is referenced as the industry standard in the International Building Code for flood resistant design and construction. ASCE 24-05 outlines the minimum requirements and expected performance for the design and construction of structures in the floodplain. It is intended to complement the NFIP minimum requirements, providing additional requirements to better resist flood loads and damages. Features of ASCE 24-05 are currently incorporated in to both the New York State Building Code and the New York City Building Code, and are described in further detail within the *Design Level of Protection* section below. Highlights of the Code are provided in *Appendix C*.

(c) The New York State Building Code

Chapter 16, Section 1612 of the New York State Building Code states that:

*“The design and construction of buildings and structures located in flood hazard areas, including flood hazard areas subject to high velocity wave action, shall be in accordance with ASCE 24.”*

This regulation has been adopted by the New York City Building Code and the Gowanus SPIP will be subject this requirement.

## **Part II Flood Map**

Prior to Hurricane Sandy, FEMA was in the process of restudying areas of the New York coastline to update Flood Insurance Rate Maps (FIRMs) necessary for administering the NFIP. According to FEMA's flood insurance study for the area, which the FIRM is based upon, the existing 2007 FIRMs were developed using data gathered in the 1980's. The current effective FIRM is provided in *Figure 3*.

Updated maps were set to be delivered to state and local officials in mid-2013 and when Hurricane Sandy impacted New York City, newly updated FIRMs had not yet been finalized. To support safe and responsible reconstruction efforts, FEMA released Advisory Base Flood Elevations (ABFEs) in January 2013 for many areas impacted by the storm (*Figure 4*).

Advisory Base Flood Elevations are derived from more recent data using improved study methodologies and incorporating new information from recent flood events. Following Hurricane Sandy, FEMA determined that the base flood elevations shown on existing FIRMs did not adequately reflect the actual flood hazard risk. It should be noted that ABFEs do not officially alter the effective FIRM. Instead, communities and property owners are encouraged to use the information for recovery and reconstruction until more detailed flood hazard data becomes available, especially if the ABFEs are somewhat higher than the BFEs. In some cases, communities officially adopt the ABFEs in the interim period before new effective FIRMs are released.

FEMA's Advisory Base Flood Elevations indicate an increase in flood risk over the original base flood elevation values in the current effective FIRM. Elevations shown in the Advisory Base Flood Elevation Map are referenced to NAVD88 (*Figure 4*). The Advisory Base Flood Elevations values as compared to those provided in the 2007 flood insurance study are provided in *Table 4*.

### **Determination of Flood Zone**

The minimum required level of protection at the site is, in part, determined based on the flood zone within which the site resides. This is due to the flood risks associated with each zone. The current regulatory FEMA FIRM indicates that the project site is in Coastal Flood Zone AE (*Figure 3*), an area of moderate wave heights. The ABFE for the site also indicates that the site is in Coastal Flood Zone AE, despite bordering a Velocity Zone (V-Zone) (*Figure 4*), an area of expected wave heights of three feet. An analysis of area and geometry at the site indicates that it is largely protected from the



hazards associated with a V-zone. As such, Flood Zone AE is an adequate reference for identifying level of protection at the site. Building requirements for both zone AE and V are provided in *Tables 2 and 3*.

### **Appropriate Flood Map**

At this time, neither New York State nor the City of New York has formally adopted the Advisory Base Flood Elevation Maps. AGC is, therefore, required to meet the Building Code standards which have adopted the existing effective FIRM. Nevertheless, for reasons described below, ARCADIS does not advise that AGC use the existing FIRM for new construction.

The current regulatory FEMA FIRM indicates elevation 9.9 NAVD88 for the 100-year recurrence interval (BFE). The 100-year base flood elevation in the ABFE map AE zone is elevation 13 NAVD88. While this is a significant elevation change from the current regulatory FIRM, Hurricane Sandy produced a surge of 11.2 feet NAVD88 according to a measured high water mark about 500 feet south of the project site. This is greater than one foot above the effective FIRM map 100-year base flood elevation.

New maps are expected to be released later this year, but the date is unknown. If AGC is to presently move forward with the project, the ABFEs may be considered as an alternative map that will allow AGC to meet current and future minimum requirements with regard to the level of protection. Evidence of support for this approach is presented below.

(d) **Mayoral Executive Order 233**

Mayor Bloomberg issued Executive Order 233 in response to the need to elevate and flood-proof structures as a result of Hurricane Sandy (see *Appendix A*). The Order suspends specific zoning restrictions for new construction and reconstruction in areas affected by the storm. Executive Order 233 lifts height restrictions in the zoning ordinance in order to facilitate structure elevations in the Special Flood Hazard Area, as indicated in the Order:

*“WHEREAS, current zoning height restrictions and other limitations pose significant practical difficulties for the reconstruction of affected buildings consistent with elevations shown on the Advisory Base Flood Elevation Maps...”*

Executive Order 233 is significant because it is an official statement by the mayor that recognizes FEMA's Advisory Base Flood Elevations as the most up to date information on safe elevations for flood resistant design over the existing FIRMs. According to the Order:

*"WHEREAS, on January 28, 2013, the Federal Emergency Management Agency ("FEMA") published Advisory Base Flood Elevation Maps for portions of New York City, and FEMA will shortly publish Advisory Base Flood Elevation Maps for the remainder of New York City, providing more up to date information on safe elevations for flood resistant construction..."*

The Order provides direction for the use of the Advisory Base Flood Elevations in determining the minimum flood design level of protection under the zoning suspension, as follows:

- *The design level of protection must be built to whichever flood zone designation is more stringent of the Advisory Base Flood Elevation Map and the existing Flood Insurance Rate Map; and*
- *The design flood elevation should be no less than the 1% Advisory Base Flood Elevation shown on the Advisory Base Flood Elevation Map.*

As stated above, neither New York State nor the City of New York has formally adopted the Advisory Base Flood Elevation Maps at this time.

(e) New York City Building Department Guidance

The New York City Building Department recently published two guidance documents. This guidance references Executive Order 233 and reiterates many of the provisions paraphrased above. In *Rebuilding NYC after Hurricane Sandy: A Guide to New Codes and Zoning Standards for Industry Professionals*, Advisory Base Flood Elevation Maps are referenced in the introduction as the most up to date information on safe elevation for flood resistant construction. In *Information about Rebuilding after Hurricane Sandy*, the New York City Building Department states: "Rebuilding to the new standards in the ABFE Maps will minimize future damage and will lead to lower insurance premiums in the long term."

Non-residential structures can be insured under the NFIP. In the case that AGC owns facilities insured by the NFIP, a brief description of the *Biggert-Waters Flood Insurance Reform Act of 2012* is provided below.



(f) Biggert-Waters Flood Insurance Reform Act of 2012

In 2012, Congress passed the Flood Insurance Reform Act of 2012 which makes a number of changes to administration and implementation of the NFIP. Key provisions of the legislation will require the NFIP to raise currently subsidized rates to actuarially sound rates, those representing a determination of true flood risk. Beginning October 1, 2013, subsidized rates for commercial properties in Special Flood Hazard Areas will be phased out and will see a 25 percent annual rate increase until rates reflect true risk.

The Act calls for risk-based rates once the City of New York adopts a new FIRM, which is expected for release later this year. Nevertheless, employing FEMA's Advisory Base Flood Elevations over the existing Base Flood Elevations in the design of the Gowanus South Pier Improvement Project will likely lower the risk of flood damage to the facility and may reduce future insurance premiums for the structure. *Any planning associated with impacts to insurance premiums should first be discussed with the insurance provider.*

### **Part III Additional Considerations**

Based on industry design guidance, and expected increases in flood probability and expected sea level rise in the region due to climate change, AGC may wish to consider a flood design level of protection for the Gowanus South Pier Improvement Project that exceeds code minimums.

#### **Design Guidance for Critical Facilities**

*FEMA 543: Design Guide for Improving Critical Facility Safety from Flooding and High Winds* recommends protecting critical facilities to the 0.2 percent annual chance flood event (500-year flood event).

This elevation is typically higher than specified by ASCE 24-05 or in the *New York City Building Code Appendix G: Section G501*. As such, there may be higher costs associated with the design and construction to a flood design level in excess of the minimum required. AGC may benefit from increased resistance to future flood loads and resulting damages, and may see reduced or stabilized future flood insurance premiums as a result. *Any planning associated with impacts to insurance premiums should first be discussed with the insurance provider.*

#### **Climate Change Considerations**

Recent events such as Superstorm Sandy strengthen evidence that New York State is now faced with a climate context that exacerbates current risks and vulnerabilities. In fact, the New York State Climate Action Council Interim Report firmly states it is no longer in question that our climate is changing (NYS Climate Action Council, 2010). One effect of climate change is rising sea levels which increases the height of storm surges and the resulting potential damage caused by a storm surge. Due to its location, any increase in flood risk through precipitation changes or sea level rise is particularly problematic for the Gowanus SPIP.

Temperature, precipitation, and sea level, as well as the frequency of severe storm events, are predicted to increase.<sup>2</sup> *Table 6* summarizes the projected climatic

---

<sup>2</sup> It should be noted that all scenarios regarding future conditions, while scientifically identified using global climate models, are projections. As with all projections, findings are hypothetical in nature.

variables for New York City identified in the technical report entitled *Responding to Climate Change in New York State: The ClimAID Integrated Assessment for Effective Climate Change Adaptation* (ClimAID), written for the New York State Energy Research Development Authority through a collaboration of members from NASA's Godard Institute of Space Science, City University of New York, Columbia University, and Cornell University.

A wide range of sea level rise trends can be found in various studies, but the U.S Army Corps of Engineers (USACE) guidance requires consideration of three projected sea level rise rates for coastal planning (USACE FIMP, 2006). The USACE FIMP study for nearby Suffolk County considers the following rates of sea level rise:

- Continued historic rate (0.6 feet in 50 years)
- Increased, "intermediate" rate (1.1 feet in 50 years)
- A higher and increased rate (2.3 feet in 50 years)

There is currently no criterion on how to use the sea level rise rates and most previous designs do not consider this factor. AGC may wish to consider this risk in determining a design level of protection for the site.

#### **Developing a Design Level of Protection**

After Hurricane Katrina, FEMA published a design guide and practical recommendations for protecting critical facilities against natural hazards, such as flooding and high wind events. The design guide, *FEMA 543*, not only presents the requirements for new construction, but also addresses rehabilitation of existing critical facilities, including power-generating stations.

Due to costs and feasibility considerations, a recommended and minimum design standard can be identified with incremental improvements in between. A benefit cost analysis, as well as multiple alternatives evaluation, can be used to determine the design elevation for mitigation measures.

AGC may consider the following when determining the ultimate design elevation for flood protection at the site:

- Minimum required and industry recommended design elevations
- Appropriate flood map (FEMA ABFE);



- Projected sea level rise; and
- An industry standard or regulated safety factor (freeboard).

*Table 7* lists potential design elevations for the 1- and 0.2-percent annual probability of flooding, which correspond to the 100-year and 500-year return periods, respectively. Each incremental improvement affords a greater level of protection.

#### **Part IV Results Summary**

AGC should adhere to the New York City Building Code for free-board guidance and FEMA's Advisory Base Flood Elevation map (ABFE) for the site regarding the minimum level of protection for its classification of facility (*Table 5*). This would require a minimum first floor elevation of 14 ft NAVD88 for the Coastal A-Zone, assuming that the site consists of Category III facilities based on the New York City Building Code (*Table 1*). Nevertheless, additional considerations may alter the ultimate design level of protection that AGC determines adequate for construction. Incremental increases in protection based on these considerations are presented in *Table 7*. The recommended design level of protection for critical infrastructure according to *FEMA 543 Design Guide for Critical Facilities in the Floodplain* is the 500-year flood elevation. The 500-year flood elevation for the site is at an elevation of 18 ft NAD88.





Table 1. Classification of Structures for Flood-Resistant Design and Construction.

Nature of Occupancy	Structural Occupancy Category
Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: <ul style="list-style-type: none"> <li>▪ Agricultural facilities</li> <li>▪ Certain temporary facilities</li> <li>▪ Minor storage facilities</li> </ul>	I
Buildings and other structures except those listed in Structural Occupancy Categories I, III and IV	II
Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: <ul style="list-style-type: none"> <li>▪ Buildings and other structures where more than 300 people congregate in one area</li> <li>▪ Buildings and other structures with elementary school, secondary school or day-care facilities with an occupant load greater than 250</li> <li>▪ Buildings and other structures with an occupant load greater than 500 for colleges or adult education facilities</li> <li>▪ Health care facilities with an occupant load of 50 or more resident patients but not having surgery or emergency treatment facilities</li> <li>▪ Jails and detention facilities</li> <li>▪ <b>Power-generating stations, water treatment for potable water, waste water treatment facilities and other public utility facilities not included in Structural Occupancy Category IV (emphasis added)</b></li> <li>▪ Buildings and other structures not included in Structural Occupancy Category IV containing sufficient quantities of toxic or explosive substances to be dangerous to the public if released</li> </ul>	III
Buildings and other structures designed as essential facilities including, but not limited to: <ul style="list-style-type: none"> <li>▪ Hospitals and other health care facilities having surgery or emergency treatment facilities</li> <li>▪ Fire, rescue and police stations and emergency vehicle garages</li> <li>▪ Designated earthquake, hurricane or other emergency shelters</li> <li>▪ Designated emergency preparedness, communication, and operation centers and other facilities required for emergency response</li> <li>▪ <b>Power-generating stations and other public utility facilities required as emergency backup facilities for Structural Occupancy Category IV structures</b></li> <li>▪ Structures containing highly toxic materials as defined by Section 307 where the quantity of the material exceeds the maximum allowable quantities of Table 307.7(2) of the New York City Building Code</li> <li>▪ Aviation control towers, air traffic control centers and emergency aircraft hangars</li> <li>▪ Buildings and other structures having critical national defense functions</li> <li>▪ Water treatment facilities required to maintain water pressure for fire suppression</li> </ul>	IV

Source: Section 1.1, Table 1-1, New York City Building Code Appendix G, Section G501



Table 2. Minimum Elevations Relative to the Base Flood Elevation (BFE) - A and V-Zones.

Structural Occupancy Category	A-Zone (elevation of lowest floor)	V-Zones (bottom of lowest horizontal structure member)	
		Orientation Parallel*	Orientation Perpendicular*
III	DFE = 1% Advisory Base Flood Elevation + 1 ft.	DFE = 1% Advisory Base Flood Elevation + 1 ft.	1% DFE = Advisory Base Flood Elevation + 2 ft.
IV	DFE = 1% Advisory Base Flood Elevation + 2 ft.	DFE = 1% Advisory Base Flood Elevation + 1 ft.	DFE = 1% Advisory Base Flood Elevation + 2 ft.

\*Orientation of lowest horizontal structural member relative to the general direction of wave approach. Parallel shall mean less than or equal to +20 degrees from the direction of approach; Perpendicular shall mean greater than +20 degrees from the direction of approach.

Source: Section 2.3 & 4.1, Table 2-1 & 4-1, New York City Building Code Appendix G, Section G501



Table 3. Minimum Elevation, Relative to Design Flood Elevation (DFE), Below Which Flood-Damage Resistant Materials Shall Be Used, Minimum Elevation of Utilites and Equipment - A and V-Zones.

Structural Occupancy Category	A-Zone	V-Zones	
		Orientation Parallel*	Orientation Perpendicular*
III	DFE = 1% Advisory Base Flood Elevation + 1 ft.	DFE = 1% Advisory Base Flood Elevation + 2 ft.	DFE = 1% Advisory Base Flood Elevation + 3 ft.
IV	DFE = 1% Advisory Base Flood Elevation + 2 ft.	DFE = 1% Advisory Base Flood Elevation + 2 ft.	DFE = 1% Advisory Base Flood Elevation + 3 ft.

\*Orientation of lowest horizontal structural member relative to the general direction of wave approach. Parallel shall mean less than or equal to +20 degrees from the direction of approach; Perpendicular shall mean greater than +20 degrees from the direction of approach.

Source: Section 5.1, Table 5-1, New York City Building Code Appendix G, Section G501



Table 4. FEMA Flood Elevation Sources, 2007 Flood Insurance Study and 2013 Advisory Maps (NAVD88).

Flood Elevations Source	10-year (10%)	50-year (2%)	100-year (1%)	500-year (0.2%)
2007 FEMA Flood Insurance Study (NAVD88) Stillwater Elevations at Governors Island	6.4	7.9	8.7	10.7
2007 FEMA Flood Insurance Study (NAVD88) BFE at the project site (DFIRM 2007)	7.3	9	9.9	12.2
2013 FEMA Advisory Base Flood Elevations (NAVD88) at the project site	-	-	13	18

Source: Federal Emergency Management Agency (FEMA)



Table 5. Identified Minimum Levels of Protection Based on the New York City Building Code and FEMA ABFE Flood Maps.

Structural Occupancy Category	A-Zone	V-Zones	
		Orientation Parallel*	Orientation Perpendicular
		III	14** / 14***
IV	15** / 15***	14** / 15***	15** / 16***

\*Orientation of lowest horizontal structural member relative to the general direction of wave approach. Parallel shall mean less than or equal to +20 degrees from the direction of approach; Perpendicular shall mean greater than +20 degrees from the direction of approach.

\*\* For the A zone, this is the elevation of lowest floor, for the V-zone, bottom of lowest horizontal structure member.

\*\*\*Elevation below which flood damage resistance materials should be used / minimum elevation of utilities and equipment.



Table 6. Projections of Climate Change for New York City Based on the Climaid Report.

Climatic Variable	Baseline	Time Slice <sup>1</sup>		
	1970-1990	2020	2050	2080
Air Temperature (°F)	53°F (annual mean)	+1.5 to +3	+3 to +5	+4 to +7.5
Precipitation (in)	46 in (annual mean)	0 to +5%	0 to +10%	+5 to +10%
Sea Level Rise (in)				
GCM	-	+1 to +5	+5 to +12	+8 to +23
Rapid Ice Melt	-	+4 to +10	+17 to +29	+37 to +55
Coastal Storm Frequency <sup>2</sup>		65-80 yr		
100 yr return period	100 yr	380-450 yr	35-55 yr	15-35 yr
500 yr return period	500 yr		250-330 yr	120-250 yr

Notes:

1) The time slice reflects a 30-year average for precipitation and temperature (10 -year average for sea level rise) centered around the given decade (i.e. the 2050 time period refers to the average of years 2040-2069).

2) Sources: Coastal Frequency data comes from McLaughlin, B., S. Murrell, S. DesRoches. *Anticipating Climate Change*. Civil Engineering- ASCE Vol. 81, No. 4, April 2011, pp. 50-55. All other climatic variables come from ClimAID report (Rosenzweig, C., W. Solecki, A. DeGaetano, M. O'Grady, S. Hassol, and P. Grabhorn (Eds.), 2011: *Responding to Climate Change in New York State: The ClimAID Integrated Assessment for Effective Climate Change Adaptation: Synthesis Report*. New York State Energy Research and Development Authority. 2011 < <http://pubs.giss.nasa.gov/abs/ro02210k.html>>).



Table 7. Incremental Design Elevation for Flood Protection for a Category IV Facility in the V-Zone.

Components	A Zone	V - Zone	
		Orientation Parallel*	Orientation Perpendicular*
FEMA Identified 100-year Advisory Base Flood Elevation (ft., NAVD88)	13	13	13
Required Freeboard for Category IV Critical Facility (ft.)	2.0** / 2.0***	1.0** / 2.0***	2.0** / 3.0***
Median Anticipated 50 year Sea Level Rise (ft.)	1	1	1
Potential Goal Design Elevation Based on 100-year (ft., NAVD88)	16.0** / 16.0***	15.0** / 16.0***	16.0** / 17.0***
Potential Goal Design Elevation Based on FEMA 543 Recommended 500-year Design Flood Elevation	18	18	18

\*Orientation of lowest horizontal structural member relative to the general direction of wave approach. Parallel shall mean less than or equal to +20 degrees from the direction of approach; Perpendicular shall mean greater than +20 degrees from the direction of approach.

\*\* For the A zone, this is the elevation of lowest floor; for the V-zone, bottom of lowest horizontal structure member.

\*\*\*Elevation below which flood damage resistance materials should be used / minimum elevation of utilities and equipment.

# Figures

## Figure 1 SITE MAP

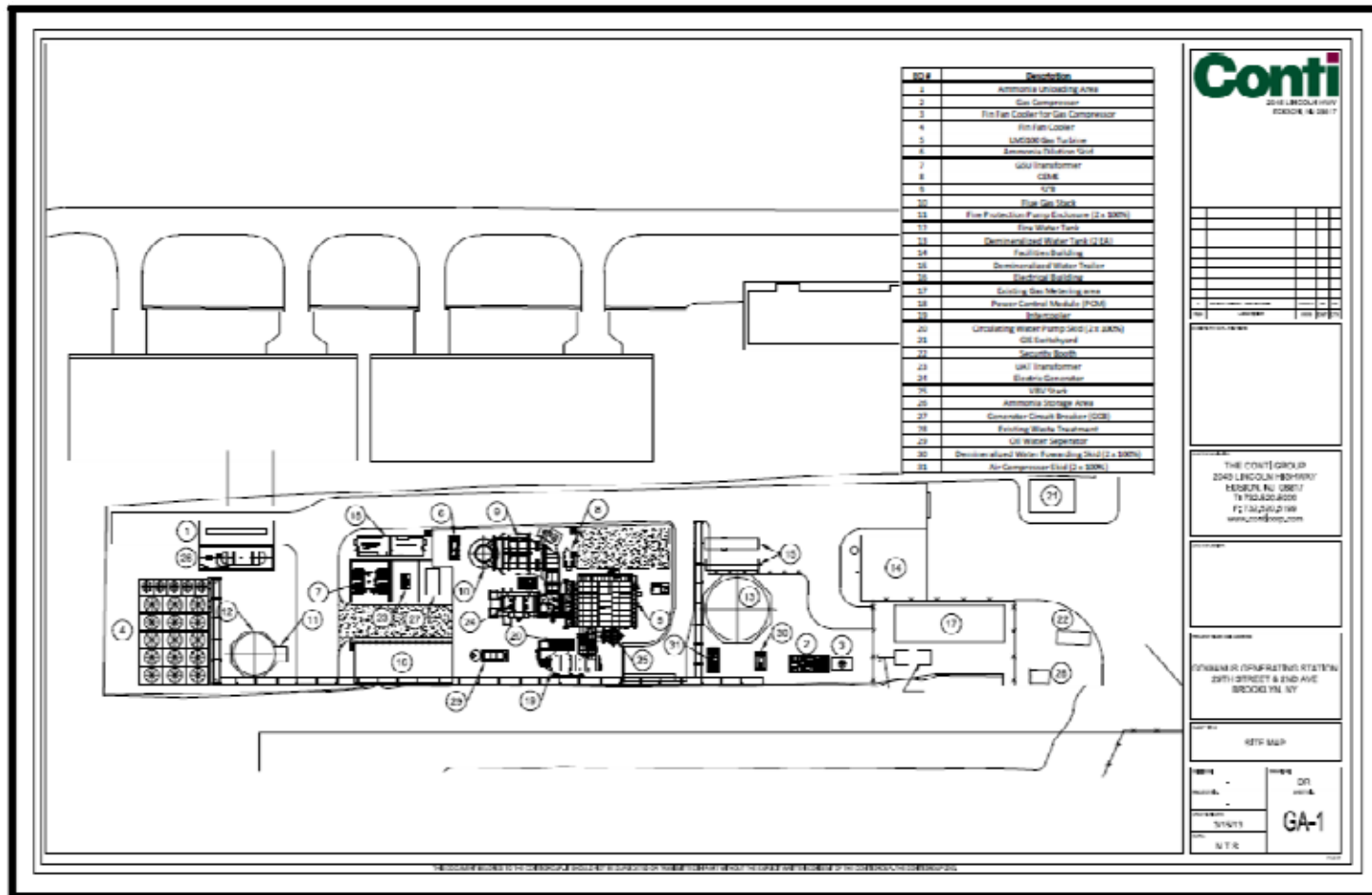




Figure 2 LOCATION MAP OF PROPOSED GOWANUS POWER GENERATING STATION



Figure 3 EFFECTIVE FLOOD INSURANCE RATE MAP

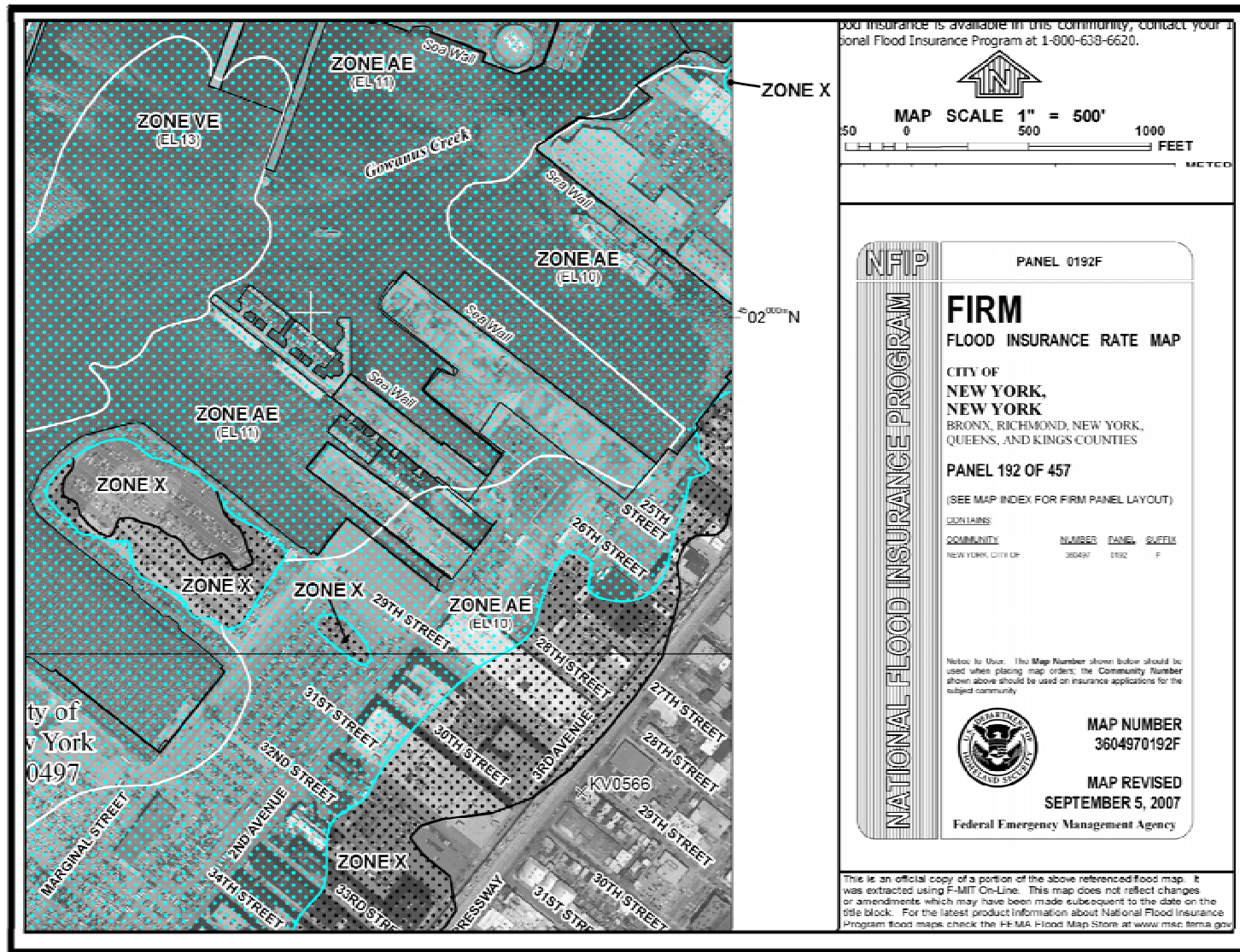


Figure 4 FEMA ADVISORY BASE FLOOD ELEVATION MAP





**Appendix A**

Mayoral Executive Order 233



THE CITY OF NEW YORK  
OFFICE OF THE MAYOR  
NEW YORK, N. Y. 10007

EXECUTIVE ORDER NO. 233

EMERGENCY ORDER TO SUSPEND ZONING PROVISIONS TO FACILITATE  
RECONSTRUCTION IN ACCORDANCE WITH ENHANCED FLOOD RESISTANT  
CONSTRUCTION STANDARDS

February 5, 2013

WHEREAS, Executive Order 225, issued January 26, 2013, contains a proclamation extending a state of emergency in the City of New York, and such proclamation remains in effect for a period not to exceed thirty days or until rescinded, whichever occurs first; and

WHEREAS, on October 26, 2012, the Governor issued a declaration of emergency for all counties in the State of New York, including the City of New York, and such declaration remains in effect for a period not to exceed six months or until rescinded, whichever occurs first; and

WHEREAS, a severe storm ("Hurricane Sandy") hit New York City recently, causing heavy flooding, power outages, property damage, and disruption of public transportation and other vital services; and

WHEREAS, the effects of Hurricane Sandy have significantly damaged or destroyed many one- and two-family homes, as well as a number of multiple dwellings and other buildings, resulting in the displacement of residents, businesses and community facilities; and

WHEREAS, the reconstruction and reoccupancy of such buildings is critical to disaster recovery and it is essential that reconstruction proceed in a manner that incorporates enhanced flood risk prevention standards reflective of best practices; and

WHEREAS, on January 28, 2013, the Federal Emergency Management Agency (“FEMA”) published Advisory Base Flood Elevation Maps for portions of New York City, and FEMA will shortly publish Advisory Base Flood Elevation Maps for the remainder of New York City, providing more up to date information on safe elevations for flood resistant construction; and

WHEREAS, pursuant to the emergency rulemaking procedures of the City Administrative Procedure Act, New York City Charter Section 1043(i)(1), the Department of Buildings promulgated an emergency rule, 1 RCNY 3606-04, to amend reference standard American Society of Civil Engineers (“ASCE”) 24 as incorporated into Appendix G ( “Flood Resistant Construction”) of the New York City Building Code (hereinafter “Appendix G”) and relating to the level above the base flood elevation to which new, substantially damaged or substantially improved buildings must be designed and constructed ; and

WHEREAS, current zoning height restrictions and other limitations pose significant practical difficulties for the reconstruction of affected buildings consistent with elevations shown on the Advisory Base Flood Elevation Maps and the timeframe required for adoption of amendments to the New York City Zoning Resolution (“Zoning Resolution”) would substantially impede rapid reconstruction in accordance with such Maps ; and

WHEREAS, current zoning limits the reconstruction and continuation in use of retail businesses located in residential districts, as well as the reconstruction of other non-conforming and non-complying buildings; and

WHEREAS, the above-described provisions of the Zoning Resolution will prevent, hinder or delay disaster recovery, requiring the adoption of emergency measures; and

WHEREAS, the Department of City Planning will proceed forthwith to prepare and forward into the public review process proposed amendments to the Zoning Resolution that will make permanent the provisions of this Executive Order;

NOW, THEREFORE, it is hereby ordered:

§1. The provisions of this Order shall apply only with respect to buildings:

- a. that are located within the Advisory Limit of the 1% Annual Chance Flood Hazard Area as delineated on FEMA Advisory Base Flood Elevation Maps;
- b. for which construction must be, or is otherwise proposed to be, performed fully in accordance with the flood resistant construction provisions of Appendix G that would apply if such building were hereafter erected; and
- c. for which construction utilizes as the Design Flood Elevation for the purposes of the Tables in Appendix G, the Zoning Design Flood Elevation as defined in Section two of this Order; provided, further, that:

- i. such construction shall be made under the provisions governing the more restrictive of the area of special flood hazard applicable to the building location shown on the FEMA Advisory Base Flood Elevation Map and the FEMA FIRMs 360497/FEMA FIS 360497;
- ii. in V-Zones, the minimum elevation below which flood-damage-resistant materials must be used shall be the sum of:  
(A) the Zoning Design Flood Elevation and (B) the difference between the Design Flood Elevation for flood-damage-resistant materials in Table 5-1, and the Design Flood Elevation for V Zones shown in Table 4-1, for the applicable structural occupancy category of ASCE 24, as amended by 1 RCNY 3606-04;
- iii. in V Zones, the minimum elevation of utilities and attendant equipment shall be the sum of: (A) the Zoning Design Flood Elevation and (B) the difference between the Design Flood Elevation for utilities and attendant equipment in Table 7-1, and the Design Flood Elevation for V Zones shown in Table 4-1, for the applicable structural occupancy category of ASCE 24, as amended by 1 RCNY 3606-04; and
- iv. for all one- or two-family residences located in A Zones, all enclosures below the Zoning Design Flood Elevation with a vertical clearance of five feet or greater, except for wet-flood



proofed enclosures for stairs and vestibules, shall be of an open lattice type construction.

- d. Notwithstanding the foregoing, the provisions of this Order shall apply where the building is located within an area of special flood hazard as established by Section G102.2 of Appendix G, but is not located within the Advisory Limit of the 1% Annual Chance Flood Hazard Area as delineated on the FEMA Advisory Base Flood Elevation Maps, in which case this Order shall apply where construction is consistent with flood-resistant construction provisions of Appendix G, including the requirements therein governing the Base Flood Elevation and Design Flood Elevation that would apply if such building were hereafter erected.

§2. The “Zoning Design Flood Elevation” is defined for purposes of this Order as an elevation that is the higher of:

- a. Any applicable Design Flood Elevation in accordance with FEMA FIRMs 360497/FEMA FIS 360497 and Appendix G, including ASCE 24 as amended by 1 RCNY 3606-04; and
- b. An elevation selected by the applicant that is:
  - i. no less than the 1% Advisory Base Flood Elevation for the building location shown on the FEMA Advisory Base Flood Elevation Maps; and
  - ii. no higher than the elevation which is the sum of: (A) the 1% Advisory Base Flood Elevation for the building location

shown on the FEMA Advisory Base Flood Elevation Maps; and (B) the difference between the Design Flood Elevation and the Base Flood Elevation for the applicable structural occupancy category as shown in Tables 2-1 (A-Zones) or 4-1 (V-Zones) of ASCE 24, as amended by 1 RCNY 3606-04.

Notwithstanding the foregoing, the Zoning Design Flood Elevation may be an elevation that is less than the 1% Advisory Base Flood Elevation for the building location shown on the FEMA Advisory Base Flood Elevation Maps, where the Department of Buildings has determined that a reduction is warranted based on more recent, detailed information provided to the City by FEMA.

§3. Pursuant to the powers vested in me by Paragraph g of Subdivision 1 of Section 24 of the New York Executive Law to suspend any local laws, ordinances, or regulations, or parts thereof, which may prevent, hinder, or delay necessary action in coping with a disaster or recovery therefrom whenever the Governor has declared a State Disaster Emergency, I hereby suspend, subject to the provisions of Sections one and two of this order, provisions of the Zoning Resolution as described in this Section and set forth in the attached list:

- a. The following shall apply to single-family and two-family residences existing on October 28, 2012:
  - i. All provisions of the Zoning Resolution establishing building height limitations, minimum distance requirements between legally required windows and walls or lot lines, yard requirements, and, for buildings that were non-complying

buildings as of October 28, 2012, the provisions prohibiting new non-compliances, or prohibiting an increase in the degree of existing non-compliances, are suspended in all cases insofar as and to the extent required to:

A. vertically elevate such a residence, or vertically elevate a reconstruction of such a residence, in order to raise the lowest floor level containing lawful habitable space located at or above the adjoining grade as of October 28, 2012, such that (1) for residences in A zones, such lowest floor may be elevated to the Zoning Design Flood Elevation, as defined in Section two of this Order, and (2) for residences in V Zones, the lowest horizontal structural member supporting such lowest floor may be elevated to the Zoning Design Flood Elevation, as defined in Section two of this Order; and

B. reposition a residence elevated pursuant to Subparagraph (A) of this Paragraph under the conditions set forth in Subparagraph (B) of Paragraph (ii) of this Subdivision.

ii. The suspensions of the Zoning Resolution pursuant to Paragraph (i) of this Subdivision are subject to the following conditions:

- A. the building footprint shall have dimensions no greater than the footprint that existed on October 28, 2012;
  - B. where a building is repositioned to reduce an encroachment into a front yard by up to three feet in depth in order to accommodate stair access, such building may also be repositioned to newly encroach or further encroach into required yards at the rear of the building by up to an equivalent depth, provided that a distance of eight feet or more, measured perpendicular to the rear wall of the building, shall be maintained between such new encroachment and all other residences on the same or adjoining zoning lots; and
  - C. elevating or repositioning such building shall not result in a new floor area non-compliance, nor increase the degree of any pre-existing floor area non-compliance.
- b. The following provisions shall apply for all buildings, whether existing, new, altered, or enlarged:
- i. All provisions of the Zoning Resolution establishing building height limitations (including height limits for building features such as ground floor transparencies and accessory

signs) based on measurement from a datum are suspended, insofar and to the extent that such limitations may be exceeded by the difference between the applicable datum and the Zoning Design Flood Elevation. Such data include, without limitation: front yard line level, base plane, base flood elevation, street wall line level, curb level, street line, and adjacent grade, as such terms are defined or used by the Zoning Resolution. *[For non-complying buildings or portions thereof see also Paragraph (i) of Subdivision (c) of this Section.]*

- ii. For residential buildings located in districts governed by the bulk regulations of R1-2A, R2A, R2X, R3, R4 or R5 Districts, the provisions of Section 12-10 of the Zoning Resolution regulating the amounts of floor space for mechanical equipment that must be included in, or may be excluded from, floor area calculations are suspended insofar and to the extent that the Commissioner of Buildings issues a written determination that an amount of floor space for mechanical equipment need not be included in floor area calculations on the basis that such floor space is necessary for mechanical equipment and the mechanical equipment is to be located at or above the Zoning Design Flood Elevation.

- iii. For single-family and two-family residences, all provisions of the Zoning Resolution governing permitted obstructions in rear or side yards or open spaces are suspended, insofar as and to the extent that an accessory emergency generator shall be allowed in such a yard or open space, provided that such generator is in compliance with all other applicable codes, rules and regulations, is located at least five feet from a lot line, and is raised to the Zoning Design Flood Elevation.
- c. The following provisions shall apply to non-complying buildings, or portions thereof, existing on October 28, 2012, other than single-family and two-family residences:
  - i. All provisions of the Zoning Resolution that prohibit increases in the degree of non-compliance through reconstruction are suspended, insofar and to the extent that an increase in height equal to the difference between the applicable datum and the Zoning Design Flood Elevation would result in any non-compliance, provided that:
    - (A) such reconstruction on the zoning lot does not result in buildings that extend beyond the footprint of buildings existing on October 28, 2012; and
    - (B) elevating a building shall not result in a new floor area non-compliance, nor increase the degree of any pre-existing floor area non-compliance.

- ii. The provisions of Section 54-41 of the Zoning Resolution that require that reconstruction of non-complying buildings or other structures damaged or destroyed by any means to the extent of 75 percent or more of their total floor area, other than single-family and two-family residences, shall be made in accordance with the applicable bulk regulations, are suspended, insofar as and to the extent that reconstruction of buildings damaged to an extent of 75 percent or more of their floor area due to the effects of Hurricane Sandy may be reconstructed to the pre-existing degree of non-compliance and in addition, with an increase in height in accordance with the provisions of Paragraph (i) of this Subdivision.
  
- d. The following provisions shall apply to non-conforming uses existing on October 28, 2012:
  - i. The provisions of Sections 52-53 and 52-54 of the Zoning Resolution, and the provisions of Section 52-22 in connection therewith, that restrict reconstruction, structural alteration, and continuance in use of non-conforming uses damaged or destroyed due to the effects of Hurricane Sandy to the extent set forth in such Sections, are suspended, insofar as and to the extent that such non-conforming uses may be reconstructed, structurally altered, and continued in use, provided that this Paragraph shall not apply to:

- A. non-conforming residential uses located in C8 or manufacturing districts; and
  - B. non-conforming manufacturing uses located in residential or commercial districts other than C8 districts.
- e. The following provisions shall apply to buildings containing residences and structures accessory thereto in existence as of October 28, 2012 in the Special South Richmond District that were damaged due to the effects of Hurricane Sandy:
- i. The provisions of Section 107-22 *et seq.* of the Zoning Resolution are suspended, insofar and to the extent that, as determined in writing by the Commissioner of Buildings, a development:
    - A. does not result in buildings or other structures that extend beyond the footprint of buildings or other structures existing on October 28, 2012; and
    - B. would not result in an increase in impervious surfaces on the zoning lot.

In addition, the provisions of Section 107-22 *et seq.* of the Zoning Resolution are suspended, insofar and to the extent that the Commissioner of Buildings may approve a site alteration that such Commissioner determines in writing is




the minimum necessary to enable the reconstruction of the building.

- ii. The provisions of Section 107-23 of the Zoning Resolution are suspended, insofar and to the extent that, as determined in writing by the Commissioner of Buildings a development on the zoning lot does not result in buildings or other structures that extend beyond the footprint of buildings or other structures existing on October 28, 2012. Such suspension shall not affect the terms of a certification previously made by the City Planning Commission pursuant to Section 107-23.
  
- f. The following provisions apply to buildings existing as of October 28, 2012, located within waterfront blocks, that sustained substantial damage, as defined in Appendix G, due to the effects of Hurricane Sandy:
  - i. The provisions of 62-50 through 62-59 of the Zoning Resolution (General Requirements for Visual Corridors and Waterfront Public Access Areas) and implementing provisions related thereto are suspended for such buildings that did not exceed 20,000 square feet of floor area prior to Hurricane Sandy, provided that, as determined in writing by the Commissioner of Buildings:

- A. the dimensions of the building footprint are no greater than the footprint that existed on October 28, 2012;
- B. if such building is repositioned on the lot, such repositioning does not newly encroach, or further encroach into a required yard, visual corridor or existing public access area; and
- C. the reconstruction does not result in a change of use from that existing on October 28, 2012.

§4. All terms used in this Order that are defined in Section 12-10 or any other provisions of the Zoning Resolution affected by this Order shall have the meaning set forth in or as used in such provisions.

§5. This Order shall take effect immediately. It shall remain in effect for five (5) days unless it is terminated or modified at an earlier date.



---

Michael R. Bloomberg  
Mayor

## LIST OF SUSPENDED ZONING RESOLUTION PROVISIONS

The suspension of the sections of the Zoning Resolution or portions thereof listed below applies only to buildings that meet the conditions of Section one of this Executive Order.

### 1. Provisions Suspended by Subdivision (a) of Section 3 of this Executive Order

Zoning Resolution Section	Paragraph
23-45	
23-461	
23-47 et seq	
23-51	
23-53 et seq	
23-54 et seq	
23-631	a
23-631	b
23-631	c
23-631	d
23-631	e
23-631	f
23-631	g
23-631	h (4)
23-632	a
23-633	
23-64	
23-661	
23-663	
23-691	
23-692	
23-693	
23-711	
23-86	
34-24	a
35-24	
35-34	
35-61	a
35-61	b
54-41	
62-324	b
62-341	a(3)
62-351	b
62-411	

<b>Zoning Resolution Section</b>	<b>Paragraph</b>
94-10	
111-20	(c)
112-103	
123-66	
128-30	
131-40	
131-421	a(2)
131-423	a
131-431	a(1)
131-432	a
131-441	a(1)
131-443	a
131-45	a

**2. Provisions Suspended by Paragraph (i) of Subdivision (b) of Section 3 of this Executive Order**

<b>Zoning Resolution Section</b>	<b>Paragraph</b>
23-44	b (5)
23-44	b (5)
23-44	b (5)
23-631	a
23-631	b
23-631	c
23-631	d
23-631	e
23-631	f
23-631	g
23-631	h (3)
23-631	h (4)
23-632	a
23-633	
23-634	
23-64	
23-651	b (2)
23-661	
23-662	
23-663	
23-691	
23-692	
23-693	

<b>Zoning Resolution Section</b>	<b>Paragraph</b>
23-711	
23-86	
24-12	
24-164	a
24-33	b
24-521	
24-522	a
23-53	
24-551	
24-552	a
24-591	
33-23	
33-431	a
33-432	
33-441	
33-442	
33-491	
34-24	a
35-24	
35-34	
35-61	a
35-61	b
43-23	b
43-43	
43-44	
43-49	
43-61	c
62-324	b
62-341	a(3)
62-342	
62-351	b
62-411	
63-22	
63-23	
94-10	
111-20	(c)
112-103	
112-104	
116-13	
123-66	
125-12	
125-30	
128-30	

Zoning Resolution Section	Paragraph
128-35	(e)
131-15	
131-40	
131-421	a(2)
131-423	a
131-431	a(1)
131-432	a
131-441	a(1)
131-443	a
131-45	a
131-47	b(2)

**3. Provisions Suspended by Paragraph (ii) of Subdivision (b) of Section 3 of this Executive Order**

Zoning Resolution Section	Paragraph
12-10	Definition of "floor area," paragraphs (m) and (8)

**4. Provisions Suspended by Paragraph (iii) of Subdivision (b) of Section 3 of this Executive Order**

Zoning Resolution Section	Paragraph
23-44	

**5. Provisions Suspended by Paragraph (i) of Subdivision (c) of Section 3 of this Executive Order**

Zoning Resolution Section	Paragraph
52-51	
52-55	
54-41	
54-42	

**6. Provisions Suspended by Paragraph (ii) of Subdivision (c) of Section 3 of this Executive Order**

Zoning Resolution Section	Paragraph
---------------------------	-----------

<b>Section</b>	
54-41	
54-42	

**7. Provisions Suspended by Subdivision (d) of Section 3 of this Executive Order**

<b>Zoning Resolution Section</b>	<b>Paragraph</b>
52-22	
52-53	
52-54	

**8. Provisions Suspended by Subdivision (e) of Section 3 of this Executive Order**

<b>Zoning Resolution Section</b>	<b>Paragraph</b>
107-22 et seq	
107-23	

**9. Provisions Suspended by Subdivision (f) of Section 3 of this Executive Order**

<b>Zoning Resolution Section</b>	<b>Paragraph</b>
62-50	
62-51 et seq	
62-52	
62-53	
62-54	
62-55	
62-56 et seq	
62-57 et seq	
62-58	
62-59	



**Appendix B**

1 Rules of The City of New York  
§3606-04 (Emergency Rule)



**NOTICE OF ADOPTION OF EMERGENCY RULE RELATING TO THE LEVEL ABOVE THE  
BASE FLOOD ELEVATION TO WHICH NEW, SUBSTANTIALLY DAMAGED OR  
SUBSTANTIALLY IMPROVED BUILDINGS THAT ARE LOCATED IN AREAS OF SPECIAL  
FLOOD HAZARD MUST BE DESIGNED AND CONSTRUCTED**

Pursuant to the authority of the Commissioner of Buildings under sections 643 and 1043(i) of the New York City Charter and section 28-103.19 of the New York City Administrative Code, notice is hereby given of the adoption of the following emergency rule, effective immediately, relating to the level above the base flood elevation to which new, substantially damaged or substantially improved buildings that are located in areas of special flood hazard must be designed and constructed.

Matter underlined is new to Title 1 of the Official Compilation of the Rules of the City of New York. Matter double-underlined is new to reference standard ASCE 24.

Subchapter G of chapter 3600 of title 1 of the rules of the city of New York is amended by adding a new section 3606-04, to read as follows:

**§3606-04 American Society of Civil Engineers (“ASCE”) 24 amendments relating to mandatory freeboard.** Pursuant to Section 28-103.19 of the New York City Administrative Code, Table 2-1 of Section 2.3, Table 4-1 of Section 4.4, Table 5-1 of Section 5.1, Table 6-1 of Section 6.2, and Table 7-1 of Section 7.1 of ASCE 24 as amended by Section BC G501.1 of the New York City Building Code, are hereby amended to read as follows:

**TABLE 2-1  
MINIMUM ELEVATION OF THE TOP OF LOWEST FLOOR  
RELATIVE TO DESIGN FLOOD ELEVATION (DFE)—A-ZONES<sup>a</sup>**

<b>STRUCTURAL OCCUPANCY CATEGORY<sup>b</sup></b>	<b>MINIMUM ELEVATION OF LOWEST FLOOR</b>
<b>I</b>	<b>DFE=BFE</b>
<b><u>II (1- and 2-family dwellings)</u></b>	<b><u>DFE=BFE+ 2 ft</u></b>
<b><u>II<sup>c</sup> (all others)</u></b>	<b><u>DFE=BFE+ 1 ft</u></b>
<b>III<sup>c</sup></b>	<b>DFE=BFE+ 1 ft</b>
<b>IV<sup>c</sup></b>	<b>DFE=BFE+ 2 ft</b>

a. Minimum elevations shown in Table 2-1 do not apply to V Zones (see Table 4-1). Minimum elevations shown in Table 2-1 apply to A-Zones unless specific elevation requirements are given in Section 3 of this standard.

b. See Table 1-1 or Table 1604.5 of the New York City Building Code, for structural occupancy category descriptions.

c. For nonresidential buildings and nonresidential portions of mixed-use buildings, the lowest floor shall be allowed below the minimum elevation if the structure meets the floodproofing requirements of Section 6.

**TABLE 4-1  
MINIMUM ELEVATION OF BOTTOM OF LOWEST SUPPORTING  
HORIZONTAL STRUCTURAL MEMBER OF LOWEST FLOOR  
RELATIVE TO DESIGN FLOOD ELEVATION (DFE)—V ZONES**

STRUCTURAL OCCUPANCY CATEGORY <sup>a</sup>	MEMBER ORIENTATION RELATIVE TO THE DIRECTION OF WAVE APPROACH	
	Parallel <sup>b</sup>	Perpendicular <sup>b</sup>
I	DFE=BFE	DFE=BFE
II (1- and 2-family dwellings)	DFE=BFE+ 2 ft	DFE=BFE+ 2 ft
II (all others)	DFE=BFE	DFE=BFE+ 1 ft
III	DFE=BFE+ 1 ft	DFE=BFE+ 2 ft
IV	DFE=BFE+ 1 ft	DFE=BFE+ 2 ft

- a. See Table I-1, or Table 1604.5 of the *New York City Building Code*, for structural occupancy category descriptions.
- b. Orientation of lowest horizontal structural member relative to the general direction of wave approach; parallel shall mean less than or equal to +20 degrees from the direction of approach; perpendicular shall mean greater than +20 degrees from the direction of approach.

**TABLE 5-1  
MINIMUM ELEVATION, RELATIVE TO DESIGN FLOOD  
ELEVATION (DFE), BELOW WHICH FLOOD-DAMAGE-RESISTANT  
MATERIALS SHALL BE USED**

STRUCTURAL OCCUPANCY CATEGORY <sup>a</sup>	A-ZONE	V-ZONES	
		Orientation Parallel <sup>b</sup>	Orientation Perpendicular <sup>b</sup>
I	DFE=BFE	DFE=BFE	DFE=BFE
II (1- and 2-family dwellings)	DFE=BFE+ 2 ft	DFE=BFE+ 2 ft	DFE=BFE+ 2 ft
II (all others)	DFE=BFE+ 1 ft	DFE=BFE+ 1 ft	DFE=BFE+ 2 ft
III	DFE=BFE+ 1 ft	DFE=BFE+ 2 ft	DFE=BFE+ 3 ft
IV	DFE=BFE+ 2 ft	DFE=BFE+ 2 ft	DFE=BFE+ 3 ft

- a. See Table I-1, or Table 1604.5 of the *New York City Building Code*, for structural occupancy category descriptions.
- b. Orientation of lowest horizontal structural member relative to the general direction of wave approach; parallel shall mean less than or equal to +20 degrees from the direction of approach; perpendicular shall mean greater than +20 degrees from the direction of approach.

**TABLE 6-1  
MINIMUM ELEVATION OF FLOODPROOFING, RELATIVE TO  
DESIGN FLOOD ELEVATION (DFE)—A-ZONES**

STRUCTURAL OCCUPANCY CATEGORY <sup>a</sup>	MINIMUM ELEVATION OF FLOODPROOFING <sup>b</sup>
I	DFE=BFE+ 1 ft
II <sup>c</sup>	DFE=BFE+ 1 ft
III	DFE=BFE+ 1 ft
IV	DFE=BFE+ 2 ft

- a. See Table I-1, or Table 1604.5 of the *New York City Building Code*, for structural occupancy category descriptions.
- b. Wet or dry floodproofing shall extend to the same level.
- c. Dry floodproofing of residential buildings and residential portions of mixed use buildings shall not be permitted.

**TABLE 7-1  
MINIMUM ELEVATION OF UTILITIES AND ATTENDANT EQUIPMENT RELATIVE TO DESIGN FLOOD ELEVATION (DFE)**

<b>STRUCTURAL OCCUPANCY CATEGORY<sup>a</sup></b>	<b>LOCATE UTILITIES AND ATTENDANT EQUIPMENT ABOVE<sup>b</sup></b>		
	<b>A-Zones</b>	<b>V-Zones</b>	
		<b>Orientation Parallel<sup>c</sup></b>	<b>Orientation Perpendicular<sup>c</sup></b>
<b>I</b>	<b>DFE=BFE</b>	<b>DFE=BFE</b>	<b>DFE=BFE</b>
<b>II (1- and 2-family dwellings)</b>	<b>DFE=BFE+ 2 ft</b>	<b>DFE=BFE+ 2 ft</b>	<b>DFE=BFE+ 2 ft</b>
<b>II (all others)</b>	<b>DFE=BFE+ 1 ft</b>	<b>DFE=BFE+ 1 ft</b>	<b>DFE=BFE+ 2 ft</b>
<b>III</b>	<b>DFE=BFE+ 1 ft</b>	<b>DFE=BFE+ 2 ft</b>	<b>DFE=BFE+ 3 ft</b>
<b>IV</b>	<b>DFE=BFE+ 2 ft</b>	<b>DFE=BFE+ 2 ft</b>	<b>DFE=BFE+ 3 ft</b>

a. See Table 1-1, or Table 1604.5 of the *New York City Building Code*, for structural occupancy category descriptions.

b. Locate utilities and attendant equipment above elevations shown unless otherwise provided in the text. Orientation of lowest horizontal structural member relative to the general direction of wave approach; parallel shall mean less than or equal to +20 degrees from the direction of approach; perpendicular shall mean greater than +20 degrees from the direction of approach

## **Statement of Basis and Purpose**

This rule is promulgated pursuant to the authority of the Commissioner of Buildings under Sections 643 and 1043 of the New York City Charter and Section 28-103.19 of the New York City Administrative Code.

The current reference standard American Society of Civil Engineers ("ASCE") 24, as modified by Section BC G501.1 of the New York City Building Code, does not mandate freeboard above the Base Flood Elevation ("BFE") for buildings in Structural Occupancy Category I or II. This rule will amend this reference standard so as to require freeboard of up to two feet for these categories of buildings, depending on the type of building and the type of flood risk.

As defined in the regulations of the Federal Emergency Management Agency relating to the National Flood Insurance Program, 44 C.F.R. 59.1, the term "freeboard" means a factor of safety usually expressed in feet above a flood level for purposes of flood plain management. Freeboard tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, bridge openings, and the hydrological effect of urbanization of the watershed.

As per Section BC G201.2 of the New York City Building Code, the BFE is the elevation of the flood having a 1-percent chance of being equaled or exceeded in any given year.

In accordance with Table 1-1 of ASCE 24, as modified by Section BC G501.1, buildings in Structural Occupancy Category I or II include the majority of new construction in New York City, including 1- and 2-family dwellings, apartment houses, retail stores, and office buildings.

This rule will require freeboard for new, substantially damaged or substantially improved buildings that are located in areas of special flood hazard. The rule will bring the New York City Building Code into alignment with the latest edition of New York State Uniform Fire Prevention and Building Code (2010) by requiring two feet of freeboard for 1- and 2-family dwellings, and into alignment with the latest edition of ASCE 24 (2005) by requiring one or two feet of freeboard for other Structural Occupancy Category II buildings and for Structural Occupancy Category I buildings with certain flood risks.

This rule will result in new construction and substantial improvements that exceed the BFE, preventing loss of life, property and business interruption in cases of flooding.

**Finding of Imminent Threat Pursuant to New York City Charter Section 1043(i)(1)**

IT IS HEREBY CERTIFIED that the immediate effectiveness of this emergency rule relating to the level above the base flood elevation to which new, substantially damaged or substantially improved buildings must be designed and constructed is necessary to prevent an immediate threat to health, safety and property, by addressing the recent devastation wrought by a severe storm ("Hurricane Sandy") and the immediate reconstruction efforts that are currently underway. I hereby make the following finding of immediate threat to health, safety and property necessary to establish that an emergency rulemaking is required in relation to the protection of health, safety and property.

On October 28<sup>th</sup> and 29<sup>th</sup>, Hurricane Sandy brought unprecedented flooding and destruction to many parts of the city. The flooding levels were by all accounts several feet higher than the base flood elevation estimated by FEMA. However, the current requirements for reconstruction of most buildings damaged or destroyed requires flood protection only as high as FEMA's base flood elevation.

Applications for building permits to reconstruct the buildings damaged or destroyed by Hurricane Sandy have already begun to be filed with the department, and many more applications are anticipated to be filed in the coming months. If these permits are issued and the buildings constructed under the current requirements, these completed buildings would not be protected against future flooding events similar to Hurricane Sandy. Further, these buildings would be deemed noncompliant with the increased base flood elevations anticipated in the revised final flood insurance rate maps to be issued by FEMA by the end of 2013.

IT IS THEREFORE HEREBY CERTIFIED that the immediate effectiveness of a rule relating to the level above the base flood elevation to which new, substantially damaged or substantially improved buildings must be designed and constructed is necessary to address an immediate threat to health, safety and property.

Dated: January 31, 2013



ROBERT D. LIMANDRI  
COMMISSIONER OF BUILDINGS

APPROVED:



MICHAEL R. BLOOMBERG  
MAYOR

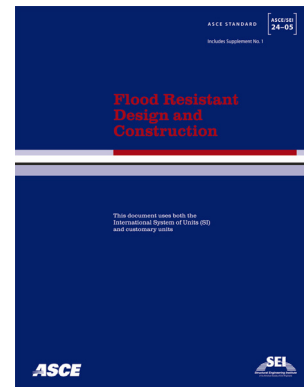


**Appendix C**

Highlights of ASCE 24-05

## HIGHLIGHTS OF ASCE 24-05 *Flood Resistant Design and Construction*

ASCE 24 is a referenced standard in the *International Building Code*<sup>®</sup>. Any building or structure that falls within the scope of the IBC that is proposed in a flood hazard area is to be designed in accordance with ASCE 24. The *International Residential Code*<sup>®</sup> requires that dwellings in floodways be designed in accordance with ASCE 24, and the 2009 edition of the IRC will include an alternative that allows communities to require homes in V zones to be designed in accordance with ASCE 24. Purchase a copy of ASCE 24 at [www.asce.org](http://www.asce.org).



ASCE 24 tells the designer the minimum requirements and expected performance for the design and construction of buildings and structures in flood hazard areas. It is not a restatement of all of the NFIP regulations, but offers additional specificity, some additional requirements, and some limitations. Buildings designed according to ASCE 24 are better able to resist flood loads and flood damage.

Highlights of ASCE 24 that complement the NFIP minimum requirements include:

### **Building Performance**

- Freeboard is required as a function of the nature of occupancy and the flood zone (see table below). Dwellings and most other buildings have 1-foot of freeboard; certain essential facilities have 2-3 feet; only agricultural facilities, temporary facilities and minor storage facilities are allowed to have their lowest floors at the BFE.
- Flood loads and other loads are those specified in ASCE 7.
- Performance of foundations exposed to flood loads and load combinations is specified; soil characteristics and underlying strata, including soil consolidation, expansion or movement, erosion and scour, liquefaction and subsidence must be considered.
- Fill is required to be stable under conditions of flooding, including rapid rise and rapid drawdown, prolonged inundation, and erosion and scour; structural fill compaction is specified or an engineering report is required, side slopes are required to be no steeper than 1:1.5.
- Specifications for slabs-on-grade are listed depending on the purpose and location of the slabs.
- Two alternatives are specified for flood openings to allow for the automatic entry and exit of floodwaters in below-BFE enclosures: nonengineered openings which do not require certification (1 sq in per sq ft of enclosed area) and engineered openings which must be certified by a registered design professional.
- Stairs and ramps shall be designed and constructed to resist flood loads and to minimize transfer of flood loads to foundations, or to break away without causing damage.
- In V Zones and Coastal A Zones:
  - . Structures shall be supported on piles, columns or shear walls.
  - . Foundation depth shall take into account erosion and scour.

- . Specifications are provided for pile foundations, attachments to piles, different types of piles (wood, steel H, concrete-filled steel pipe, prestressed concrete, precast concrete, cast-in-place concrete).
- . Specifications are provided for pile design (capacity, capacity of supporting soils, minimum penetration, spacing, pile caps, connections, splicing, and mixed and multiple types of piles).
- . Specifications are provided for footings, mats, rafts, and slabs-on-grade; grade beams; bracing; and shear walls.
- . Walls designed to breakaway shall not produce debris that is capable of damaging structures (breakaway walls in Coastal A Zones require openings).
- . Mechanical, heating, ventilation, and air conditioning elements shall be located on the landward side of structures.
- . Erosion control structures (bulkheads, seawalls, revetments) shall not be attached to buildings or focus or increase flood forces or erosion impacts on structures.
- . Decks, concrete pads, and patios shall be structurally independent of buildings and constructed to break away without producing damaging debris.
- . Pools shall be elevated, designed to breakaway without producing damaging debris, or sited to remain in the ground without obstructing flow that causes damage.
- Dry floodproofed nonresidential buildings are:
  - . Not permitted in V Zones, Coastal A Zones, where flood velocities exceed 5 ft/sec, where conformance with certain human intervention limits cannot be achieved.
  - . Required to have at least one exit door above the design flood elevation.
  - . Allowed where warning time is a minimum of 12 hours unless a community warning system provides a minimum warning time sufficient to accomplish certain activities related to dry floodproofing.
  - . Required to have a flood emergency plan, posted in at least two conspicuous locations, that addresses specified elements and actions.

### **Flood-Damage Resistant Materials**

- Flood-damage resistant materials shall be used below the lowest floor elevations, including freeboard (see table below).
- Requires structural steel exposed to salt water, salt spray, or other corrosive agents to be hot-dipped galvanized after fabrication; other metal components shall be stainless steel or hot-dipped galvanized.

### **Utilities and Service Equipment**

- Utilities and attendant equipment that is elevated shall not be located below the lowest floor elevations, including freeboard (see table below).
- Fuel supply lines shall be equipped with float operated automatic shut-off valves.



- Tanks that are below the design flood elevation and that are attached to or beneath buildings shall be installed and anchored to resist at least 1.5 times the potential buoyant and other flood forces assumed to act on empty tanks.
- Elevator cabs that descend below the design flood elevation shall be equipped with controls that prevent the cab from descending into floodwaters.

### **Siting Considerations**

- Structures shall not be built in:
  - . Areas subject to flash flooding (floodwaters rise to 3' or more above banks in less than 2 hours).
  - . Erosion-prone areas (determined by analyses) unless protected.
  - . High velocity flow areas (faster than 10 ft/sec) unless protected.
- Buildings in proximity to flood protective works (dams, levees, floodwalls, diversions, channels) shall not have adverse effects on, or conflict with, maintenance and repairs of those protective works.
- In-ground and above-ground pools shall be designed to withstand flood loads and load combinations; pools that are structurally connected to structures are to be designed to function as a continuation of foundations.

*Content from ASCE 24-05 and ASCE 7-05 used with permission from ASCE.*

See next page for description of Categories →

		Category I	Category II	Category III	Category IV
<b>Elevation of Lowest Floor or Bottom of Lowest Horizontal Structural Member</b> (A Zone: Table 2-1) (V Zone: Table 4-1)	All A Zones: elevation of lowest floor	DFE	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher
	All V Zones and Coastal A Zones: where the lowest horizontal structural member is parallel to direction of wave approach	DFE	DFE	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher
	All V Zones and Coastal A Zones: where the lowest horizontal structural member is perpendicular to direction of wave approach	DFE	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher
<b>Elevation Below Which Flood-Damage-Resistant Materials Shall be Used</b> (Table 5-1)	All A Zones	DFE	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher
	All V Zones and Coastal A Zones: where the lowest horizontal structural member is parallel to direction of wave approach	DFE	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher
	All V Zones and Coastal A Zones: where the lowest horizontal structural member is perpendicular to direction of wave approach	DFE	BFE +2 ft or DFE, whichever is higher	BFE +3 ft or DFE, whichever is higher	BFE +3 ft or DFE, whichever is higher
<b>Minimum Elevation of Utilities and Equipment</b> (Table 7-1)	All A Zones	DFE	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher
	All V Zones and Coastal A Zones: where the lowest horizontal structural member is parallel to direction of wave approach	DFE	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher
	All V Zones and Coastal A Zones: where the lowest horizontal structural member is perpendicular to direction of wave approach	DFE	BFE +2 ft or DFE, whichever is higher	BFE +3 ft or DFE, whichever is higher	BFE +3 ft or DFE, whichever is higher
<b>Dry Floodproofing</b> (Table 6-1)	All A Zones: elevation to which dry floodproofing extends	BFE +1 ft or DFE, whichever is higher	Not permitted	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher
	All V Zones and Coastal A Zones: dry floodproofing not allowed	Not permitted	Not permitted	Not permitted	Not permitted

**TABLE 1-1. Classification of Structures for Flood-Resistant Design and Construction  
(Classification same as ASCE 7, Ref. [1])**

Nature of Occupancy	Category
<p>Structures that represent a low hazard to human life in the event of failure including, but not limited to:</p> <ul style="list-style-type: none"> <li>▪ Agricultural facilities<sup>a</sup></li> <li>▪ Certain temporary facilities</li> <li>▪ Minor storage facilities<sup>b</sup></li> </ul>	I
<p>All structures except those listed in Categories I, III and IV</p>	II
<p>Structures that represent a substantial hazard to human life in the event of failure including, but not limited to:</p> <ul style="list-style-type: none"> <li>▪ Buildings and other structures where more than 300 people congregate in one area</li> <li>▪ Buildings and other structures with day-care facilities with capacity greater than 150</li> <li>▪ Buildings and other structures with elementary school or secondary school facilities with capacity greater than 250</li> <li>▪ Buildings and other structures with a capacity greater than 500 for colleges or adult education facilities</li> <li>▪ Health care facilities with a capacity of 50 or more resident patients but not having surgery or emergency treatment facilities</li> <li>▪ Jails and detention facilities</li> <li>▪ Power generating stations and other public utility facilities not included in Category IV</li> </ul> <p>Buildings and other structures not included in Category IV (including, but not limited to, facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, hazardous waste, or explosives) containing sufficient quantities of hazardous materials considered to be dangerous to the public if released.</p> <p>Buildings and other structures containing hazardous materials shall be eligible for classification as Category II structures if it can be demonstrated to the satisfaction of the authority having jurisdiction by a hazard assessment as described in Section 1.5.2<sup>c</sup> that a release of the hazardous material does not pose a threat to the public.</p>	III
<p>Structures designated as essential facilities including but not limited to</p> <ul style="list-style-type: none"> <li>▪ Hospitals and other health-care facilities having surgery or emergency treatment facilities</li> <li>▪ Fire, rescue, ambulance, and police stations and emergency vehicle garages</li> <li>▪ Designated earthquake, hurricane, or other emergency shelters</li> <li>▪ Designated emergency preparedness, communication, and operation centers and other facilities required for emergency response</li> <li>▪ Power generating stations and other public utility facilities required in an emergency</li> <li>▪ Ancillary structures (including, but not limited to, communication towers, fuel storage tanks, cooling towers, electrical substation structures, fire water storage tanks or other structures housing or supporting water, or other fire-suppression material or equipment) required for operation of Category IV structures during an emergency</li> <li>▪ Aviation control towers, air traffic control centers, and emergency aircraft hangars</li> <li>▪ Water storage facilities and pump structures required to maintain water pressure for fire suppression</li> <li>▪ Buildings and other structures having critical national defense functions</li> </ul> <p>Buildings and other structures (including but not limited to, facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, hazardous waste, or explosives) containing extremely hazardous materials where the quantity of the material exceeds a threshold quantity established by the authority having jurisdiction.</p> <p>Buildings and other structures containing extremely hazardous materials shall be eligible for classification as Category II structures if it can be demonstrated to the satisfaction of the authority having jurisdiction by a hazard assessment as described in Section 1.5.2<sup>c</sup> that the extremely hazardous material does not pose a threat to the public. This reduced classification shall not be permitted if the buildings or structures also function as essential facilities</p>	IV

<sup>a</sup>Certain agricultural structures may be exempt from some of the provisions of this Standard – see section C.4.3.

<sup>b</sup>For the purposes of this standard, minor storage facilities do not include commercial storage facilities.

<sup>c</sup>Section 1.5.2 reference is made to ASCE Standard 7-05, not this standard.