



North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk

LOSS OF LIFE

MEASURING HUMAN RESPONSE TO EVACUATION ORDERS

January 2015



**US Army Corps
of Engineers®**

Loss of Life Phase of the
North Atlantic Coast Comprehensive Study
Measuring Human Response to Evacuation Orders



**US Army Corps
of Engineers
North Atlantic Division**

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EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (USACE), North Atlantic Division (NAD) is preparing the North Atlantic Coast Comprehensive Study (NACCS), which is a multi-agency effort to develop strategies that will reduce risk and increase resiliency for populations vulnerable to tidally influenced flooding and storm surge in areas from New Hampshire to Virginia. Part of the NACCS entails estimating loss of life from storm events based partly on estimated evacuation rates of residents living and working in the impacted areas. To estimate the human response to storm events, this study focused on how residents in urban areas responded to Hurricane Sandy in October 2012.

USACE NAD collected data about human response to evacuation advisories to determine the regional characteristics for compliance with evacuation orders and reactions to evacuation obstacles. USACE selected a mail survey approach to collect data about human response to storm events. The approach required development of a survey sample set and creation of a questionnaire. The analysis of the survey results will be used to inform planners on the human response to storm events, including compliance with evacuation orders and reactions to evacuation obstacles. The product of this study will provide a framework to predict the likely evacuation rates in urban areas based on characteristics deemed relevant by the statistical analysis.

The results of this study could have significant implications for future planning purposes to anticipate evacuation rates and possibly mitigate hurricane damage. Various data were analyzed to determine if certain characteristics could be deemed significant as to whether a person evacuated in response to the threat from Hurricane Sandy. The data included the major categories of socioeconomic and demographic characteristics, structural characteristics, structure location, post-storm impacts, rationale and future actions, and perceived risk of Hurricane Sandy.

The analysis of the data indicates that only the respondent's race and the location of the structure were statistically significant indicators of the respondent's decision to evacuate. Based on chi-square analysis, which is used for testing independence and whether one variable helps to estimate another, respondents who identified as "black" were less likely to evacuate. Additional chi-square analysis reveals that residents living in Zone A were significantly more likely to evacuate than the residents living in either Zone B or Zone C. Furthermore, the chi-square analysis reveals that significantly more people correctly identified that they lived in Zone A than Zone B and Zone C. Therefore, respondents were more likely to identify their correct hurricane evacuation zone when they lived in Zone A and less likely to identify their correct hurricane

evacuation zone when they lived in Zone C. A regression analysis indicates that for every additional foot a structure was located away from the shoreline, residents were 0.004% less likely to evacuate.

The analysis of post-storm impacts reveals that as the extent of structural damage incurred increased, respondents were more likely to evacuate for a similar event in the future. As reported depth of flooding increased, up to 6 feet, the respondents were more likely to evacuate for a similar event in the future. However, when respondents reported more than 8 feet of flooding, they were less likely to evacuate again for a similar event in the future than both respondents who received 6 to 8 feet of flooding and respondents who received 4 to 6 feet of flooding.

Rationale and future actions were also analyzed in this report. Results reveal that the most prevalent reasons reported for not evacuating were that respondents wanted to protect their property from the storm and looters, followed closely by the belief that they left unnecessarily in past storms, and the perception that officials did not issue a mandatory evacuation order. These three responses make up a combined 30% of the provided responses. The most prevalent reason reported for evacuating was based on advice from elected officials. This was followed by advice from a friend or relative, emergency management officials, and the National Weather Service. With regard to future actions, 53% of respondents who evacuated for Hurricane Sandy reported that they had no additional storm surge measures planned for their individual residence to reduce damage from future storm surge events, while 61% of respondents who did not evacuate also report no additional measures to reduce damage from future storm surge events are planned. The minimum amount of time needed for evacuation reported by the respondents was analyzed and results reveal that within 1 hour or less, 29% of the population could be evacuated while an additional 29%, for a combined total of 58%, could be evacuated within 2 to 3 hours. An estimated 86% of the population could be evacuated in less than 24 hours.

The final category analyzed is the perceived risk of hurricane hazards and strengths. These results reveal that, when deciding to evacuate their home, respondents consider storm surge and waves as the most significant hazards. These are followed by hurricane winds and then flooding from rivers or streams. Furthermore, when presented with the sustained wind speeds of the five different hurricane categories, 33% of respondents reported that they would evacuate for a Category 1 hurricane, while 84% reported that they would evacuate for a Category 5 hurricane. The 33% is similar to the 32% of respondents in this study who reported evacuating for Hurricane Sandy, which was a Category 1 hurricane as it approached New York and made landfall as an extra tropical storm. This supports the current standard practice that separate evacuation rates should be used for each category of hurricane strength.

1.0 INTRODUCTION

The U.S. Army Corps of Engineers (USACE), North Atlantic Division (NAD) is preparing the North Atlantic Coast Comprehensive Study (NACCS), which is a multi-agency effort to develop strategies that will reduce risk and increase resiliency for populations vulnerable to tidally influenced flooding and storm surge in areas from New Hampshire to Virginia. Part of the NACCS entails estimating loss of life from storm events based partly on estimated evacuation rates of residents living and working in the impacted areas. To estimate the human response to storm events, this study focused on how residents in urban areas responded to Hurricane Sandy in October 2012.

USACE selected a mail survey approach to collect data about human response to storm events. The approach required development of a survey sample set and creation of a questionnaire. The analysis of the survey results will be used to inform planners on the human response to storm events, including compliance with evacuation orders and reactions to evacuation obstacles. The product of this study will provide a framework to predict the likely evacuation rates in urban areas based on characteristics deemed relevant by the statistical analysis.

2.0 STUDY AREA AND SURVEY SAMPLE SET

While the impacts from Hurricane Sandy were widespread, this study focused on analyzing evacuation rates from urban areas rather than suburban or rural environments. Therefore, the study area selected for this analysis spanned the five boroughs of New York City, which include 14 neighborhoods: Arverne, Astoria, College Point, Far Rockaway, Flushing, Forest Hills, Howard Beach, Jamaica, Ozone Park, Rockaway Park, Rosedale, South Ozone Park, Springfield Gardens, and Woodhaven. For this report, New York City refers to the geographic location and City of New York refers to the governing body.

Many areas outside of New York City were severely affected by Hurricane Sandy, including New Jersey, Connecticut, Rhode Island, Massachusetts, Delaware, Virginia, and Pennsylvania. These areas experienced various evacuation trends based on the estimated path of Hurricane Sandy, any mandatory evacuation orders issued, and the vulnerability of their communities. For example, discussions with local emergency response officials from coastal communities in New Jersey indicated that, in some areas, a large majority of the population evacuated prior to Hurricane Sandy, whereas other areas had a much lower evacuation response. Therefore, it would not be appropriate to apply the results of this study to all areas along the North Atlantic coast. Evacuation response may have been due to perceived risk, how evacuation orders were conveyed, and the timing of when the evacuation order was issued, among other reasons.

The survey sample set for this study was randomly selected from residential addresses based on two factors: City of New York's hurricane evacuation zones (referred to as Zones A, B, and C throughout the report) and whether the properties were flooded during Hurricane Sandy.¹ Evacuation zones are based on the storm surge risk, the geography of low-lying neighborhoods, and accessibility by bridges and roads. Zone A is considered the highest risk zone with the highest risk of flooding and is characterized as "low-lying coastal areas and other areas that could experience storm surge from ANY hurricane making landfall close to New York City." Zone B is considered a moderate risk zone that may experience storm surge flooding from a Category 2 or higher hurricane, and Zone C is a zone where residents may experience storm surge flooding from a MAJOR hurricane (Category 3 and 4), the lowest risk area with possible but unlikely flooding. More respondents were selected and more flooded properties were

¹ Since Hurricane Sandy, the City of New York has revised the designation of the hurricane evacuation zones, which are now classified by single numbers from one to six. The questionnaire used the previous hurricane evacuation zones A, B, and C to reduce confusion between the questionnaire and the evacuation orders and the evacuation decisions that were made at the time of Hurricane Sandy.

selected from Zone A. This was determined using the pre-Hurricane Sandy evacuation zones established by the City of New York and the depth of inundation as calculated by National Oceanic and Atmospheric Administration buoys, high water marks, and depth grids. The survey sample set was stratified first by evacuation zone, because only Zone A was issued a mandatory evacuation order by Mayor Bloomberg. Zones B and C were not issued mandatory evacuation orders, which would suggest fewer evacuations. To determine key indicators of evacuation rates, the survey sample set was stratified by zone to focus on capturing characteristics of each. The sample set was also stratified based on the depth of flooding to the residences to assess the level of damage and determine whether depth would influence evacuation decisions in similar future events. **Table 1** illustrates the distribution of the survey sample based on zone and depth of flooding. The analysis of all three zones is provided later in this report.

Table 1: Distribution of Survey Sample Set

Evacuation Zone	Amount of Flooding	Total Number of Properties
Zone A	>4 feet of flooding	196
Zone A	≤4 feet of flooding	196
Outside of Zone A	>4 feet of flooding	84
Outside of Zone A	≤4 feet of flooding	84
Zone A	0 feet of flooding	120
Outside of Zone A	0 feet of flooding	120
Total		800

For this study, USACE used the City of New York’s PLUTO² database to select the survey sample set. The PLUTO database is maintained by the City of New York and contains extensive land use and geographic data at the tax lot level. The survey sample set was developed by randomly selecting records from the PLUTO database based on the distribution presented in Table 1.

Initial review of the survey sample set showed potential errors in names and addresses, which raised concerns about whether the survey packages would reach the intended respondents. To help refine the PLUTO database, the mailing addresses were verified using Esri’s World Geocoding service and cross-checked with the U.S. Postal Service address locator service. Any

² USACE considered other sources for obtaining name and address data, including the City of New York Build it Back database, which the City developed in direct response to Hurricane Sandy. Unfortunately, the request to use the database was denied by the Mayor’s Office, as were other requests.

outstanding property mailing names and addresses were then checked against Google Maps and online white pages. The mailing names and addresses were revised as appropriate. The survey sample set was imported into a Microsoft Access® database to track mailings and questionnaire responses.

3.0 QUESTIONNAIRE DEVELOPMENT

USACE created an evacuation questionnaire to identify the key factors that determined whether a household evacuated in response to the threat from Hurricane Sandy. The questionnaire consisted of 45 questions and included a blank page on which the respondent could write comments. The evacuation questionnaire was developed largely from other questionnaires approved by the Office of Management and Budget (OMB) for the U.S. Census Bureau and USACE—specifically, the American Community Survey, the Emergency Response Questionnaire, the Island Hurricane Evacuation Survey, and the Resident Flood Damage Survey. After a series of internal reviews, the questionnaire was included as part of a submittal package to the OMB under the Paperwork Reduction Act on November 18, 2013, for review and approval. The package identified the purpose of the questionnaire, the intended respondents, and specific relationships between questions asked on the questionnaire and those on the pre-approved questionnaires. OMB reviewed the questionnaire to ensure it complied with Federal regulations and did not unnecessarily burden the public. OMB approved the questionnaire on December 20, 2013. See **Appendix A** for the OMB-approved questionnaire.

4.0 MAILING PROTOCOLS

To increase survey response rates, efforts were made to address envelopes and cover letters to specific people by using the residents’ first and last names, which were based on the owner’s name field (“OwnerName”) in the PLUTO database. However, because various types of residences (e.g., single-family, multiple-family, multiple-unit) were included in the survey sample set, using first and last names was not always appropriate. Therefore, a protocol for how to address potential respondents was developed based on the building class field (“BldgClass”) in the PLUTO dataset. **Table 2** shows the protocol for addressing mailings based on building class. If an owner’s name was listed as an LLC/Trust/Company, “Current Unit 1 Resident” or “Current Resident” was used for introduction, depending on the building class.

Table 2: Protocol for Mailing Format

Building Class	Name on the Address and Letter Salutation
Building Class A (Single Family)	[First Name] [Last Name] or Current Resident
Building Class B (Two Families)	[First Name] [Last Name] or Current Resident
Building Class C (Three or More Families)	Current Unit 1 Resident
Building Class D (Large Building/Multiple Units)	Current Unit 1 Resident
Building Class R (Condo)	Current Unit 1 Resident
LLC/Trust/Company Name	Current Unit 1 Resident or Current Resident

Of the original survey packages sent to respondents, 92% used the “[First Name] [Last Name] or Current Resident” format, 4% used the “Current Resident” format, and 4% used the “Current Unit 1 Resident” format. Of the returned questionnaires, the response rate of people who were addressed using the “[First Name] [Last Name] or Current Resident” format was 35%, while the response rate of those who were addressed using the “Current Resident” format was 34%. Of the returned questionnaires, the response rate of those who were addressed using the “Current Unit 1 Resident” format was 19%.

Each potential respondent received a survey package in a white 9- by 12-inch envelope with a label identifying the USACE as the sender. The package included three items: a cover letter explaining the purpose of the questionnaire and confidentiality statements, the questionnaire, and a stamped return envelope. Every questionnaire included a unique identification number at the footer of each page. See **Appendix B** for the initial Hurricane Sandy Evacuation Study cover letter.

To maximize response rates, reminder postcards and follow-up survey packages were sent to residents who had not yet returned the questionnaire. See **Appendix C** for the reminder postcard and **Appendix D** for the letter sent with an additional questionnaire in the follow-up survey package. Although addresses in the sample set were verified, some survey packages were sent back as undeliverable. Potential respondents of undeliverable survey packages were removed from the sample set and were not included in any additional mailings. **Table 3** lists the items mailed to potential respondents, the date material was sent, and the quantity sent.

Table 3: Date and Quantity of Survey Packages Mailed to Potential Respondents

Mailing	Date Sent	Quantity
Original Survey Package	1/8/2014	800
Reminder Postcard	1/17/2014	700
Second Survey Package	1/31/2014	657
Reminder Postcard	2/7/2014	624

5.0 DATA COLLECTION

Returned questionnaires were entered into a Microsoft Access® database, and quality assurance / quality control (QA/QC) measures were performed.

5.1 Data Entry

Questionnaire data were collected over 4 months and collection concluded at the end of April 2014. The identification number in the footer of each page of the questionnaire was used to indicate which recipients returned the questionnaire. Team members entered all questionnaire results into a Microsoft Access® database specifically created for the study that captured results for all 45 questions and contained fields identifying whether a questionnaire was returned, received, and completed, as well as selected fields from the PLUTO database.

Team members entered data and any comments exactly as they appeared on the questionnaires. Hard copies of the questionnaires were retained for review.

5.2 Quality Assurance

A quality assurance review was completed to confirm that the questionnaire responses matched the database entries. For the review, a team member who had not originally entered the questionnaire data into the database compared each question on the questionnaire with the value in the database. Any discrepancies were adjusted to ensure that the database values correctly reflected the questionnaire.

5.3 Quality Control

Following data entry and quality assurance review, team members reviewed missing responses to determine whether other responses on the questionnaire could be used to fill in the missing values. For example, for people who did not answer question 4 (whether they evacuated or not), the remaining answers were reviewed to determine whether the answer could be inferred. Team members also adjusted for conflicting responses, which could have occurred as a result of misinterpretation of a question or accidental entry of a wrong value. If a conflicting response was identified, subsequent questions were examined to determine the most probable response. For example, if a respondent stated in question 4 that he or she did not evacuate, but he or she did *not* answer questions 5 through 7 (which were to be answered by those who did not evacuate) and answered questions 8 through 17 (which were to be answered by those who *did* evacuate), then the answer to question 4 was revised to indicate that the respondent did evacuate.

To maintain an accurate record of changes to the database responses, a separate column was added to the database. The original responses were recorded in this column to maintain the integrity of the original responses. However, for data analysis purposes, the adjusted responses were used.

5.4 Survey Response

A total of 277 of the 800 questionnaires were returned. However, as expected, some of the returned questionnaires were not usable. Two questionnaires were duplicates of previously returned questionnaires, and two questionnaires included only written responses expressing severe disinterest in study participation. These questionnaires were flagged in the database and filtered to be excluded from the analysis. One questionnaire was returned correctly; however, the respondent lived outside the New York City region when Hurricane Sandy hit and, thus, the questionnaire was not included in the data analysis. The remaining 272 were used for data analysis, which equates to a 34% response rate. **Table 4** lists the total questionnaires returned, usable questionnaires returned, protest questionnaires, duplicate questionnaires, and undeliverable questionnaires. See **Figure 1** for a geographical representation of the location of respondents for returned questionnaires.

Table 4: Status of Returned and Undeliverable Questionnaires

Questionnaire Response Summary	Number of Responses
Total Questionnaires Returned	277
Useable Questionnaires	272
Protest Questionnaires (unusable and not included in useable total)	2
Duplicate Questionnaires (returned twice and not included in useable total)	2
Undeliverable Questionnaires (returned to sender or other reason)	45
Questionnaire from Respondent who lived outside the study area	1*

*This value is the one questionnaire that was completed and returned correctly, however, the respondent lived outside the New York City region when Hurricane Sandy hit. This response prompted respondents to return the questionnaire with the remaining questions unanswered. Therefore, this questionnaire is not included in the statistical analysis for this report.

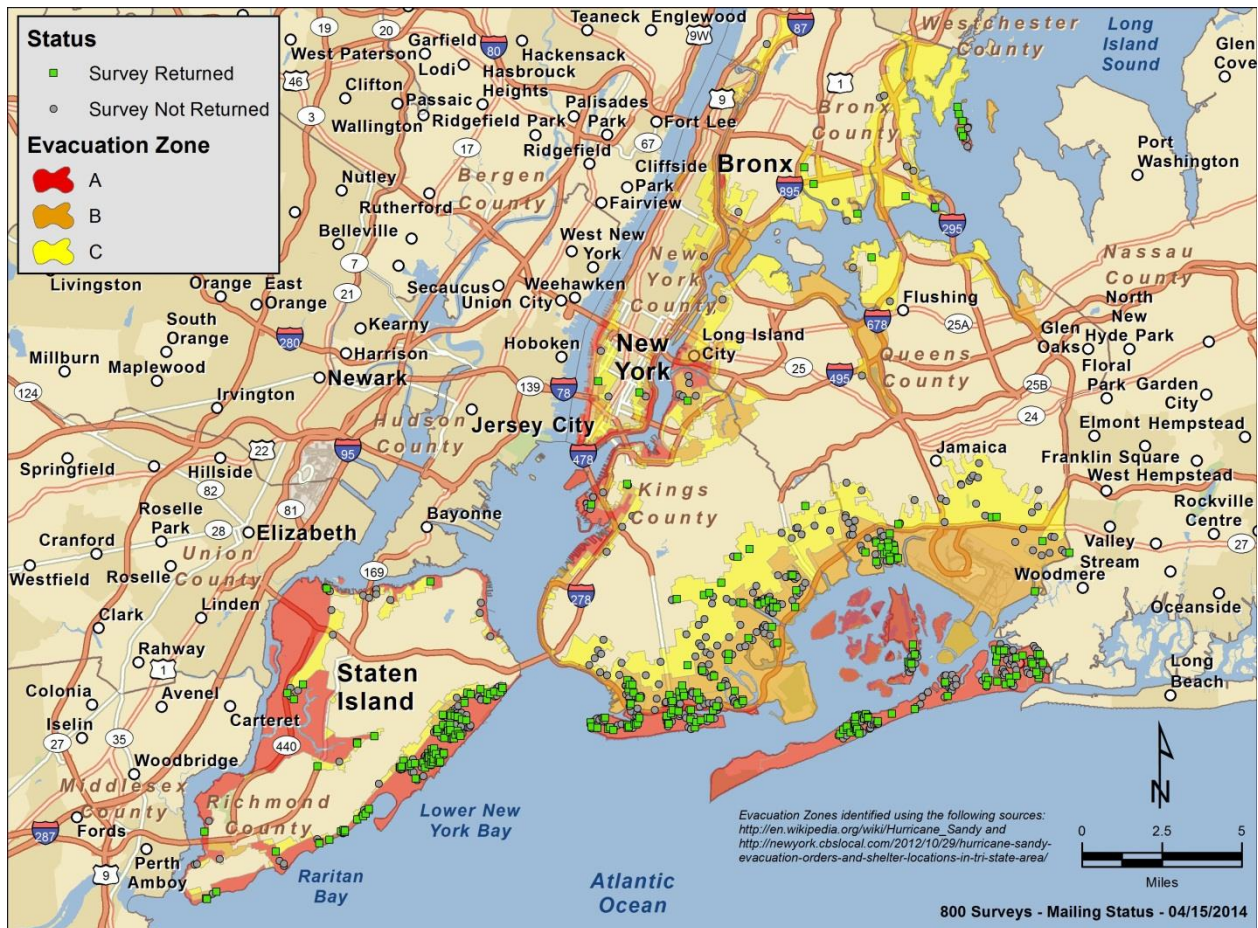


Figure 1: Geographical locations of residents who returned questionnaires

5.5 Study Area Representation

To determine if survey respondents are representative of the general population in the area, socioeconomic characteristics of the respondents were compared to U.S. Census data. Respondents were grouped into five study areas, which were composed of Zones A, B and C for each of the five New York City counties: New York County, Kings County, Queens County, Richmond County, and Bronx County. These five counties are synonymous with the New York City boroughs: Manhattan, Brooklyn, Queens, Staten Island, and The Bronx, respectively.

U.S. Census data were collected at the census tract level for each study area. A census tract was included in the analysis if any part of the evacuation zones covered a portion of the census tract (**Figure 2**). Although including all parts of a census tract overestimates the population for each study area, the percentage composition of the socioeconomic characteristics should be representative.

Comparisons between the respondent population and the study areas included analysis of median household income, race, and homeowners vs. renters.³ Efforts were made to analyze age characteristics; however, data collected from the surveys did not identify the total number of residents living in a household or provide a breakdown of the ages of the residents. Since data were not collected on the number of residents in each household and, thus, the total population number of household residents cannot be determined, a comparison cannot be made between the U.S Census data and the survey data.

For income, the median household income was estimated for the respondent population by determining the income cohort that represented the median value for each study area. The midpoint of that cohort was then used to represent the median household income. For race, survey respondents who reported two or more races were included in the same comparison with U.S. Census data that included two or more races and other. If respondents checked “Prefer not to Answer,” for any of the categories, they were removed from the analysis.

³ Study areas with high numbers of renters may or may not mirror the evacuation rates identified in this report since the survey did not receive significant numbers of questionnaires from renters.

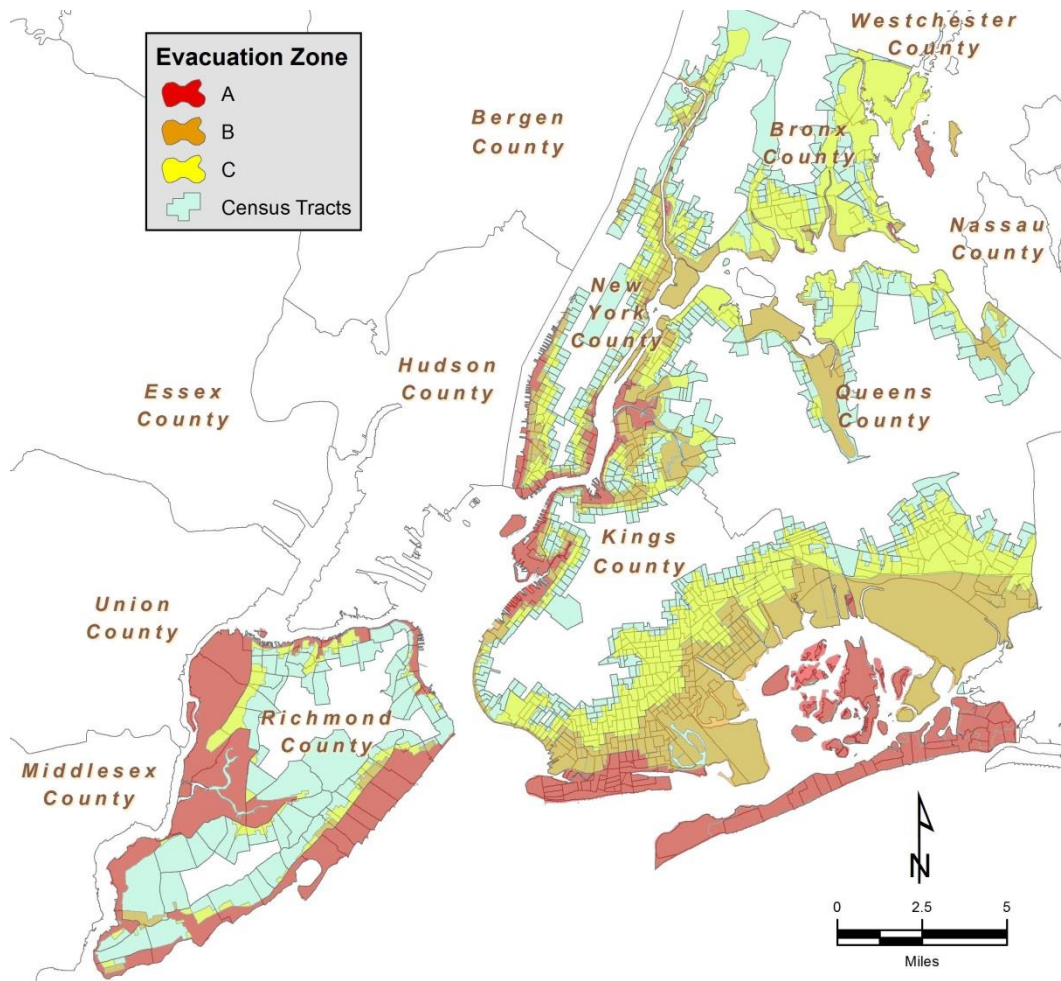


Figure 2: Census tracts for City of New York’s hurricane evacuation Zones A, B, and C

5.5.1 New York County / Manhattan

Only three surveys were returned from within the New York County study area. **Table 5** illustrates that those who identified as white compose 54 percent of the population within the New York County study area compared to 67 percent within the respondent population. The remaining 33 percent of the respondent population identified as two or more races. The lack of representation of respondents who identify as the other race categories could be attributed to the small number of survey respondents. Although the Hispanic representation in the study area is 26%, the respondent population does not include any Hispanics.

Table 5: New York County

Category	Study Area	Survey Respondents
Population Size	979,595	3*
Median Income	\$69,200	\$62,500
Race		
White	54 %	67 %
Black	18 %	0 %
Asian, Pacific Islander	12 %	0 %
American Indian, Alaskan Native	1 %	0 %
Two or More Races, Other	15 %	33 %
Hispanic	26 %	0 %
Home Ownership		
Owners	21 %	67 %
Renters	79 %	33 %

Source: U.S Census 2010. Income estimated using 2008–2012 American Community Survey data and U.S Census 2010 figures.

*This is the total number of survey respondents for this county, not the total number of individuals in respondent's households.

Median household income within the study area was estimated to be \$69,200 compared to \$62,500 within the respondent population, which indicates that the income data for the study area and the respondent population is not vastly different. With regards to representation of homeowners and renters, the majority of the study area was characterized by renters, 79 percent, whereas the majority of the respondent population was homeowners, 67 percent.

Although the respondent population from New York County had an over representation of those who identified as white, two or more races, and homeowners, there was some similarity in income data between the two populations.

5.5.2 Kings County / Brooklyn

A total of 89 surveys were returned from within the Kings County study area. **Table 6** illustrates that those who identified as white compose 47 percent of the population within the Kings County study area compared to 49 percent within the respondent population. Those who identified as black compose a third of the study area population but only 22% of the respondent population. The Asian or Pacific Islander respondent population was more than triple as compared to the

study area population, while the Hispanic respondent population was less than one-third of the study area population.

Table 6: Kings County

Category	Study Area	Survey Respondents
Population Size	1,402,071	89*
Median Income	\$48,000	\$62,500
Race		
White	47 %	49 %
Black	33 %	22 %
Asian, Pacific Islander	9 %	28 %
American Indian, Alaskan Native	<1 %	0 %
Two or More Races, Other	10 %	0 %
Hispanic	18 %	5 %
Home Ownership		
Owners	31 %	99 %
Renters	69 %	1 %

Source: U.S Census 2010. Income estimated using 2008–2012 American Community Survey data and U.S Census 2010 figures.

*This is the total number of survey respondents for this county, not the total number of individuals in respondent’s households.

Median household income within the study area was estimated to be \$48,000 compared to \$62,500 within the respondent population. Thus, the respondent population comprises a wealthier representation of Kings County residents. With regards to representation of homeowners and renters, the majority of the study area is characterized by renters, 69 percent, whereas the majority of the respondent population is homeowners, 99 percent.

Although the respondent population from Kings County had a relatively similar representation of those who identified as white, there was an over representation of Asian or Pacific Islander populations and an underrepresentation of the remaining race categories. The Hispanic population was under represented in the respondent population. The respondent population had a drastic over representation of homeowners and a relatively large over representation of median household income.

5.5.3 Queens County/Queens

The respondent population from within the Queens County study area consisted of 76 returned surveys. **Table 7** illustrates that those who identified as white composed 37% of the population within the Queens County study area compared to double that percentage, 74%, within the respondent population. The respondent population contained nearly one-third less of the representation of black respondents compared to the study area with only 21% in the respondent population and 33% in the study area population. In the respondent population, Asian or Pacific Islanders, those who identified as two or more races, and the Hispanic population were all drastically under represented.

Table 7: Queens County

Category	Study Area	Survey Respondents
Population Size	765,796	76*
Median Income	\$60,000	\$62,500
Race		
White	37 %	74 %
Black	33 %	21 %
Asian, Pacific Islander	14 %	5 %
American Indian, Alaskan Native	1 %	0 %
Two or More Races, Other	15 %	0 %
Hispanic	23 %	5 %
Home Ownership		
Owners	45 %	99 %
Renters	55 %	1 %

Source: U.S Census 2010. Income estimated using 2008–2012 American Community Survey data and U.S Census 2010 figures.

*This is the total number of survey respondents for this county, not the total number of individuals in respondent’s households.

The median household income of the respondent population compared to the study area is relatively similar. Also, once again, the majority of the study area study area was characterized by home renters, 55 percent, whereas the majority of the respondent population was homeowners, 99 percent.

Although the respondent population from Queens County had an over representation of those who identified as white and homeowners, there was relative similarity in income data between the two populations.

5.5.4 Richmond County / Staten Island

The respondent population from within the Richmond County study area consisted of 94 returned surveys. **Table 8** illustrates that those who identified as white composed 72 percent of the population within the Richmond County study area compared to 94 percent within the respondent population. The respondent population included an under representation of those who identified as black, Asian or Pacific Islander, two or more races, and Hispanic.

Table 8: Richmond County

Category	Study Area	Survey Respondents
Population Size	347,652	94*
Median Income	\$68,500	\$62,500
Race		
White	72 %	94 %
Black	12 %	3 %
Asian, Pacific Islander	7 %	3 %
American Indian, Alaskan Native	<1 %	0 %
Two or More Races, Other	9 %	1 %
Hispanic	19 %	3 %
Home Ownership		
Owners	63 %	98 %
Renters	37 %	2 %

Source: U.S Census 2010. Income estimated using 2008–2012 American Community Survey data and U.S Census 2010 figures.

*This is the total number of survey respondents for this county, not the total number of individuals in respondent’s households.

Median household income within the study area was estimated to be \$68,500 compared to \$62,500 within the respondent population, which indicates that the income data for the study area and the respondent population is not vastly different.

Richmond County is the only study area where the percentage of homeowners was larger than the percentage of renters in the study area population. However, the respondent population still indicated a drastically larger representation of homeowners, 98%, compared to renters, 2%.

Although the respondent population from Richmond County had an over representation of those who identified as white and homeowners, there was some similarity in income data between the two populations.

5.5.5 Bronx County / The Bronx

Only 10 surveys were returned from within the Bronx County study area. **Table 9** illustrates that the representation of those who identified as white in the respondent population is more than double compared to the Bronx County study area population. Those who identified as white composed 32 percent of the population within the study area compared to 100 percent within the respondent population. The Hispanic representation in the respondent population, 25%, was less than half of the Hispanic representation in the study area population.

Table 9: Bronx County

Category	Study Area	Survey Respondents
Population Size	488,199	10*
Median Income	\$39,000	\$50,000
Race		
White	32 %	100 %
Black	34 %	0 %
Asian, Pacific Islander	3 %	0 %
American Indian, Alaskan Native	1 %	0 %
Two or More Races, Other	29 %	0 %
Hispanic	54 %	25 %
Home Ownership		
Owners	25 %	100 %
Renters	75 %	0 %

Source: U.S Census 2010. Income estimated using 2008–2012 American Community Survey data and U.S Census 2010 figures.

*This is the total number of survey respondents for this county, not the total number of individuals in respondent’s households.

Median household income within the study area was estimated to be \$39,000 compared to \$50,000 within the respondent population. Thus, the respondent population represents wealthier Bronx County residents.

With regards to representation of homeowners and renters, the majority of the study area was characterized by home renters, 75 percent, whereas the entirety of the respondent population was homeowners.

The respondent population from Bronx County had an over representation of those who identified as white. There was also an over representation of homeowners and median household incomes.

6.0 RESULTS

Of the 272 respondents who returned usable questionnaires, approximately 32% reported having evacuated their residences before Hurricane Sandy made landfall. **Figure 3** illustrates the locations of respondents who evacuated and those who did not. Although this evacuation rate may appear low, it is similar to the findings of a study conducted by the City of New York Office of Emergency Management in January 2013, which reported an evacuation participation rate of 33%. In May 2013, the City of New York published a study and reported that 29% of residents evacuated.

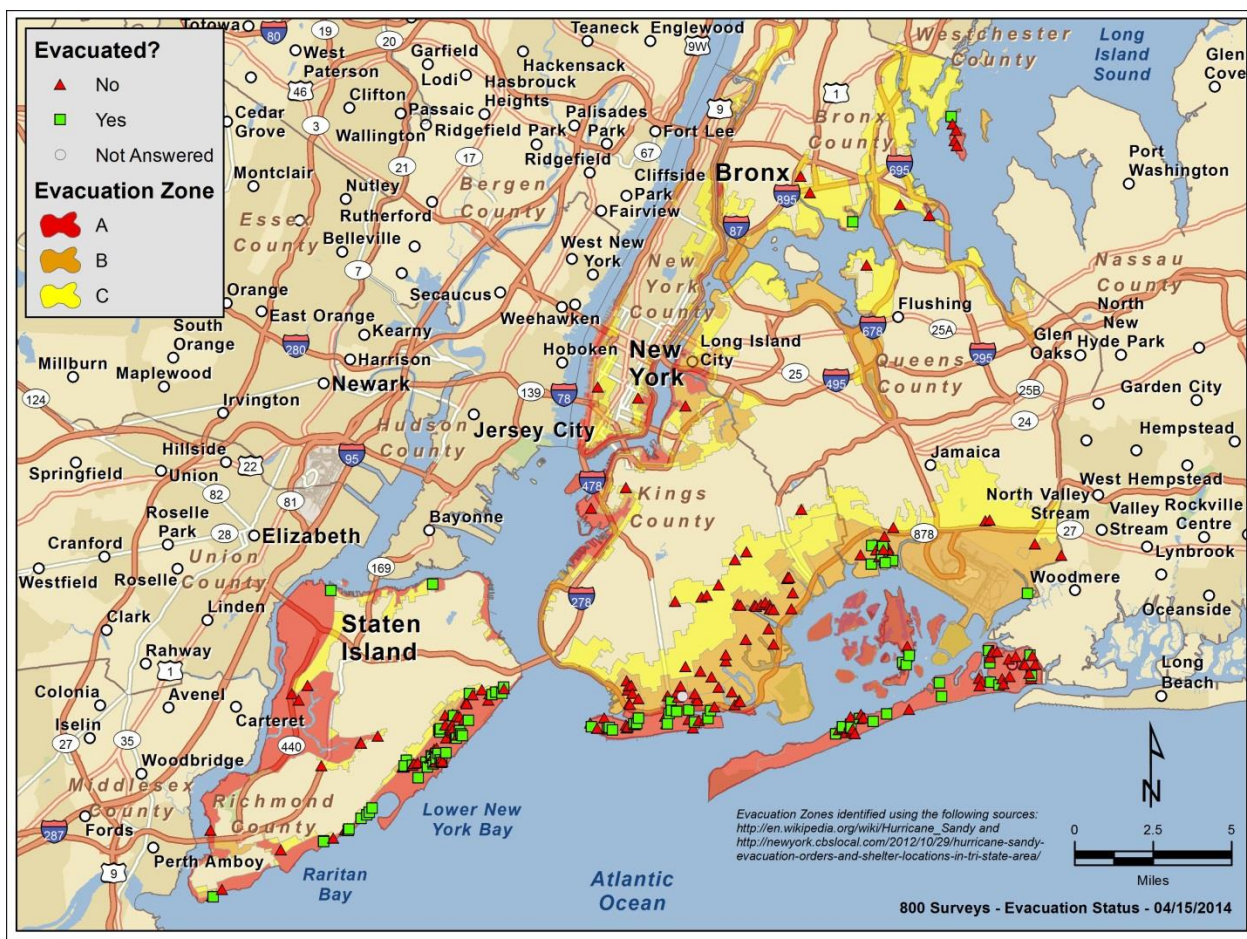


Figure 3: Respondents' evacuation status by geographic location

The data were analyzed to determine whether certain characteristics could be identified to help refine evacuation rates for future studies. The following sections present the results of selected analyses.⁴ Responses to each question on the questionnaire are presented in **Appendix E**.

⁴ Although the responses to all of the questions are important, this study's focus is on the respondent's decision to

Participants' comments on the questionnaire are provided in **Appendix F**. Tables showing frequency counts and relationships between evacuation decisions and survey questions are provided in **Appendix G**.

6.1 Demographic Characteristics

The respondents' demographic characteristics were evaluated to determine whether they could be used to identify differences between respondents who evacuated and those who did not.

Single variable chi-square tests were conducted to determine the statistical significance of various socioeconomic and demographic categories against respondents' decisions to evacuate. With a single variable test, a p-value above the commonly accepted 0.05 threshold does not necessarily imply that the tested variable is a causal factor. The following categories were analyzed:

- Household income
- Race
- Number of residents under age 17
- Number of residents over age 65
- Highest level of education
- Number of household vehicles
- Number of household residents
- Ethnic background

The resulting p-values indicated that only two of these categories—household income and race—suggested any statistically significant variable. With a p-value of 0.03 calculated for a correlation between each household income level and evacuation decisions, respondents with a total household pre-tax income greater than \$200,000 were less likely to evacuate their residences. However, when a chi-square test was conducted and included all income levels, the resulting p-value of 0.2 indicates no statistical significance. Thus, although respondents who reported having an annual income level greater than \$200,000 were less likely to have evacuated their residences, income level as a variable did not have a statistically significant correlation with evacuation decisions.

evacuate, not their actions when evacuating. Therefore, only selected questions and analyses that were the most pertinent to the decision to evacuate are presented in this section.

Race was the other category with statistically significant p-values. A chi-square test analyzing all reported race categories resulted in a statistically significant p-value of 0.048, indicating that there is a relationship between the race categories reported and the decision to evacuate for Hurricane Sandy. **Table 10** represents the respondents' reported races, while **Table 11** reveals which reported races were more likely to have evacuated before Hurricane Sandy to provide a more detailed analysis of evacuation characteristics.

Table 10: Reported Races of Respondents

Race	Percent Respondents
White	62%
Black	12%
American Indian or Alaskan Native	0%
Asian or Pacific Islander	9%
Two or More Races	1%
Prefer not to Answer	17%

Table 11: Racial Breakdown of Respondents by Evacuation Status

Race	Evacuated
White	64%
Black	5%
American Indian or Alaskan Native	0%
Asian or Pacific Islander	7%
Two or More Races	1%
Prefer not to Answer	24%
Total*	101%
	Did Not Evacuate
White	60%
Black	15%
American Indian or Alaskan Native	0%
Asian or Pacific Islander	10%
Two or More Races	1%
Prefer not to answer	13%
Total*	99%

*The totals do not equal 100% as a result of rounding.

Single variable chi-square tests were also conducted to determine any statistical significance between the individual races identified against evacuation decisions. The resulting statistically significant p-values were for “black” and “prefer not to answer” respondents, which were calculated as 0.02 and 0.04, respectively. Respondents who identified themselves as “black” were less likely to evacuate, and those who selected the response “prefer not to answer” were more likely to have evacuated before Hurricane Sandy. Thus, respondents’ identified race, specifically “black” and “prefer not to answer” does have statistically significant implications for evacuation decisions in this study. However, for planning purposes, respondents who identified as “prefer not to answer” would not be useful in predicting evacuation rates of different races.

Age demographics were examined to determine whether the age of a member of the household played a significant role in evacuation decisions. Chi-square tests were conducted, and the resulting p-values indicated that there is no statistical significance between the number of residents under 17 in the household and respondents’ decision to evacuate their residence. Additionally, there was no statistical significance between the number of residents older than 65 in the household and respondents’ decision to evacuate their residences. Therefore, having residents under 17 or over 65 years of age did not appear to influence the decisions of respondents to evacuate their residences. In future studies, greater limitations on age brackets could be used to determine any significance between age and evacuation decision, such as for ages under 10 and over 80.

With the exception of race, none of the socioeconomic or demographic characteristics evaluated appeared to influence whether respondents evacuated their residences. The resulting multi-variable p-values were statistically insignificant.

6.2 Structural Characteristics

Single variable chi-square tests were conducted for structural characteristics of the residences, including number of stories, foundation height, building type, and construction materials.

6.2.1 Number of Stories

Chi-square tests were conducted to determine any statistical significance of number of stories of the residences against evacuation decisions. With a p-value of 0.55, the number of building stories does not have statistically significant implications for a respondent’s decision to evacuate. Additionally, 63% of the respondents lived in two-story buildings, 23% lived in three-story buildings, 12% lived in one-story buildings, and 2% lived in buildings more than three stories.

6.2.2 Foundation Height

In the questionnaire, foundation height was described as the number of feet between the ground outside the home or building and the entrance to the first floor. With a p-value of 0.73, foundation height did not have statistically significant implications for a respondent's decision to evacuate; 16% of respondents reported having a foundation height of less than 1 foot, 14% of respondents reported having a foundation height of 1 to 2 feet, 13% reported a foundation height of 2 to 3 feet, 23% reported foundation heights of 3 to 4 feet, 19% reported foundation heights of 4 to 6 feet, and 15% of respondents reported having a foundation height of more than 6 feet.

6.2.3 Number of Units in Building

The analysis was conducted relative to the number of units and structural information for the respondents' buildings. Of the respondents, 66% lived in single-family homes, 26% lived in buildings of two apartments/units, and 6% lived in buildings of three or four apartments/units. Statistical analysis of the number of units in the respondents' buildings compared with the evacuation decisions included a chi-square test between the number of units that were reported by respondents who chose to evacuate and those who chose to shelter in place. The resulting p-value from the chi-square test using the seven options for number of units, 0.88, is not statistically significant, indicating that the number of units of the respondents' buildings did not play a significant role in the decision of whether to evacuate or shelter for Hurricane Sandy.

However, given the low observation counts for buildings with greater than 10 units, the chi-square test may not accurately reflect the significance of the number of units of the respondents' buildings. The survey data utilize three survey responses to represent structures of 10 units or more. Based on U.S. Census data, the survey responses do not represent the true population of residents in multi-unit housing structures. The survey results are biased towards respondents from single-family homes. Therefore, whether the number of units per structure influences the evacuation rate cannot be accurately determined from the survey data.

6.2.4 Building Construction Materials

A chi-square test was conducted to compare the evacuation data to determine whether building construction materials had any significant implications for a respondent's decision to evacuate. A resulting p-value of 0.22 indicates that there is no statistically significant correlation between a respondent's building construction materials and his or her decision to evacuate before Hurricane Sandy. Thus, building construction materials should not be considered a reliable indicator for predicting evacuation rates.

6.3 Structure Location

A structure's distance from the shoreline and the associated potential risks of damage from storm surge (as indicated by evacuation zone) were evaluated to determine their influence on whether respondents evacuated.

6.3.1 Proximity to Shoreline

A regression analysis was conducted to determine whether a residence's proximity to the shoreline, measured in feet, had any significance in respondents' decision to evacuate their residence. The distances were measured from the leading edge of the residence and the center of the parcel using geographic information system (GIS) and the PLUTO dataset. The closest residence was measured at 12 feet from the shoreline, while the longest distance from a residence to a shoreline was measured at 12,307 feet. The summary output revealed a statistically significant p-value of 9.75E-21, indicating that there is a statistically significant correlation between the decisions to evacuate and the residence's distance from the shoreline. Residents who lived closer to the shoreline tended to decide to evacuate more often than those who resided farther from the shoreline. A regression analysis calculated that for every additional foot away from the shoreline, residents were 0.004% less likely to evacuate. With a y-intercept of 0.39, residents in structures located on the shoreline would have a 39% likelihood of evacuation.

6.3.2 Evacuation Zone

This section presents the hurricane evacuation zones reported by respondents and then the actual distribution of respondents by hurricane evacuation zone. **Table 12** illustrates the reported evacuation zones by respondents, while **Table 13** illustrates the actual evacuation zones of respondents. All survey packages were mailed to recipients who lived in either Zone A, Zone B, or Zone C.

Table 12: Reported Hurricane Evacuation Zones

Reported Evacuation Zone	Percent Respondents
Zone A	45%
Zone B	13%
Zone C	2%
I didn't live in one.	4%
I don't know.	31%

*The percent total does not equal 100% because 5% of respondents did not answer this question.

Table 13: Actual Hurricane Evacuation Zone Distribution

Actual Evacuation Zone	Percent Respondents
Zone A	72%
Zone B	21%
Zone C	8%

Next, the percentages of correctly and incorrectly identified evacuation zones by respondents were examined. **Table 14** illustrates the percentages of respondents who correctly and incorrectly identified their actual hurricane evacuation zone.

Table 14: Correctly and Incorrectly Identified Actual Hurricane Evacuation Zones

Actual Evacuation Zone	Correct Identification	Incorrect Identification
Zone A	62%	38%
Zone B	21%	79%
Zone C	8%	92%

Chi-square tests revealed statistically significant p-values for correlations between the three zones and respondents' correct identification of their zones. With statistically significant p-values of 0.03 and 3.8E-6, more people correctly identified that they lived in Zone A than Zone B, and Zone A than Zone C, respectively. With a statistically significant p-value of 0.002, more people correctly identified that they lived in Zone B than Zone C. Therefore, people were more likely to correctly identify their hurricane evacuation zone if they lived in Zone A, and less likely to correctly identify their hurricane evacuation zone if they lived in Zone C. As the actual hurricane evacuation zone progressed from Zone A to Zone C, respondents were less likely to know which zone they lived in.

Finally, implications of respondent's actual hurricane evacuation zone for their evacuation decision were evaluated. **Table 15** presents the percentages of respondents for each evacuation decision relative to their actual hurricane evacuation zones.

Table 15: Actual Hurricane Evacuation Zones and Evacuation Decisions

Actual Evacuation Zone	Evacuated	Did Not Evacuate
Zone A	42%	58%
Zone B	12%	88%
Zone C	0%	100%

Chi-square analysis resulted in the following p-values analyzing the evacuation rates of people in Zones A, B, and C. Correlations between Zones A and B and between Zones A and C were suggested by statistically significant p-values of 6.83E-5 and 2.05E-4, respectively. More people from Zone A evacuated than from Zone B or Zone C. Therefore, the hurricane evacuation zone was a significant indicator of whether respondents evacuated their residences. Respondents in Zone A were the most likely to evacuate, while respondents in Zone C were the least likely to evacuate.

However, it is important to note that Mayor Bloomberg issued a mandatory evacuation order for everyone in Zone A, approximately 375,000 people. This could have significant implications for the statistical analysis of those who evacuated from Zone A compared to Zone B and Zone C.

Table 16 lists the counts of respondents’ actual hurricane evacuation zones compared to their reported hurricane evacuation zone.

Table 16: Counts of Actual and Reported Hurricane Evacuation Zones

	Reported Evacuation Zone					TOTAL
	A	B	C	I don’t know	No Zone	
Actual Evacuation Zone						
Zone A	122	9	3	49	2	185
Zone B	2	26	1	22	4	55
Zone C	0	1	2	13	4	20
TOTAL	124	36	6	84	10	260*

*The total is 260 because 12 people did not respond to question 3.

6.4 Post-Storm Impacts

Hurricane Sandy’s impacts on respondents were reviewed to identify whether the level of impact would make a difference in evacuation decisions during the next storm event.

6.4.1 Structural Damage

As for the extent of structural damage to homes—regardless of whether residents evacuated—29% of the respondents reported no damage, 19% reported partial damage (minor repairs were necessary), 48% reported major damage (extensive repairs were necessary), and 5% reported complete damage, such that demolishing the structure and rebuilding was necessary.

However, because the extent of structural damage is a post-storm factor, and is not related to evacuation decisions made prior to the storm, the structural damage information should be compared with the data collected on projected response to a similar event in the future. This will indicate whether the structural damage incurred might have an impact on the decision to evacuate for similar hurricanes in the future. **Table 17** illustrates the evacuation decisions of respondents based on the amount of structural damage reported.

Table 17: Extent of Structural Damage and Evacuation Decisions.

Amount of Damage	Evacuated for Hurricane Sandy	Did Not Evacuate	Total
None/Negligible	14%	86%	100%
Partial – minor repairs were necessary	21%	79%	100%
Major – extensive repairs were necessary	33%	67%	100%
Complete – demolishing the structure and rebuilding was necessary	14%	86%	100%

Note: These calculations include values only for people who responded to both questions 18 and 20.

Table 17 demonstrates that of the respondents who did evacuate, the majority received major structural damage, while of the respondents who did not evacuate, the majority equally received complete and negligible damage. **Table 18** presents future evacuation decisions of respondents based on their reported structural damage. It includes both respondents who did and did not evacuate prior to Hurricane Sandy.

Table 18: Future Evacuation Decisions Based on Reported Structural Damage

Amount of Damage	Would Evacuate for a Similar Event
None/Negligible	43%
Partial – minor repairs were necessary	64%
Major – extensive repairs were necessary	84%
Complete – demolishing the structure and rebuilding was necessary	100%

Note: These calculations include values only for people who responded to both questions 18 and 20.

The information provided in **Table 18** suggests that as the extent of the structural damage incurred increased, respondents were more likely to evacuate for a similar hurricane event in the future. Furthermore, despite the amount of structural damage incurred, the majority of respondents did not evacuate for Hurricane Sandy, but every category reported an increase in the likelihood of evacuating for a similar hurricane event in the future. These tables could be used for planning purposes as they suggest an increase in predicted evacuation rates for future hurricane events. The smallest increase in evacuation rates is from those who received none/negligible damage, where 29% more respondents reported they would evacuate in the future, despite receiving no structural damage.

However, an important factor to study further would be whether respondent’s perceptions of the storm severity changed as time passed. If people’s perceptions of the severity of events diminished with time, perhaps fewer people would report that they would evacuate for a similar event. This same question could be asked of the same respondents in the future to determine whether a significantly fewer number of people respond that they would evacuate for a similar event.

6.4.2 Depth of Flooding

Data were also analyzed regarding the depth of flooding at each respondent’s residence and was compared with evacuation decisions. Then, analysis of the future evacuation decisions of respondents based on depth of flooding received is conducted. **Table 19** presents the evacuation decisions by reported depth of flooding.

Table 19: Reported Depth of Flooding and Evacuation Decisions

Depth of Flooding	Evacuated for Hurricane Sandy	Did Not Evacuate
Was not Flooded	18%	82%
0 to 1 Foot	12%	88%
1 to 2 Feet	22%	78%
2 to 4 Feet	38%	62%
4 to 6 Feet	56%	44%
6 to 8 Feet	25%	75%
More than 8 Feet	10%	90%

Note: These percentages include values only for people who responded to both questions 2 and 20.

Table 20 presents the percentages of respondents who would evacuate again for a similar event based on the reported depth of flooding.

Table 20: Future Evacuation Decisions Based on Reported Depth of Flooding

Depth of Flooding	Would Evacuate Again for a Similar Event
0 to 1 Foot	65%
1 to 2 Feet	72%
2 to 4 Feet	76%
4 to 6 Feet	81%
6 to 8 Feet	90%
More Than 8 Feet	80%
Was Not Flooded	52%

Note: These percentages include values only for people who responded to both questions 2 and 20

Based on the information provided in **Table 19** and **Table 20**, it is evident that, of the respondents who evacuated, the majority reported 4 to 6 feet of flooding while, of the respondents who did not evacuate, the majority reported more than 8 feet of flooding. Furthermore, respondents from all categories of flooding depth reported an increase in their likelihood to evacuate for a future similar hurricane event. This is significant for planning purposes because it demonstrates a likely increase in evacuation rates for future hurricane events. However, it is important to note that data analysis for **Table 19** and **Table 20** only includes respondents who answered *both* question 2, flood depth, and question 20, actions for the same situation in the future. Some respondents omitted answers for certain questions and, thus,

different results could be calculated if analysis was conducted on only question 2 against evacuation decisions or only question 20 against evacuation decisions. Furthermore, it seems contradictory to intuition that people who received the greatest flooding depths were less likely to evacuate. Not all respondents filled in the entire questionnaire correctly and, thus, not all surveys provided usable data for every question. Therefore, the *N* value for each question varies and this could contribute to the contradictory calculations.

6.5 Rationale and Future Actions

Several survey questions examined the participants' rationales for their decisions to either evacuate or shelter in place for Hurricane Sandy. It also included questions about whether participants would act differently in the same situation again and what actions they have planned for future storm surge events. Analysis of these four topics illustrates general rationales behind evacuation decisions and helps determine whether previous experiences influence future decisions. These topics could have implications for planning purposes by identifying the issues individuals face that could influence evacuation decisions. They could also inform planners about the most effective measures to encourage people to evacuate and determine if previous storm experiences influence future storm actions. Furthermore, analysis of the minimum amount of time needed for evacuation could have significant implications for planning purposes. Knowing the estimated amount of time needed to evacuate certain percentages of people could prove useful in evacuation planning.

6.5.1 Reasons for Not Evacuating

Of the respondents who did not evacuate, the following list shows the number of times an option was designated by respondents as a reason to **not** evacuate prior to Hurricane Sandy. The question initially asked for respondents to rank their top three choices. However, because many respondents did not rank their choices and decided to check their applicable options instead, this report presents the results as counts rather than ranks.

Question #5: What made you decide **not** to evacuate prior to the storm? (**Rank top three (3) choices.**)

- | | |
|-----------|---|
| <u>25</u> | Forecast indicated a low chance of the storm hitting my location. |
| <u>19</u> | Storm wasn't severe enough to pose a serious danger even if it hit. |
| <u>33</u> | House is well built (strong enough to be safe in storm). |
| <u>45</u> | Home is elevated above the level of storm surge. |
| <u>5</u> | Evacuation notice from officials came too late. |
| <u>46</u> | Officials didn't issue a mandatory order to evacuate. |
| <u>8</u> | Officials seemed unsure whether evacuation was necessary. |

- 15 Heard conflicting messages as to whether evacuation was necessary.
- 10 Media said evacuation wasn't necessary.
- 6 Friend or relative said evacuation wasn't necessary.
- 23 Had no place to go.
- 42 Wanted to protect property from looters.
- 60 Wanted to protect property from the storm.
- 49 Left unnecessarily in past storms.
- 3 Job required staying.
- 16 Waited too long to leave.
- 4 Traffic was too bad.
- 8 No place to take pets/shelter would not accept pets.
- 18 Concerned about being able to re-enter the community after evacuating.
- 7 Had no transportation.
- 4 Was physically unable to evacuate.
- 41 My neighbors were not evacuating.
- 32 Other, please specify: _____
- 9 Don't know.

The most prevalent reason reported was that respondents wanted to protect their property from the storm, followed closely by the option that they left unnecessarily in past storms, and the perception that officials didn't issue a mandatory evacuation order. These three responses make up a combined 30% of the responses.

6.5.2 Reasons for Evacuating

Of the respondents who did evacuate, the following are the number of times an option was designated by respondents as a reason to evacuate prior to Hurricane Sandy. The question initially asked for respondents to rank their top three choices. However, because many respondents did not rank their choices and decided to check their applicable options instead, this report presents the results as counts rather than ranks.

Question #8: What convinced you to leave your home to go someplace safer? (**Rank top three (3) choices.**)

- 30 Advice or order from elected officials.
- 27 Advice or order from emergency management officials.
- 27 Advice from the National Weather Service.
- 10 Advice/order from a police officer or firefighter.
- 23 Advice from the media.
- 28 Advice from a friend or relative.
- 23 Information about the severity of the storm.
- 26 Concerned that storm would cause home to flood.

- 17 Concerned that strong winds would make the house unsafe.
- 21 Concerned that flooding would cut off roads.
- 13 Forecasted probability (odds) was high that the storm would hit.
- 5 National Weather Service issued Hurricane Watch.
- 15 National Weather Service issued Hurricane Warning.
- 11 Experience in other storms.
- 9 Neighbors evacuated
- 23 Other, please specify: _____
- 8 Don't know

The most prevalent reason reported for evacuating was advice from elected officials. This was followed by advice from a friend or relative, emergency management officials, and the National Weather Service.

6.5.3 What to Do Differently in the Same Situation

The following are the number of times an option was designated related to what a respondent would do differently in the same situation again. The question initially asked for respondents to select their top three choices. However, because many respondents did not rank their choices and decided to check their applicable options instead, this report presents the results as counts rather than ranks.

Question #20: Would you do anything differently in the same situation again? (**Select up to three (3) categories.**)

- 96 Would evacuate.
- 39 Would **not** evacuate.
- 39 Would leave earlier.
- 17 Would wait and leave later.
- 20 Would go farther away.
- 43 Wouldn't go as far away.
- 11 Would go to a public shelter.
- 9 Wouldn't go to a public shelter
- 2 Would use a different route.
- 98 No, I wouldn't do anything different.
- 46 Other, please specify: _____
- 25 Don't know

These responses to act differently in the same situation again were compared against the evacuation decisions of participants. **Table 21** presents the actions reported by those who did evacuate prior to Hurricane Sandy. The values are the percentages of the reported responses.

Table 21: Anticipated Future Actions of Respondents Who Did Evacuate

Anticipated Future Action	Percent
Would Not Evacuate.	2%
Would leave earlier.	18%
Would wait and leave later.	4%
Would go farther away.	8%
Wouldn't go as far away.	4%
Would go to a public shelter.	5%
Wouldn't go to a public shelter.	2%
Would use a different route.	0%
No, I wouldn't do anything different.	39%
Other, please specify.	16%*
Don't know.	4%

* To view the responses reported as "Other" see **Appendix E**.

Table 21, specifically the first option for anticipated future actions, illustrates that the majority of respondents who did evacuate believe they made the correct decision and would make the same decision in the future. Only 2% reported they would change their evacuation decision and choose to shelter the storm instead. Furthermore, 18% of respondents who evacuated would actually choose to leave earlier in the same situation. The low percentages reported in **Table 21** demonstrate that respondents were generally happy with their evacuation decisions and would not act differently in the future.

Table 22 represents the actions reported by those who did not evacuate prior to Hurricane Sandy and sheltered in their homes. The values are the percentages of the reported responses.

Table 22: Anticipated Future Actions of Respondents Who Did Not Evacuate

Anticipated Future Action	Percent
Would Evacuate.	28%
Would leave earlier.	9%
Would wait and leave later.	6%
Would go farther away.	5%
Would go to a public shelter.	3%

Anticipated Future Action	Percent
Would use a different route.	1%
No, I wouldn't do anything different.	26%
Other, please specify.	13%*
Don't know.	9%

*To view the responses reported as "Other" see **Appendix E**.

Table 22 illustrates that 28% of the respondents who did not evacuate would choose to do so in a similar situation in the future. Thus, evacuation rates are predicted to be higher for future hurricane events, a useful conclusion for planning purposes. Furthermore, based on **Table 21** and **Table 22**, the majority of people who did evacuate believe they made the correct decision while almost one-third of those who did not evacuate believe they made the incorrect evacuation decision. Respondents who reported that they would "leave earlier" were not included as "would evacuate" because these respondents could be referring to leaving earlier but still after the hurricane was already over. Therefore, they did not technically evacuate prior to Hurricane Sandy but would still choose a different course of action.

6.5.4 Actions for Future Storm Surge

The following are counts of respondents who designated each option as an action completed, or planned to be completed, within the next year to reduce damage from future storm surge events.

Question #24: In response to Hurricane Sandy, have you or the owner of the property **completed or plan to complete** within the next year any of the following measures to reduce damage from future storm surge events? (Check all answers that apply.)

- 168 No additional storm surge measures are planned (skip to Question 26).
- 10 Elevate the structure.
- 44 Relocate appliances or other contents to a higher location in the structure.
- 19 Construct a berm, floodwall, or other barrier.
- 2 Relocate the structure to another location on the property.
- 6 Demolish the structure (e.g., through a buyout program) and relocate (skip to Question 26).
- 38 Other, please specify: _____

Of the respondents who reported answers to Question 24, 58% reported no additional storm surge measures planned. The measures participants plan to complete to reduce damage from future storm events were compared against the respondents' original evacuation decisions. The results are illustrated in **Table 23**.

Table 23: Planned Measures to Reduce Damage from Future Storm Surge Events

Planned Measure to Reduce Damage in Future	Evacuated for Hurricane Sandy	Did not Evacuate
No Additional Storm Surge Measures Planned	53%	61%
Elevate the Structure	3%	3%
Relocate Appliances or Other Contents to a Higher Location in the Structure	14%	16%
Construct a Berm, Floodwall, or other Barrier	7%	6%
Relocate the Structure to Another Location on the Property	1%	<1%
Demolish the Structure and Relocate	5%	<1%
Other*	16%	12%

*See **Appendix E** for responses to “Other.”

6.5.5 Minimum Amount of Time Needed for Evacuations

The following question examines the estimated minimum amount of time respondents anticipate needing to prepare for an evacuation based on their experiences during Hurricane Sandy. These results, illustrated in **Table 24**, could have significant implications for planning purposes in future evacuation events. **Figure 4** depicts the minimum amount of time needed to evacuate by a percentage of the population.

Question #16: Given your experience preparing for evacuation during Hurricane Sandy, what is the minimum amount of time you would need to prepare for evacuation (from the time you decided to evacuate until you actually evacuated your home)?

Table 24: Minimum Amount of Time Needed for Evacuation

Minimum Amount of Time Needed	Percent	Cumulative Percent
1 hour or less	29%	29%
2 to 3 hours	29%	58%
4 to 6 hours	16%	74%
7 to 12 hours	5%	79%
12 to 24 hours	7%	86%
More than 24 hours	9%	95%*

*The percent total does not equal 100% because 5% reported “don’t know” for the minimum amount of time needed to prepare for evacuation.

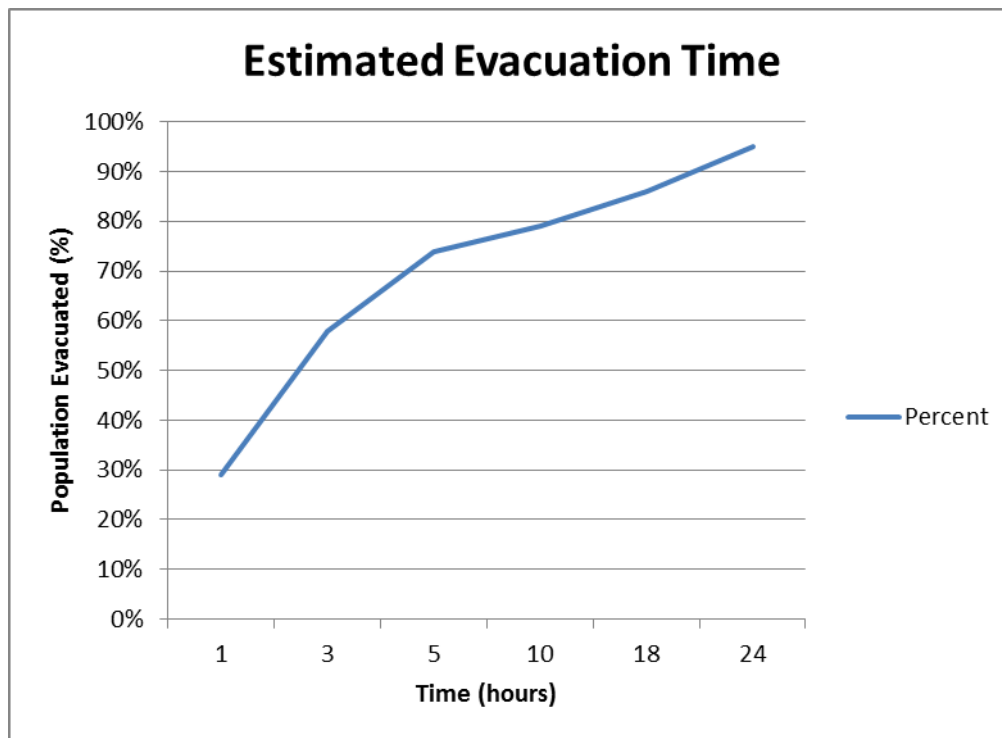


Figure 4: Minimum amount of time needed for evacuation of population

6.6 Perceived Risk Hurricane Hazards and Strengths

For this study, hurricane hazards include winds, storm surge and waves, flooding from rivers or streams, and tornadoes. As reported in section 6.5.2, Reasons for Evacuating, most respondents were convinced to evacuate their homes as a result of information about the severity and the perceived risk of the storm. A total of 26 respondents reported that flooding to their home was concern enough to evacuate. Furthermore, 21 respondents reported that concern that flooding would cut off roads convinced them to evacuate, while 17 respondents reported they evacuated because strong winds would make their house unsafe. These three factors are related to survey question #26 determining the importance of hurricane-related hazards in evacuation decisions. **Table 25** illustrates which hazards respondents from the three different evacuation zones value in terms of deciding to evacuate for an impending hurricane event.

Question #26: When deciding whether to evacuate your home, how important in your decision making process are concerns about the following hurricane-related hazards? (**Check an answer for each hazard.**)

Table 25: Importance of Hurricane-Related Hazards in Evacuation Decisions

Hazards	Not Important	Somewhat Important	Very Important	Don't Know
All Respondents:				
Hurricane winds	6%	25%	67%	2%
Storm surge and waves	5%	13%	82%	1%
Flooding from rivers or streams	24%	8%	62%	6%
Tornadoes	18%	12%	60%	11%
Respondents in Zone A:				
Hurricane winds	5%	22%	70%	3%
Storm surge and waves	4%	9%	86%	1%
Flooding from rivers or streams	25%	8%	59%	7%
Tornadoes	16%	13%	60%	11%
Respondents in Zone B:				
Hurricane winds	6%	39%	55%	0%
Storm surge and waves	2%	22%	76%	0%
Flooding from rivers or streams	17%	4%	77%	2%
Tornadoes	22%	11%	57%	11%
Respondents in Zone C:				
Hurricane winds	6%	25%	69%	0%
Storm surge and waves	27%	27%	47%	0%
Flooding from rivers or streams	38%	8%	46%	8%
Tornadoes	23%	0%	69%	8%

The information in Table 25 illustrates which categories the respondents of the three different evacuation zones value in terms of deciding to evacuate for an impending hurricane event. The information in Table 25 represents survey question 26 and supports findings from question 8, reasons for evacuating. Both question #26 and question #8 demonstrate that hurricane hazards have significant implications for evacuation decisions.

Survey question #27 examined the implications of hurricane strength categories in evacuation decisions. **Table 26** illustrates that as hurricane strength category increases, the evacuation rates increase as well.

Question #27: Considering wind, storm surge, and flooding from rainfall, would you evacuate your home if a hurricane in the various hurricane strength categories listed in the following table was predicted to hit near your location? **(Circle an answer for each category.)**

Table 26: Evacuation Decisions Based on Hurricane Strength Categories.

Hurricane Strengths	Sustained Wind Speed	Would you evacuate?		
		Yes	No	Don't Know/Depends
All Respondents:				
1	Up to 95 mph	33%	38%	30%
2	96 to 110 mph	49%	23%	29%
3	111 to 129 mph	69%	11%	20%
4	130 to 156 mph	78%	5%	17%
5	Greater than 156 mph	84%	3%	13%
Zone A Respondents				
1	Up to 95 mph	37%	31%	32%
2	96 to 110 mph	56%	15%	28%
3	111 to 129 mph	76%	8%	16%
4	130 to 156 mph	87%	2%	11%
5	Greater than 156 mph	90%	1%	9%
Zone B Respondents:				
1	Up to 95 mph	22%	55%	22%
2	96 to 110 mph	29%	46%	25%
3	111 to 129 mph	49%	26%	26%
4	130 to 156 mph	55%	12%	33%
5	Greater than 156 mph	64%	11%	26%

Hurricane Strengths	Sustained Wind Speed	Would you evacuate?		
		Yes	No	Don't Know/Depends
Zone C Respondents:				
1	Up to 95 mph	25%	50%	25%
2	96 to 110 mph	28%	33%	39%
3	111 to 129 mph	47%	12%	41%
4	130 to 156 mph	59%	12%	29%
5	Greater than 156 mph	82%	6%	12%

As can be expected, respondents living in Zone A would be more likely to evacuate with increasing storm strength. Respondents in Zones B and C anticipated similar rates of evacuation in relation to hurricane strength. Because the increase in percentages confirming evacuation is not proportional, the data suggest that separate evacuation curves for each hurricane strength category should be created. Furthermore, 33% of all respondents reported that they would evacuate for a Category 1 hurricane, which is consistent with findings in this study that 32% of participants evacuated for Hurricane Sandy (which was designated as a Category 1 hurricane as it approached the shoreline).

6.7 Summary

The results of this study will help future planning studies when estimating the evacuation rates for storm events in urban areas. The data were analyzed to determine if certain characteristics could be deemed significant as to whether a person evacuated in response to the threat from Hurricane Sandy. The data include the major categories of socioeconomic and demographic characteristics, structural characteristics, structure location, post-storm impacts, rationale and future actions, and perceived risk of Hurricane Sandy. When utilizing these evacuation rates for planning purposes, it is significant to note that the survey response rate was low and, therefore, the actual evacuation rates may vary.

The analysis of the data indicates that only the respondent's race and location of the structure were statistically significant indicators of respondent's decision to evacuate. Based on chi-square analysis, respondents who identified as "black" were less likely to evacuate. Additional chi-square analysis revealed that residents living in Zone A were significantly more likely to evacuate than the residents living in either Zone B or Zone C. Furthermore, chi-square analysis determined that significantly more people correctly identified that they lived in Zone A than

Zone B and Zone C. Therefore, respondents were more likely to identify their correct hurricane evacuation zone when they lived in Zone A and less likely to identify their correct hurricane evacuation zone when they lived in Zone C. A regression analysis indicates that for every additional foot a structure was located away from the shoreline, residents were 0.004 % less likely to evacuate.

The analysis of post-storm impacts revealed that as the extent of structural damage incurred increased, respondents were more likely to evacuate for a similar event in the future. As reported depth of flooding increased, the respondents were more likely to evacuate for a similar event in the future.

Rationale and future actions were also analyzed in this report. The results reveal that the most prevalent reasons reported for not evacuating were that respondents wanted to protect their property from the storm and looters, the belief that they left unnecessarily in past storms, and that officials didn't issue a mandatory evacuation order. These three responses make up a combined 30% of the provided responses. The most prevalent reason reported for evacuating was based on advice from elected officials. This was followed by advice from a friend or relative, emergency management officials, and the National Weather Service. With regard to future actions, 53% of respondents who evacuated for Hurricane Sandy reported that no additional storm surge measures are planned to reduce damage from future storm surge events while 61% of respondents who did not evacuate also reported that no additional measures to reduce damage from future storm surge events are planned. The minimum amount of time needed for evacuation was analyzed and results reveal that within 1 hour or less, 29% of the population could be evacuated while an additional 29%, for a combined total of 58%, could be evacuated within 2 to 3 hours. A calculated 86% of the population could be evacuated in less than 24 hours.

The final category analyzed is the perceived risk of hurricane hazards and strengths. These results reveal that, when deciding to evacuate their home, respondents consider storm surge and waves as the most significant hazards. These are followed by hurricane winds and then flooding from rivers or streams. Furthermore, when presented with the sustained wind speeds of the five different hurricane categories, 33% of respondents reported that they would evacuate for a Category 1 hurricane while 84% reported that they would evacuate for a Category 5 hurricane.

Appendix A: OMB-Approved Questionnaire

Emergency Evacuation Questionnaire

1. Did you live at the address shown on the enclosed letter when Hurricane Sandy made landfall on October 29, 2012?

Yes.
 No, but I lived elsewhere in NYC at this address: _____
 No, I lived outside the NYC region when Sandy hit (if so, please return the questionnaire with the remaining questions unanswered).

2. If your home was flooded during Hurricane Sandy, how high, in feet, was the water relative to the first floor of the inside of your home?

0 to 1 foot.
 1 to 2 feet.
 2 to 4 feet.
 4 to 6 feet.
 6 to 8 feet
 More than 8 feet.
 Was not flooded.

3. What was your Hurricane Evacuation Zone in October 2012?

Zone A.
 Zone B.
 Zone C.
 I didn't live in one.
 I don't know.

4. Prior to the storm making landfall the evening of October 29, 2012, did you evacuate your home to go someplace safer in response to the threat created by Hurricane Sandy?

Yes (skip to Question 8).
 No, I sheltered in my home until after the threat caused by the storm had passed.

5. What made you decide **not** to evacuate prior to the storm? (**Rank top three (3) choices.**)

- Forecast indicated a low chance of the storm hitting my location.
- Storm wasn't severe enough to pose a serious danger even if it hit.
- House is well built (strong enough to be safe in storm).
- Home is elevated above the level of storm surge.
- Evacuation notice from officials came too late.
- Officials didn't issue a mandatory order to evacuate.
- Officials seemed unsure whether evacuation was necessary.
- Heard conflicting messages as to whether evacuation was necessary.
- Media said evacuation wasn't necessary.
- Friend or relative said evacuation wasn't necessary.
- Had no place to go.
- Wanted to protect property from looters.
- Wanted to protect property from the storm.
- Left unnecessarily in past storms.
- Job required staying.
- Waited too long to leave.
- Traffic was too bad.
- No place to take pets/shelter would not accept pets.
- Concerned about being able to re-enter the community after evacuating.
- Had no transportation.
- Was physically unable to evacuate
- My neighbors were not evacuating
- Other, please specify: _____
- Don't know.

6. If Hurricane Sandy had looked to you like it was going to hit your location directly, would you have left your home to go someplace safer?

- Yes.
- No.
- Don't know/depends.

7. What precautionary action, if any, did you take if you stayed in your home?

- Sheltered in the second story (or higher), in my building.
- Went to an attic space in my building.
- Went to the basement.
- None of the above. Sheltered on the first floor of the building.
- Other, please specify: _____

If You Answered Question 7, Skip to Question 18

8. What convinced you to leave your home to go someplace safer? **(Rank top three (3) choices.)**

- Advice or order from elected officials.
- Advice or order from emergency management officials.
- Advice from the National Weather Service.
- Advice/order from a police officer or firefighter.
- Advice from the media.
- Advice from a friend or relative.
- Information about the severity of the storm.
- Concerned that storm would cause home to flood.
- Concerned that strong winds would make the house unsafe.
- Concerned that flooding would cut off roads.
- Forecasted probability (odds) was high that the storm would hit.
- National Weather Service issued Hurricane Watch.
- National Weather Service issued Hurricane Warning.
- Experience in other storms.
- Neighbors evacuated.
- Other, please specify: _____
- Don't know.

9. Where did you evacuate to?

- Public shelter (such as a school or Red Cross shelter).
- Church.
- Friend or relative's home.
- Hotel.
- Workplace.
- Other, please specify: _____

10. Is the location you evacuated to in your neighborhood or someplace else?

- Neighborhood (skip to Question 12).
- Somewhere else.
- Don't know.

11. What city or town did you evacuate to? _____

12. Was your evacuation location your original destination when you left your home?

- Yes - original destination.
- No - changed mind after leaving home.
- No - forced to change plans by outside events (e.g., direction from an official or road conditions).
- Don't know.

13. Was the location you evacuated to flooded during the event?

- Yes.
- No.
- Don't know.

14. Hurricane Sandy made landfall on the evening of Monday, October 29, 2012. When did you first receive warning that evacuation might be necessary?

- Friday, October 26, 2012, or before.
- Saturday, October 27, 2012.
- Sunday, October 28, 2012.
- Morning of Monday, October 29, 2012.
- Afternoon of Monday, October 29, 2012.
- Evening of Monday, October 29, 2012.
- Other, please specify: _____
- Don't know.

15. When did you actually evacuate your home?

- Friday, October 26, 2012, or before.
- Saturday, October 27, 2012.
- Sunday, October 28, 2012.
- Morning of Monday, October 29, 2012.
- Afternoon of Monday, October 29, 2012.
- Evening of Monday, October 29, 2012.
- Other, please specify: _____
- Don't know.

16. Given your experience preparing for evacuation during Hurricane Sandy, what is the minimum amount of time you would need to prepare for evacuation (from the time you decided to evacuate until you actually evacuated your home)?

- 1 hour or less.
- 2 to 3 hours.
- 4 to 6 hours.
- 7 to 12 hours.
- 12 to 24 hours.
- More than 24 hours.
- Other, please specify: _____
- Don't know.

17. What form of transportation did you use to evacuate?

- Used own vehicle(s).
- Rode with someone else.
- Used public transportation.
- Walked or biked.
- Other, please specify: _____

18. What was the extent of the structural damage to your home?

- None/Negligible.
- Partial - minor repairs were necessary.
- Major - extensive repairs were necessary.
- Complete - demolishing the structure and rebuilding was necessary.

19. How long were you displaced from your home before you were able to return to it or find a new permanent residence?

- I never left.
- 1 day or less.
- More than a day but less than a week.
- More than a week but less than 1 month.
- More than 1 month but less than 6 months.
- More than 6 months.
- I have not yet returned to a permanent residence.

20. Would you do anything differently in the same situation again? **(Select up to three (3) categories.)**

- Would evacuate.
- Would **not** evacuate.
- Would leave earlier.
- Would wait and leave later.
- Would go farther away.
- Wouldn't go as far away.
- Would go to a public shelter.
- Wouldn't go to a public shelter
- Would use a different route.
- No, I wouldn't do anything different.
- Other, please specify: _____
- Don't know.

21. Did you live at this address during 2011 when Hurricane Irene struck?

- Yes.
- No (skip to Question 24).

22. Did you evacuate from your home prior to Hurricane Irene making landfall?

- Yes.
- No.

23. Was your home damaged during Hurricane Irene?

- Yes.
- No.

24. In response to Hurricane Sandy, have you or the owner of the property **completed or plan to complete within the next year** any of the following measures to reduce damage from future storm surge events? (Check all answers that apply.)

- No additional storm surge measures are planned (skip to Question 26).
- Elevate the structure.
- Relocate appliances or other contents to a higher location in the structure.
- Construct a berm, floodwall, or other barrier.
- Relocate the structure to another location on the property.
- Demolish the structure (e.g., through a buyout program) and relocate (skip to Question 26).
- Other, please specify: _____

25. Would these additional protection measure(s) affect your decision to evacuate during future hurricane events?

- No.
- Yes.
- Don't know/not sure.

26. When deciding whether to evacuate your home, how important in your decision making process are concerns about the following hurricane-related hazards? (**Check an answer for each hazard.**)

Hazard Category	Not Important	Somewhat Important	Very Important	Don't Know
Hurricane winds				
Storm surge and waves				
Flooding from rivers or streams				
Tornadoes				

27. Considering wind, storm surge, and flooding from rainfall, would you evacuate your home if a hurricane in the various hurricane strength categories listed in the following table was predicted to hit near your location? (**Circle an answer for each category.**)

Hurricane Strength Category	Sustained Wind Speed	Would you evacuate?		
1	Up to 95 mph	Yes	No	Don't Know/Depends
2	96 to 110 mph	Yes	No	Don't Know/Depends
3	111 to 129 mph	Yes	No	Don't Know/Depends
4	130 to 156 mph	Yes	No	Don't Know/Depends
5	Greater than 156 mph	Yes	No	Don't Know/Depends

28. Which best describes your home or building? Include all apartments, flats, etc., even if they are vacant.

- A mobile home.
- A single-family house.
- A building with 2 apartments/units.
- A building with 3 or 4 apartments/units.
- A building with 4 to 9 apartments/units.
- A building with 10 to 19 apartments/units.
- A building with 20 to 49 apartments/units.
- A building with 50 or more apartments/units.

29. How many stories does your home or building have?

- 1 story.
- 2 stories.
- 3 stories.
- More than 3 stories.

30. Does your home or building have a basement?

- No.
- Yes.
- Don't know/not sure.

31. Of which of the following materials is your home or building mostly constructed?

- Wood.
- Brick.
- Cement block.
- Steel.
- Other.
- Don't know.

32. How many feet are between the ground outside your home or building and the entrance to the first floor (this is the "foundation height")?

- Less than 1 foot.
- 1 to 2 feet.
- 2 to 3 feet.
- 3 to 4 feet.
- 4 to 6 feet.
- More than 6 feet.

33. How long have you lived at this address?

- Less than 1 year.
- 1 to 5 years.
- 5 to 10 years.
- More than 10 years.

34. Do you own or rent your home or unit?

- Own.
 Rent.

35. During which months of the year do you most often stay at this address? (**Check all that apply**)

- | | | |
|-----------------------------------|------------------------------------|-----------------------------------|
| <input type="checkbox"/> All Year | <input type="checkbox"/> May | <input type="checkbox"/> October |
| <input type="checkbox"/> January | <input type="checkbox"/> June | <input type="checkbox"/> November |
| <input type="checkbox"/> February | <input type="checkbox"/> July | <input type="checkbox"/> December |
| <input type="checkbox"/> March | <input type="checkbox"/> August | |
| <input type="checkbox"/> April | <input type="checkbox"/> September | |

36. How many people live in your household, including yourself?

- Number of people.

37. How many in your household are children 17 years of age or younger?

- Number of children.

38. How many in your household are 65 years of age or older?

- Number of people 65 years of age or older.

39. Does anyone in your household (not including infants or toddlers) have serious difficulties walking or climbing stairs that would limit their mobility to evacuate or seek a safer location within the home?

- Yes (number of individuals:).
 No.
 Don't know/prefer not to answer.

40. What is the highest level of education you have attained?

- Some high school.
 High school graduate.
 Some college.
 College graduate.
 Post graduate.
 Prefer not to answer.

41. Which of the following best describes **your** ethnic background?

- Hispanic origin.
 Non-Hispanic origin.
 Prefer not to answer.

42. Which of the following best describes **your** race?

- White.
- Black.
- American Indian or Alaskan Native.
- Asian or Pacific Islander.
- Two or more races.
- Prefer not to answer.

43. How well do the majority of the members of your household speak English?

- Not well or not at all.
- Well.
- Very well/fluent.
- Prefer not to answer.

44. What was your household's total pre-tax income during the previous year?

- Less than \$10,000.
- Between \$10,000 and \$15,000.
- Between \$15,000 and \$25,000.
- Between \$25,000 and \$35,000.
- Between \$35,000 and \$50,000.
- Between \$50,000 and \$75,000.
- Between \$75,000 and \$100,000.
- Between \$100,000 and \$150,000.
- Between \$150,000 and \$200,000.
- Greater than \$200,000.
- Prefer not to answer. (Remember, your response is confidential)

45. How many vehicles does your household have at home available to use for evacuation?

- 0
- 1
- 2
- 3 or more

Thank you for your time. Please feel free to include any comments you have on your experiences during Hurricane Sandy on the lined page on the back of the questionnaire. If you have any questions regarding this survey before you return it, you may contact Nicholas Lutz at (502) 315-6874 or Nicholas.j.lutz@usace.army.mil

Please return the completed questionnaire in the enclosed envelope. If the provided return envelope is misplaced, you may mail the completed questionnaire to the below address:

**URS Corporation
Attn: Kimberly Carlins
12420 Milestone Center Drive
Germantown, MD 20876**

Comments

Appendix B: Hurricane Sandy Evacuation Study Cover Letter

DEPARTMENT OF THE ARMY
NORTH ATLANTIC DIVISION, CORPS OF ENGINEERS

FORT HAMILTON MILITARY COMMUNITY
GENERAL LEE AVENUE, BLDG 301
BROOKLYN, NY 11252



13 December 2013

**SUBJECT: Emergency Evacuation Questionnaire,
North Atlantic Coastal Comprehensive Study**

Dear John Doe Or Current Resident:

The purpose of this letter is to request your assistance in our efforts to better understand regional evacuation patterns related to coastal storms. This effort by the United States Army Corps of Engineers is part of an overall study evaluating methods to reduce coastal storm damages and improve resiliency of communities along the coast. This effort primarily consists of collecting data on how individuals evacuate in response to large coastal storms. Your responses, collected through the enclosed questionnaire, will help us develop a strategy that will reduce risk to populations affected by Hurricane Sandy and those areas vulnerable to tidally-influenced flooding and storm surge.

The Emergency Evacuation Questionnaire is estimated to take approximately 20 minutes to complete. All answers will be kept confidential and will not be disclosed outside of the immediate study team. To assist with this effort, URS Corporation has been tasked with collecting the survey results. While participation in this survey is voluntary, it is hoped that you are willing to spend a few minutes completing the questionnaire and returning it in the provided envelope.

If you have any questions regarding this data collection process, please direct them to Nicholas Lutz of Louisville District of the USACE at (502) 315-6874, Anna Foley of URS Corporation at (973) 883-8562, or myself at (917) 790-8615.

Thank you,

Naomi R. Fraenkel, A.I.C.P.
Chief Economist
North Atlantic Division

Appendix C: Reminder Postcard



US Army Corps
of Engineers

We want to hear from you!

An Emergency Evacuation Questionnaire was recently mailed to you. If you have not done so already, please complete and return the questionnaire. Your responses are important to us. We appreciate your input and time.

Thank you.

Questions? Contact Nicholas Lutz (502-315-6874) at the USACE.

Appendix D: Follow-up Letter Sent with an Additional Questionnaire



DEPARTMENT OF THE ARMY
NORTH ATLANTIC DIVISION, CORPS OF ENGINEERS
FORT HAMILTON MILITARY COMMUNITY
GENERAL LEE AVENUE, BLDG 301
BROOKLYN, NY 11252

31 January 2014

**SUBJECT: Hurricane Sandy Evacuation Survey,
North Atlantic Coastal Comprehensive Study**

Dear «Salutation»:

An Emergency Evacuation Questionnaire was mailed to you in early January. We have not yet received a response from you and we are interested in hearing your thoughts. We are therefore resending the questionnaire in hopes that you will complete it and return it in the provided envelope. If you have recently returned the completed questionnaire, then no further action is needed; we appreciate your time and look forward to reviewing your responses.

This initiative by the United States Army Corps of Engineers is part of an overall study evaluating methods to reduce coastal storm damages and improve resiliency of communities along the coast. This effort primarily consists of collecting data on how individuals evacuate in reaction to large coastal storms. Your responses, collected through the enclosed questionnaire, will help us develop a strategy that will reduce risk to populations affected by Hurricane Sandy and those areas vulnerable to tidally-influenced flooding and storm surge. Your reply is important to us.

Participation in the survey is voluntary and all answers will be kept confidential and will not be disclosed outside of the immediate study team. To assist with the study, URS Corporation has been tasked with collecting the survey results. If you have any questions regarding this data collection process, please direct them to Nicholas Lutz (502-315-6874) of the USACE, Louisville District, Anna Foley (973- 883-8562) of URS Corporation, or myself (917-790-8615).

Thank you,

A handwritten signature in black ink, reading "Naomi R. Fraenkel", is positioned above the typed name.

Naomi R. Fraenkel, A.I.C.P.
Division Economist and Planner
USACE, North Atlantic Division

Appendix E: Responses

These are the percentages for questionnaire responses. Some summations of the percentages do not always equal 100% due to the failure of some respondents to answer a particular question.

Emergency Evacuation Questionnaire

1. Did you live at the address shown on the enclosed letter when Hurricane Sandy made landfall on October 29, 2012?

96% Yes.
4% No, but I lived elsewhere in NYC at this address: _____
<1% No, I lived outside the NYC region when Sandy hit (if so, please return the questionnaire with the remaining questions unanswered).

2. If your home was flooded during Hurricane Sandy, how high, in feet, was the water relative to the first floor of the inside of your home?

14% 0 to 1 foot.
9% 1 to 2 feet.
12% 2 to 4 feet.
13% 4 to 6 feet.
13% 6 to 8 feet
7% More than 8 feet.
29% Was not flooded.

3. What was your Hurricane Evacuation Zone in October 2012?

45% Zone A.
13% Zone B.
2% Zone C.
4% I didn't live in one.
31% I don't know.

4. Prior to the storm making landfall the evening of October 29, 2012, did you evacuate your home to go someplace safer in response to the threat created by Hurricane Sandy?

32% Yes (skip to Question 8).
67% No, I sheltered in my home until after the threat caused by the storm had passed.

5. What made you decide **not** to evacuate prior to the storm? (**Rank top three (3) choices.**)

- 4% Forecast indicated a low chance of the storm hitting my location.
- 4% Storm wasn't severe enough to pose a serious danger even if it hit.
- 6% House is well built (strong enough to be safe in storm).
- 9% Home is elevated above the level of storm surge.
- 1% Evacuation notice from officials came too late.
- 8% Officials didn't issue a mandatory order to evacuate.
- 1% Officials seemed unsure whether evacuation was necessary.
- 3% Heard conflicting messages as to whether evacuation was necessary.
- 2% Media said evacuation wasn't necessary.
- 1% Friend or relative said evacuation wasn't necessary.
- 4% Had no place to go.
- 8% Wanted to protect property from looters.
- 11% Wanted to protect property from the storm.
- 9% Left unnecessarily in past storms.
- 1% Job required staying.
- 3% Waited too long to leave.
- 1% Traffic was too bad.
- 1% No place to take pets/shelter would not accept pets.
- 3% Concerned about being able to re-enter the community after evacuating.
- 1% Had no transportation.
- 1% Was physically unable to evacuate
- 8% My neighbors were not evacuating
- 6% Other, please specify: _____
- 2% Don't know.

The following were responses included by respondents who selected "other, please specify."
These responses are reported exactly as they were written on the questionnaires by the respondents.

- 1) Wanted to be home in the morning to clean
- 2) We thought house was high enough from storm surge
- 3) Water never entered house in 66 years that my family lived here
- 4) far from the beach
- 5) We didn't see any need to leave except losing electric power
- 6) House has three levels

- 7) last storm- no flooding
- 8) Mother very ill + could not transport her
- 9) Based on geography was not concerned about direct hit- only losing power
- 10) have a 2nd floor
- 11) we were out of town when hit
- 12) Did not think flood water would reach my home
- 13) Never had flood problem at my house
- 14) Stayed for all previous storms
- 15) I got raw sewage in basement
- 16) Everyone left but me
- 17) my household never been near high water in the last 60 years
- 18) Always cry. FEMA maps prior to 2005. house on line of 500 yr flood plain and no flood zone
- 19) didn't think it would be bad- had never happened
- 20) no flood in home
- 21) we had sandbagged our house, duct taped, put up tarps, bought a pump & thought we could handle the storm.
- 22) home never flooded previous to this storm
- 23) evacuated during Irene without any damage.
- 24) wasn't in evacuation zone
- 25) didn't expect as much water that did come because it wasn't raining.
- 26) that was first time the basement was damaged.
- 27) I am a senior
- 28) my area was not identified as an evacuation zone
- 29) never had flooding before - only my basement was flooded 8 ft during Sandy
- 30) my home is at the edge of evacuation zone (next to zone B on the other corner)
- 31) we did not think water would reach us

6. If Hurricane Sandy had looked to you like it was going to hit your location directly, would you have left your home to go someplace safer?

- 58% Yes.
- 12% No.
- 30% Don't know/depends.

7. What precautionary action, if any, did you take if you stayed in your home?

- 45% Sheltered in the second story (or higher), in my building.
- 4% Went to an attic space in my building.
- 0% Went to the basement.
- 36% None of the above. Sheltered on the first floor of the building.
- 14% Other, please specify: _____

The following were responses included by respondents who selected “other, please specify.” These responses are reported exactly as they were written on the questionnaires by the respondents.

- 1) A friend’s house on higher ground just two block away
- 2) did not have any flooding or damage to my house never had
- 3) moved my driveway vehicles to higher ground
- 4) Sand bagged put wood over windows
- 5) all depends water high
- 6) My apartment is on fourth floor.
- 7) basement flooded- remained on 1st floor
- 8) kept eye on basement to see where water might be coming in. Shoved cemenet in hole. Did not flush or turn on water.
- 9) I was on the 1st floor
- 10) sand bagged
- 11) 1st Floor
- 12) a young friend insisted on coming to my home, because I live alone.
- 13) went up on roof as water receded, we came down and went in attic
- 14) Had the option of using the basement as I have a duplex

If You Answered Question 7, Skip to Question 18

8. What convinced you to leave your home to go someplace safer? (**Rank top three (3) choices.**)

- 9% Advice or order from elected officials.
- 8% Advice or order from emergency management officials.
- 8% Advice from the National Weather Service.
- 3% Advice/order from a police officer or firefighter.
- 7% Advice from the media.
- 9% Advice from a friend or relative.
- 10% Information about the severity of the storm.
- 8% Concerned that storm would cause home to flood.
- 5% Concerned that strong winds would make the house unsafe.
- 7% Concerned that flooding would cut off roads.
- 4% Forecasted probability (odds) was high that the storm would hit.
- 2% National Weather Service issued Hurricane Watch.
- 5% National Weather Service issued Hurricane Warning.
- 3% Experience in other storms.

- 3% Neighbors evacuated
- 5% Other, please specify: _____
- 2% Don't know

The following were responses included by respondents who selected "other, please specify." These responses are reported exactly as they were written on the questionnaires by the respondents.

- 1) Height of morning tide
- 2) Directions storm may take
- 3) Water in house in AM tide before storm
- 4) saw seawall crumble
- 5) electricity, heat power failure
- 6) Ohildra insisted I get out!
- 7) years of experience living in this neighborhood
- 8) Instinct
- 9) Left when storm surge hit
- 10) disabled parents to care for.
- 11) San Wate Flooding Street
- 12) No electric
- 13) had to be at work
- 14) I was working - did not want family home alone.
- 15) most of the above
- 16) medical (chest pain)
- 17) Con Edison

9. Where did you evacuate to?

- 3% Public shelter (such as a school or Red Cross shelter).
- 1% Church.
- 88% Friend or relative's home.
- 5% Hotel.
- 0% Workplace.
- 2% Other, please specify: _____

The following were responses included by respondents who selected "other, please specify." These responses are reported exactly as they were written on the questionnaires by the respondents.

- 1) Hospital
- 2) Myrtle Beach, SC

10. Is the location you evacuated to in your neighborhood or someplace else?

20% Neighborhood (skip to Question 12).

80% Somewhere else.

0% Don't know.

11. What city or town did you evacuate to? _____

The following provides the responses of participants who responded to question number 11; what city or town did you evacuate to?

- 1) Bronx, NY
- 2) Brooklyn, NY (18)
- 3) Cedarhurst
- 4) Crestwood, Westchester Co., NY
- 5) East Rockaway, NY 11518
- 6) Elisabeth, NJ
- 7) Floral Park (Nassau County)
- 8) Flushing, NY (2)
- 9) Forest Hills
- 10) Hewlett
- 11) Holbrook, New York
- 12) Jamaica, NY
- 13) Jersey City, NJ
- 14) Long Island, NY (4)
- 15) Manhattan
- 16) Mid Island (Approximately 4 miles in)
- 17) Middletown, N.J.
- 18) Morris N.J.
- 19) Myrtle Beach, SC
- 20) *Name of City is illegible. Somewhere in N.Y.*
- 21) North woodmere, n.y. 11598, valley stream
- 22) park slope
- 23) Queens, NY (3)
- 24) S. Plainfield NJ
- 25) Same city (3)
- 26) South Planfield N.J.
- 27) State Island, NY (20)

12. Was your evacuation location your original destination when you left your home?

- 87% Yes - original destination.
- 2% No - changed mind after leaving home.
- 5% No - forced to change plans by outside events (e.g., direction from an official or road conditions).
- 6% Don't know.

13. Was the location you evacuated to flooded during the event?

- 11% Yes.
- 86% No.
- 3% Don't know.

14. Hurricane Sandy made landfall on the evening of Monday, October 29, 2012. When did you first receive warning that evacuation might be necessary?

- 17% Friday, October 26, 2012, or before.
- 25% Saturday, October 27, 2012.
- 18% Sunday, October 28, 2012.
- 13% Morning of Monday, October 29, 2012.
- 3% Afternoon of Monday, October 29, 2012.
- 3% Evening of Monday, October 29, 2012.
- 6% Other, please specify: _____
- 8% Don't know.

The following were responses included by respondents who selected "other, please specify." These responses are reported exactly as they were written on the questionnaires by the respondents.

- 1) Don't remember- Probably Saturday
- 2) No warning
- 3) don't remember
- 4) been watching reports regarding conditions (high tide, full moon, direct hit) days before the 29th.

15. When did you actually evacuate your home?

- 3% Friday, October 26, 2012, or before.
- 9% Saturday, October 27, 2012.
- 28% Sunday, October 28, 2012.
- 18% Morning of Monday, October 29, 2012.
- 16% Afternoon of Monday, October 29, 2012.
- 17% Evening of Monday, October 29, 2012.
- 0% Other, please specify: _____
- 1% Don't know.

16. Given your experience preparing for evacuation during Hurricane Sandy, what is the minimum amount of time you would need to prepare for evacuation (from the time you decided to evacuate until you actually evacuated your home)?

- 29% 1 hour or less.
- 29% 2 to 3 hours.
- 16% 4 to 6 hours.
- 5% 7 to 12 hours.
- 7% 12 to 24 hours.
- 9% More than 24 hours.
- 0% Other, please specify: _____
- 5% Don't know.

17. What form of transportation did you use to evacuate?

- 76% Used own vehicle(s).
- 17% Rode with someone else.
- 1% Used public transportation.
- 1% Walked or biked.
- 5% Other, please specify: _____

The following were responses included by respondents who selected "other, please specify." These responses are reported exactly as they were written on the questionnaires by the respondents.

- 1) Army vehicle
- 2) Police van took us to the shelter
- 3) ambulance

18. What was the extent of the structural damage to your home?

- 29% None/Negligible.
- 19% Partial - minor repairs were necessary.
- 48% Major - extensive repairs were necessary.
- 5% Complete - demolishing the structure and rebuilding was necessary.

19. How long were you displaced from your home before you were able to return to it or find a new permanent residence?

- 44% I never left.
- 4% 1 day or less.
- 7% More than a day but less than a week.
- 12% More than a week but less than 1 month.
- 23% More than 1 month but less than 6 months.
- 9% More than 6 months.
- 2% I have not yet returned to a permanent residence.

20. Would you do anything differently in the same situation again? (Select up to three (3) categories.)

- 15% Would evacuate.
- 8% Would **not** evacuate.
- 9% Would leave earlier.
- 8% Would wait and leave later.
- 7% Would go farther away.
- 3% Wouldn't go as far away.
- 4% Would go to a public shelter.
- 3% Wouldn't go to a public shelter
- 1% Would use a different route.
- 13% No, I wouldn't do anything different.
- 22% Other, please specify: _____
- 7% Don't know

The following were responses included by respondents who selected "other, please specify." These responses are reported exactly as they were written on the questionnaires by the respondents.

- 1) Just stay alert with news and officials, police dept and fire department
- 2) move my car to higher ground
- 3) clean out first floor!
- 4) depends on how serious its going to be
- 5) get flood insurance
- 6) I would stay + try + clean out basement
- 7) Would board-up basement windows
- 8) Would get a generator
- 9) would get a pump & generator
- 10) would move cars
- 11) would move my car
- 12) would remove things from the basement
- 13) would secure my home better
- 14) Add generators for emergency purpose
- 15) have a generator and sump pumps and water tight windows
- 16) if we were in an evacuation zone we would of left
- 17) if my neighborhood effected would have evacuate
- 18) Go to family in other neighborhoods not affected
- 19) would go to friend or relative's home
- 20) go to second level of home
- 21) I would have removed my belongings from the basement. 2 Shut off gas and electricity.
- 22) Take my auto's inland to Brooklyn
- 23) would move electrical appliances, clothing and linen to higher location.
- 24) would move my vehicle move generator to 2nd floor

- 25) Install gate valve for main-sewer Trap
- 26) prepare better
- 27) Bring as much as possible to as high as possible point of the house
- 28) I would leave because we were not safe after the storm. No police, no food in store.
People stealing and no gas for cars.
- 29) Would go to relatives home in P.A.
- 30) Bring valuables to 2nd level of home
- 31) Leave and not come back
- 32) move out my belongings from basement
- 33) take my own car (it was damaged beyond repair) arrange for clean up crew/repairs
beforehand
- 34) Try to save more valuables
- 35) Would pack up and safely store as many belongings are possible
- 36) except take more clothing
- 37) Except take more personal possessions like pictures, documents etc that were all ruined
- 38) remove all contents of my basement
- 39) remove clothing, goods from 1st floor to upper level. Lost everything on 1st floor from
furniture, clothes, appliances, etc.
- 40) Try to fortify home
- 41) son's house one mile away
- 42) Spend more time packing important documents
- 43) would take more items with me
- 44) would have, should have, taken more important things, sentimental thing. Clothes to
another location the day before the storm.
- 45) Move all items out of house
- 46) would probably board up windows + doors

21. Did you live at this address during 2011 when Hurricane Irene struck?

- 92% Yes.
- 6% No (skip to Question 24).

22. Did you evacuate from your home prior to Hurricane Irene making landfall?

- 30% Yes.
- 70% No.

23. Was your home damaged during Hurricane Irene?

- 19% Yes.
- 81% No.

24. In response to Hurricane Sandy, have you or the owner of the property **completed or plan to complete within the next year** any of the following measures to reduce damage from future storm surge events? (Check all answers that apply.)

- 59% No additional storm surge measures are planned (skip to Question 26).
- 3% Elevate the structure.
- 15% Relocate appliances or other contents to a higher location in the structure.
- 7% Construct a berm, floodwall, or other barrier.
- 1% Relocate the structure to another location on the property.
- 2% Demolish the structure (e.g., through a buyout program) and relocate (skip to Question 26).
- 13% Other, please specify: _____

The following were responses included by respondents who selected “other, please specify.” These responses are reported exactly as they were written on the questionnaires by the respondents.

- 1) Can't afford to take other measure!
- 2) Rebuild new elevation house
- 3) elevate all electrical boxes
- 4) Would like to elevate need money
- 5) I already built a strong barrier around my house 20 years ago
- 6) It is perfect as it is
- 7) replace 1st floor carpet with tile
- 8) Cut down 5 trees. Install Roof that can withstand 130 mph wind
- 9) I was told by my community leaders that US Corps of Engineers does not allow rebuilding of our seawall
- 10) Completed wind damage repairs
- 11) some of the above
- 12) none
- 13) same as #20
- 14) Install outside wall. Buy more water. Pray those hooded robbers don't come back.
- 15) Installed pumps
- 16) would like to raise land (fill) to be higher since my property slopes downward from street.
- 17) water tight windows and generator and water sump pumps
- 18) No money left
- 19) don't know how answer
- 20) opened two dry wells & connected them to drains
- 21) funds to neighborhood will take steps to protect better
- 22) waterproof (plastic or rubber?) hosing in baseboard radiator placed much higher

- 23) fix the roof
- 24) would evacuate & relocate appliances if financially capable.
- 25) water only came in through basement door, so have replaced with a more solid one.?
- 26) Rebuild from scratch, with elevated construction
- 27) *Comments Not Legible*
- 28) Flood proof windows and install backup generator to run sump pumps
- 29) main sewage gate valve- would like to elevate electric service.
- 30) submersible pump
- 31) Since the bay water flooded the basement via the basement windows, I'd waterproof the windows
- 32) bd up windows and doors
- 33) have a generator on the 2nd floor
- 34) Demoed and rebuilt on property
- 35) raised boiler & hot water heater

25. Would these additional protection measure(s) affect your decision to evacuate during future hurricane events?

- 54% No.
- 18% Yes.
- 28% Don't know/not sure.

26. When deciding whether to evacuate your home, how important in your decision making process are concerns about the following hurricane-related hazards? **(Check an answer for each hazard.)**

Hazard Category	Not Important	Somewhat Important	Very Important	Don't Know
Hurricane winds	6%	25%	67%	2%
Storm surge and waves	5%	13%	82%	1%
Flooding from rivers or streams	24%	8%	62%	6%
Tornadoes	18%	12%	60%	11%

27. Considering wind, storm surge, and flooding from rainfall, would you evacuate your home if a hurricane in the various hurricane strength categories listed in the following table was predicted to hit near your location? **(Circle an answer for each category.)**

Hurricane Strength Category	Sustained Wind Speed	Would you evacuate?		
		Yes	No	Don't Know/Depends
1	Up to 95 mph	Yes	No	Don't Know/Depends
2	96 to 110 mph	Yes	No	Don't Know/Depends

Hurricane Strength Category	Sustained Wind Speed	Would you evacuate?		
3	111 to 129 mph	Yes	No	Don't Know/Depends
4	130 to 156 mph	Yes	No	Don't Know/Depends
5	Greater than 156 mph	Yes	No	Don't Know/Depends

Hurricane Strength Category	Sustained Wind Speed	Would you evacuate?		
1	Up to 95 mph	33%	38%	30%
2	96 to 110 mph	49%	23%	29%
3	111 to 129 mph	69%	11%	20%
4	130 to 156 mph	78%	5%	17%
5	Greater than 156 mph	84%	3%	13%

28. Which best describes your home or building? Include all apartments, flats, etc., even if they are vacant.

- 0% A mobile home.
- 66% A single-family house.
- 26% A building with 2 apartments/units.
- 6% A building with 3 or 4 apartments/units.
- 1% A building with 4 to 9 apartments/units.
- <1% A building with 10 to 19 apartments/units.
- <1% A building with 20 to 49 apartments/units.
- <1% A building with 50 or more apartments/units.

29. How many stories does your home or building have?

- 12% 1 story.
- 63% 2 stories.
- 23% 3 stories.
- 2% More than 3 stories.

30. Does your home or building have a basement?

- 26% No.
- 73% Yes.
- 1% Don't know/not sure.

31. Of which of the following materials is your home or building mostly constructed?

- Wood.
- Brick.
- Cement block.
- Steel.
- Other.
- Don't know.

Building Material	Percent of Reported Counts
Wood	41%
Brick	27%
Wood/Brick	9%
Cement Block	5%
Wood/brick/cement block	4%
Wood/cement block	4%
Don't know	4%
Brick/cement block	3%
Other	3%

32. How many feet are between the ground outside your home or building and the entrance to the first floor (this is the “foundation height”)?

- 16% Less than 1 foot.
- 14% 1 to 2 feet.
- 13% 2 to 3 feet.
- 23% 3 to 4 feet.
- 19% 4 to 6 feet.
- 15% More than 6 feet.

33. How long have you lived at this address?

- 2% Less than 1 year.
- 9% 1 to 5 years.
- 11% 5 to 10 years.
- 78% More than 10 years.

34. Do you own or rent your home or unit?

- 98% Own.
- 2% Rent.

35. During which months of the year do you most often stay at this address? (**Check all that apply**)

<input type="checkbox"/> All Year	<input type="checkbox"/> May	<input type="checkbox"/> October
<input type="checkbox"/> January	<input type="checkbox"/> June	<input type="checkbox"/> November
<input type="checkbox"/> February	<input type="checkbox"/> July	<input type="checkbox"/> December
<input type="checkbox"/> March	<input type="checkbox"/> August	
<input type="checkbox"/> April	<input type="checkbox"/> September	

Months	Count of Respondents	Percent of Respondents
All Year	260	95%
All Year Except June	1	<1%
All Year Except April and November	1	<1%
All Year Except Jan, Feb, Mar, May	1	<1%
June, Jul, Aug, Sept, Oct	1	<1%
Nov, Dec, Jan, Feb	1	<1%
Sept, Oct, Nov, Dec	1	<1%
November	1	<1%
Did not Respond	6	2%

36. How many people live in your household, including yourself?

_____ Number of people.

Number of People Living in House	Percent of Respondents
Zero	1%
One	12%
One to Two	<1%
Two	27%
Three	16%
Three to Four	<1%
Four	21%
Five	9%
Six	5%

Number of People Living in House	Percent of Respondents
Seven	3%
Eight	2%
Nine	1%
Ten	<1%
Twelve	<1%

37. How many in your household are children 17 years of age or younger?

___ Number of children.

Number of Children 17 Years or Younger	Percent of Respondents
Zero	68%
One	14%
Two	11%
Three	3%
Four	2%
Five	<1%
Seven	1%

38. How many in your household are 65 years of age or older?

___ Number of people 65 years of age or older.

Number of Residents 65 Years or Older	Percent of Respondents
Zero	48%
One	30%
Two	20%
Three	1%
Four	1%

39. Does anyone in your household (not including infants or toddlers) have serious difficulties walking or climbing stairs that would limit their mobility to evacuate or seek a safer location within the home?

20% Yes (number of individuals: __).

75% No.

6% Don't know/prefer not to answer.

40. What is the highest level of education you have attained?

- 7% Some high school.
- 21% High school graduate.
- 19% Some college.
- 24% College graduate.
- 21% Post graduate.
- 7% Prefer not to answer.

41. Which of the following best describes **your** ethnic background?

- 4% Hispanic origin.
- 73% Non-Hispanic origin.
- 23% Prefer not to answer.

42. Which of the following best describes **your** race?

- 62% White.
- 12% Black.
- 0% American Indian or Alaskan Native.
- 9% Asian or Pacific Islander.
- 1% Two or more races.
- 17% Prefer not to answer.

43. How well do the majority of the members of your household speak English?

- 4% Not well or not at all.
- 22% Well.
- 69% Very well/fluent.
- 5% Prefer not to answer.

44. What was your household's total pre-tax income during the previous year?

- 3% Less than \$10,000.
- 4% Between \$10,000 and \$15,000.
- 6% Between \$15,000 and \$25,000.
- 5% Between \$25,000 and \$35,000.
- 8% Between \$35,000 and \$50,000.
- 14% Between \$50,000 and \$75,000.
- 12% Between \$75,000 and \$100,000.
- 14% Between \$100,000 and \$150,000.
- 4% Between \$150,000 and \$200,000.
- 6% Greater than \$200,000.
- 24% Prefer not to answer. (Remember, your response is confidential)

45. How many vehicles does your household have at home available to use for evacuation?

<u>10%</u>	0
<u>46%</u>	1
<u>32%</u>	2
<u>12%</u>	3 or more

Appendix F: Respondent's Questionnaire Comments

Additional comments were provided on the back of the questionnaire by 76 people. These comments have been reported exactly as they were written on the returned questionnaires; however personally identifiable information has been removed.

- 1) Information regarding POST hurricane would have been very helpful, especially concerning less than ethical demolition crews. We were erroneously led to believe that the house needed to be emptied as much as possible in ONE DAY so that demolition and mold control could begin. As it turned out, we could have taken out time emptying.
- 2) Tell the insurance companies to do the right thing for flood damage not nickel and dime the people. I'm paying over 40 years but had difficulty trying to get money from my insurance company.
- 3) I think you folks should be looking at the bay wall not so much the ocean.
- 4) Local roadway for all evacuation routes flooded well before the storm surge. Evacuation would have to occur at least 24 hours in advance. There is no place to put half million evacuees in that amount of time. A storm like typhoon haiywan would have killed at least 50,000 people here. Wave/surge barriers are needed to break water flow.
- 5) There are two of us living in our home. My husband chose to stay. I left because I had just had surgery- was on crutches I didn't want to be a burden to emergency service if it came to that. We also have a large dog and didn't think emergency workers could save her if things got too bad. One of the problems with evacuating next time is we won't have a good place to go (our evacuation place will also be in an evacuation zone next time). Finding an appropriate location that will allow dogs will be a challenge. We will never abandon our pets.
- 6) The bay side wall should be higher and should run from marine park bridge to the bridge crossing to broad channel. The dunes should be higher than are currently being planned. Should be as high as Lido Beach in Long Island. The Dunes in that area are as high as second floor on the homes in the area. The dunes should also be included in the rehabilitation of Riis Park (park name written illegible). The federal park should equally be protected. It is not clear that the federal government is planning to protect that facility. This endangers the blocks closest to that unprotected area.
- 7) When will you dredge Flushing Bay and the College Point shore front? The toxins are my concern. It is long over due.
- 8) Cross Bay Blvd is the evacuation route for 800 families. If Cross Bay blvd flood again like it did in Hurricane Sandy, evacuation will be impossible. 800 families in broad channel and thousands of families in the rockaways will be trapped.
- 9) A floodwall needs to be constructed in Rockaway Park, New York 11694. And, we did not receive and assistance with rebuilding from FEMA. And, we did not receive any assistance from the city to help rebuild the home.
- 10) I am the owner of the house at XX Hamilton beach, n.y. 11414. My house was unliveable after Hurricane Sandy. I had to leave the house the next day Oct. 30-2012. There was no electric lights or heat. I am 83 years old and my wife is 80. We were frozen. The 106 pct. Police came and help us. They are heroes. They turned the heat up in the police car because we were frozen. We spent a few day's at my sister in laws house. Then my granddaughter came from up state ny. to help us. We got rooms in greenville, n.y. My daughter called FEMA for help they were very, mean and

nasty to my daughter. They gave her a hard time every time she called them they final broke their heart and gave me a few dollars to pay my rent.

- 11) would like to know what is being done for the Howard Beach community relating to the Jamaica Bay? Are there any plans to building barriers to prevent high tides and flooding from coming in to the streets. This is the major reason why 95% of the homes were ruined with flooding.
Question 4 Response- I was not considered in the zone to evacuate and I was prepared with pumps and generators but the impact of the water coming in when the tide rose from the Jamaica bay “screwed” my home and many other in the howard beach community. If we had barriers this would have been prohibited. So, due to the high tide I had no choice but to evacuate with the coastal guard assistance where the boat was on my deck. That’s how high the water was. I had 10ft of water in my basement.
- 12) My family has lived in this house for 66 years. We have never gotten water in the house (1st floor) Irene + Donna were the worse storms we have experienced. Sandy was at least 2x worse (water height around house, 56” between house + garage).
- 13) The water was 5ft above Crossbay Blvd in Broad Channel which is the evacuation route. Should consideration be made as to elevating this roadway. Broad Channel and the surrounding areas have a number of elderly people with no cars. How are they to get to an evacuation site? Neighbors can’t always take everyone with them. A bus to transport them to the evacuation site should be considered.
- 14) My house had no electricity for six days. That's the only problem that we dealt with.
- 15) I firmly believe what would be helpful to home owners in the Rockaways and other flood prone areas, are seminars or other information sharing on how to flood proof and hurricane proof our homes. Types of building materials to use in rebuilding, ways in which we can flood proof our homes, steps we can take to prevent damage or sustain minimal damage to our homes from hurricane force winds are all useful information that we, the home owners in the Rockaways can utilize. Techniques in rebuilding workshops, teaching what types of building materials to use would be very helpful.
- 16) The only problem I had during Sandy was no electricity for two weeks. I also had my backyard fence fall down and my landscaping destroyed (trees) in front yard.
- 17) God Bless America.
- 18) We used a battery operated radio and all they kept saying was go online to various site for help on call the following number for help. Since we had no electricity how were we to go online- very frustrating- there has to be better accountability for the electrical sources- some kind of backup system so if our electricity goes out- We won’t bet without a way to keep in touch. We felt isolated for a long time.
- 19) No help despite extreme damage in neighborhood. Poor (no) response.
- 20) We wanted to raise the house + add a second flood but there was too much red tape dealing with the city of NY Dept. of Buildings. We are still not back in the house due to bureaucracy + still renting. Accordingly, we are just going to put the house together the way it was + hope that Hurricane Sandy was a once in a lifetime storm.
- 21) Left before evacuation order- Would have brought more if I knew I would have been out of home for so long. Stayed at relatives because no electric, hot water, etc. after storm. Gas shortage was also a problem limiting me on how often I could return to check in on home- save gas to make

- sure I could get back to vote on election day so I could vote for local candidates. Police with loud speakers saying to evacuate might have motivated more to leave.
- 22) Thank you for the Dunes on the beach. Your men did a great job!
- 23) We were very fortunate; we did not have any damages. My neighbors only have minor damage (tiles uprooted) on their roof. Two trees (small) came down in front of my neighbor's home. We had several trees (3) large ones on my property. I have since removed these trees in "wake" of Sandy.
- 24) I wish that the promenade on Mayberry promenade could be restored to the way it was before Hurricane Sandy. The beauty and tranquility of this neighborhood is the promenade. Hopefully by my neighbors and myself taking the time to fill out this questionnaire your organization can put some resources into fixing up our once beautiful promenade. I would also like to thank you for compiling this questionnaire and getting it to the many people who were affected by Hurricane Sandy. Once again, thank you.
- 25) Where can I get info on seawall repair plans of Atlantic Village (my community where I live)? Thanks.
- 26) In my community we had a storm wall that was designed and built by the United States Army Corps of Engineers. This storm wall was destroyed by Hurricane Sandy, and the USACE has done nothing to reimburse us or offer to rebuild this wall, which should be their responsibility. The fact of the matter is, our homeowners association is still making payments on a wall that no longer exists! This is a total disgrace and the USACE should do the right thing. Rather than ignoring the situation.
- 27) I think you printed envelope does not have enough postage for this six-page survey, only good for a four-page survey.
- 28) I have lived in the Rockaway Peninsula since 1980 and I never experienced anything like Hurricane Sandy. In August 1912 my family convinced me to leave (evacuate) which was a waste, as the water barely reached the sidewalk. In previous Hurricane the water usually came from the (Jamaica) bay. Any damage was typically in basements as the foundation was too low. In my house XX 125 St. we never had any water from the bay or the ocean. The only reason I left was I had no heat or electricity. I came back everyday until my heat was restored on Dec. 16, 2012.
- 29) Basement flooded with about 6-7 ft. water. Water entered three basement windows. Started making plywood basement window "covers" which could be inserted if again. Vertical distance from way water level at high tide to bottom of the basement window, above 6 ft. Street slopes upward from Bay. Stayed in house although others on my block left. Tidal Flooding slow moving therefore did not feel threatened. Had lots of candles and extra food. Electric out for about 2 weeks that was bad. Hope this helps~
- 30) There are 2 very large trees in front of the house. Heavy rain and wind am always afraid.
- 31) Can your engineers dredge Jamaica Bay to water the water table and rebuild the marshes to provide natural drainage? Thank you for looking into this matter.
- 32) I have been paying insurance all my life and when I needed it most, got paid almost nothing! I was forced to take loan and at 71 I am still working! Now there is talk about Big increases in Flood ins. They don't pay out policy limit; "what nerve!!!!" This may not apply to your survey, but this is how I feel! The only thing they did for me was put me deeper in debt!

- 33) Warning through media should have been communicated more intensely. Reports seemed to give people the impression that they had the choice to stay in "A" flood zones.
- 34) I am President of Oakwood civic ASS, and Oakwood, Each, I also was head of 1991 North Eastin, with army corp of eng. XXXX XXX-XXX-XXXX and EEM, XXXX XXX, XXX-XXX-XXXX, also XXX XXXX, XXX-XXX-XXXX. I speak to Nicholas Lutz, 502-315-6874, at USACE, I would like to get into this, or meet some and talk more about the problem. XX Malone Ave S.I. N.Y. 10306
- 35) The worst thing that happened after the storm was finding an honest contractor! Went with a "licensed and insured" contractor" and ended up with a nightmare. Turned out he was not licensed at all and I had to hire a different contractor to repair the mess the first one made.
- 36) I think the gov't could have made it more clear about the danger the storm was going to cause. Some people took it very lightly. That thinking caused them they lives.
- 37) From Dongan Hills Staten Island. If there was a 3 minute warning of the surge I could have moved my vehicle. If we had HONEST, not hype, weather reports I would have reacted different. I would remained in my home, but done things differently. It would be nice to have a media station in broadcasting with live camera shots of my area of the beach front. There should be a 8 ft berm (permanent) along the beach area, designed to be extendable screw the view, screw the inconvenience to the 50 bathers who use the beach in the summer days. Screw the home owners who want the ocean view. At this point I have hydrophobia, if I did not need water to live I would do away with my plumbing (grin)
- 38) I could have returned to my house to my house sooner but it took 2 weeks to restore electricity, no electric, no heat. Telephone and cable took 18 days.
- 39) Lived in this home 41 years my wife family in as at home 95 years never any flood threat before storm sandy.
- 40) For the most part I was totally satisfied with FEMA & my insurance company. Only one elected official (Debi Rose my city council woman) showed any concern about my neighborhood. The rest of my elected officials are all the equivalent of horse poop. They were totally uncaring in my neighborhood. I got more help from neighbors, friends and relatives and local churches and even strangers. My elected officials were totally useless.
- 41) I have been on ocean going ships all my life. WTR doesn't scare me. I would be very worried to leave my house
- 42) Stayed until storm surge hit most neighbors stayed, we had plan to monitor storm, had bags packed at front door, neighbors planned to work as a group stem basement flooding with pump. When storm surge hit water went to 5 ft. deep (above ground level) in matter of seconds. We (neighbors and I) evacuated as a group in chest high water. 17 of us got out in 2 vehicles and went to friends house on high ground all basements flooded to ceilings and some houses had from 1 ft to 8 ft on first floor.
- 43) There needs to be consistent messaging among all government depts./agencies regarding mandatory evacuations and a designated media outlet to advise citizens of mandatory evacuation.
- 44) Should there every be another storm I hope before there is some protection done so that there is no storm surge that would cause all the damage that sandy caused. Be it a berm on the beaches or some sort of flood wall.

- 45) I did not sustain as much damage as others in my neighborhood but the outpouring of help and assistance was overwhelming, this sort of thing doesn't usually happen in New York. It was a bad experience and I didn't expect, I lived here my whole life and Im 67.
- 46) Hurricane Irene was a big hype in the news the previous summer w/ its evacuations and we did not sustain any damages. We thought it was the same type of hype for Hurricane Sandy and if it was worse; damages would have been minimal. I guess I was wrong. I will evacuate for all other hurricane threats.
- 47) Hope to find a solution for this. We are seniors who lived here more than 30 yrs. Not knowing what to do is frightening.
- 48) While we didn't have flooding as did all my neighbors we did have puddling in the basement. The water came up past my basement windows. We also lost a skylight and back door and window.
- 49) I evacuated for Hurricane Irene. We fortunately had no stern damage. But we did get burglarized - they were in my house for hours - took everything of value and all out sentimental memories, jewelry. My elderly mom lives w/me. This was heart breaking for her. That I why I did not evacuate for Hurricane Sandy.
- 50) We made all repairs at our own expense. Waiting for reimbursement above insurance. Also waiting for information regarding elevating! Is it necessary? How much? Cost? Reimbursement available? Effect on insurance if we don't?
- 51) We didn't leave because we did not believe it would be so bad. We left Irene & nothing happened. I've been here 30 years and this is the first time we have had any problems. Even if we decided to leave, where could we go with our pets. We will not leave them and most places won't take them. They are family and will not go without them. We spent \$45,000.00 to fix the house & yard. We only got \$17,000.00 from house insurance and flood insurance. Since we had flood insurance, FEMA would not help us. We did the responsible thing and we got screwed.
- 52) The power went off at 6:00 pm by staying I was able to turn on my generator and run all my sump pumps keeping the water level down to a few inches and having minor damage instead of major damage. My neighbors that left there homes had major water damage. If I needed to get out I was one block away to high grown.
- 53) I was concerned that water from Long Island Sound would come into my driveway and damage my autos so I moved them to Hawkins Street (a hill) where my son lives. The water did not surge that badly but a large tree near the opening to the driveway was blown down into my driveway and crushing my aluminum chain link fence. If I had not moved the cars two of them would have been crushed.
- 54) Now, what will the government do to help reinforce and make our community safer??? So far - the army corps of Engineers helped destroy our beaches and safety years ago and still does nothing.
- 55) Although the 1st floor wasn't flooded, my basement was flooded with 4 feet of water and destroy all I have in the basement, including the water boiler and gas heater. The reason for the flood was due to the sewer not functioning properly. The water from the storm surge had nowhere to go so it went back into my house through the toilet and even the water well. The water from the street couldn't go down the sewer, so it came through my basement with 4 feet of water. The city needs to fix the sewer situation in my neighborhood. We pay a very high sewer fee each year and deserves better sewer drainage.
- 56) well done

- 57) Electric problems unsolved fill now. House still need reconstruct.
- 58) We believe that police cars patrolling our area prior to evacuation, announcing that after evacuation there will be no police protection, was an open invitation to looters.
- 59) Our neighborhood is waiting anxiously to see what the US Army Corp of Engineers is going to do to help protect Manhattan Beach from living through another nightmare, destructive storm like Hurricane Sandy. We have been kept in the dark long enough and our neighborhood is hardly mentioned, even though we endured devastating damage to our homes and lives.
- 60) According to the 2013 Emergency Flood Map from NYC OEM my home is in zone 6 - and unlikely to be flooded. In the case of a different pattern of landfall, increased winds, etc. Evacuate if directed to do so - and early. NYC OEM did a good job - closing subways, ordering evacuation, etc. The largest number of fatalities occurred to people who did not evacuate. I would seek shelter in a public school near me - and take my large timid, person-phobia dog with me.
- 61) If we were in a zone A we would have definitely evacuated. We did not because we were in zone c. In other words not mandatory for a Category 1 Hurricane. In the future if these designations change we will act accordingly. 1/9/14
- 62) raise the belt pkwy and put gates on the bridge (belt pkwy)
- 63) Presently, home insurance companies are not insuring home owners who require flood insurance. After examining the damage done by "Sandy" I trust the insurance companies should see things differently.
- 64) Damage to house would have been worse if I had evacuated as my neighbor did. I was able to push cement into where water was coming in at night. When rain subsided for a while, sewer water stopped coming in, so we were able to pack in more quick drying cement which started to dry before it started again. If we didn't do that, we would have had 5-6 ft of water like my neighbors did. When power came back on, we were able to get the sump pump and wet dry vac worked. Prior to that we used mops and brooms to push water into the pump well. Next day, we finished resealing with cement; tarred the area once cement dried and are happy that we stayed. As of today, my immediate neighbor is still doing repairs.
- 65) There is a 70 ft oak tree in the front of my house. NYC Dept of Forestry planted the tree in the early 1950's. The tree took a beating during Hurricane Sandy. I am fearful that the next storm will tipple the tree on to my house. I complained to the city and was told that the tree is "ok". The tree is partially "ok" @ present -however the tree should not be taller than the house.
- 66) Don't spend too much resources preventing the effects of Sandy- there is a limit that man can do to stop the force of nature. I have lived in my house for twenty years and this is the first time flooding has affected my basement. The water with fish, eels, and feces came from than 3 miles away. I did not evacuate my home or make any preparations to clear my basement because the weather conditions did not indicate flooding. There was very little rain and only strong winds.
- 67) Since we didn't get much rain, I didn't think we would be flooded. All we heard was the window. Then later that night we see water coming up the block and people were running to move their cars. It was a total disaster. While everyone is taking care of the cars that water was filling the drains and coming into the basements through any opening available. It filled up the outside basement stairs and the water pressure broke down the basement doors and windows. It was really very frightening don't know if I could ever be ready for something like that again.
- 68) Although I have repaired the basement, but as of this date I am not yet finished cleaning out or digging out debris from the garage. Being a senior with knee and shoulder problems, I am still

struggling after excess of one year, due to the fact that Insurance company claimed that Sandy was not a "flood" but a "disaster"

- 69) 1. Please repair binder ground sewers. 2. I put sand bags next to my basement windows.
- 70) Just my basement was flooded with 8 ft water- sewer and sea water.
- 71) I went to work at 0430 on Saturday 10/27/12. I took lost time on Monday 10/29/12 at 0800 to get and bring my family to her family in Brooklyn. They were flooded in the location I took them to while I was at work at 9 Metro Tech, Brooklyn, N.Y.C. Fire Department Headquarters. I will be taking my family further away next time. We will also be leaving earlier then we did next time. I would like to raise my house but it is not financially possible at this time. I would like to put my utilities higher-up in my house but is also not financially possible at this time. We had 8-8 1/2 feet of water in our basement. It took five (5) days to get the water out of the basement. I had to pump it out four (4) days in a row.
- 72) 1. Unfair distribution of Fema dollars. 2. Build it Back Program too slow-to much stolling of paperwork- 3. Contact us 5 months after all required documents were submitted regarding missing info or incorrect infor on documents- looks like a stoll tactic so you may decide to not go forward & give up on getting money well deserved by the applicants. - to much to say about the NYC Program- XX 98 st Howard Beach, NY 11414
- 73) My comments is that I did not know that I was living on a sink hole from the front bed room to the right of the outside all the way from the front to the back side of the house I was very surprise to see that. And it is still here even tho the water is in at the moment. I am wondering what to do with it. I would really like to know your idea on that. That very important. I really miss my YI6 jaqua. Good by for now.
- 74) I am not quite sure how the increased reinforcements across the street would fare in the event of another Sandy but we all hope that it would not be for another. But thankfully we are still here. Drains added to the infrastructure would help. It floods often here. Thank you for your efforts.
- 75) I don't think it should matter what my race is. Or if I speak English in my house or how much I make the amount of money I make couldn't even come close to the damage done. And the wonderful mayor didn't announce to evacuate until the last minute I also want to commend everyone that helped NYPD, NYFD, Military Officer Awesome Job!
- 76) News reports did not talk about tidal surge until Oct. 29 afternoon. Later in afternoon when we were thinking of leaving, Mayor was saying it wasn't safe to leave storm was increasing. Expected only little flooding until news stressed dangers.

Appendix G: Analysis Tables

This appendix provides the frequency counts for selected survey questions.

Table G-1: Question 3: What is your Hurricane Evacuation Zone?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
Zone A	68	56
Zone B	34	2
Zone C	5	1
I didn't live in one	9	1

Table G-2: Question 6: Would you have evacuated if Hurricane Sandy looked like it was going to hit your location directly?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
Yes	103	n/a
No	21	n/a
Don't Know/Depends	53	n/a

Table G-3: Question 9: Where did you evacuate to?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
Church	n/a	1
Friend or relative's home	n/a	77
Hotel	n/a	4
Public shelter	n/a	2
Other, please specify:	n/a	2
Workplace	n/a	0

Table G-4: Question 17: What form of transportation did you use to evacuate?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
Used own vehicle(s)	n/a	62
Rode with someone else	n/a	14
Used public transportation	n/a	1
Walked or biked	n/a	1
Other, please specify:	n/a	4

Table G-5: Question 18: What was the extent of structural damage to the residence?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
None/Negligible	64	11
Partial-minor repairs were necessary	35	13
Major-extensive repairs were necessary	70	55
Complete-demolishing the structure and rebuilding was necessary	8	4

Table G-6: Question 28: Which best describes your home or building type?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
A mobile home	0	0
A single-family home	115	60
A building with 2 apartments/units.	49	20
A building with 3 or 4 apartments/units.	10	5
A building with 4 to 9 apartments/units.	1	1
A building with 10 to 19 apartments/units	1	0
A building with 20 to 49 apartments/units.	1	0
A building with 50 or more apartments/units	1	0

Table G-7: Question 29: How many stories does your home or building have?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
1 Story	21	12
2 Stories	111	54
3 Stories	42	19
More than 3 Stories	5	0

Table G-8: Question 30: Does your home or building have a basement?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
No	36	33
Yes	141	53
Don't know/not sure	3	0

Table G-9: Question 32: How many feet are between the ground outside your home or building and the entrance to the first floor (this is the “foundation height”)?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
Less than 1 foot	30	10
1 to 2 feet	26	11
2 to 3 feet	21	12
3 to 4 feet	39	20
4 to 6 feet	30	18
More than 6 feet	28	11

Table G-10: Question 34: Do you own or rent your home or unit?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
Own	176	86
Rent	4	1

Table G-11: Question 36: How many people live in your household, including yourself?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
One	19	13
One to Two	1	0
Two	47	27
Three	30	13
Three to Four	1	0
Four	39	17
Five	17	7
Six	11	3
Seven	6	1
Eight	4	2

Response	Respondents who did NOT evacuate	Respondents who did evacuate
Nine	1	1
Ten	0	1
Twelve	1	0

Table G-12: Question 37: How many people in your household are children 17 years of age or younger?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
Zero	115	58
One	26	11
Two	21	8
Three	6	2
Four	4	1
Five	0	1
Seven	2	0

Table G-13: Question 38: How many people in your household are 65 years of age or older?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
Zero	86	41
One	55	24
Two	32	20
Three	2	0
Four	3	0

Table G-14: Question 39: Does anyone in your household (not including infants or toddlers) have serious difficulties walking or climbing stairs that would limit their mobility to evacuate or seek a safer location within the home?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
Yes (number of individuals: __)	35	17
No	132	65
Don't know/prefer not to answer	11	4

Table G-14a: Responses provided by those who selected “yes.”

Response	Count of Respondents who provided this number
One	40
Two	6
Three	1

Table G-15: Question 40: What is the highest level of education you have attained?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
Some high school	10	9
High school graduate	39	17
Some college	38	13
College graduate	40	24
Post graduate	40	17
Prefer not to answer	11	7

Table G-16: Question 41: Which of the following best describes your ethnic background?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
Hispanic origin	5	5
Non-Hispanic origin	132	57
Prefer not to answer	36	23

Table G-17: Question 42: Which of the following best describes your race?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
White	105	54
Black	26	4
American Indian or Alaskan Native	0	0
Asian or Pacific Islander	18	6
Two or more races	2	1
Prefer not to answer	23	20

Table G-18: Question 43: How well do the majority of the members of your household speak English?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
Not well or not at all	8	3
Well	37	20
Very well/fluent	123	57
Prefer not to answer	7	5

Table G-19: Question 44: What was your household's total pre-tax income the previous year?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
Less than \$10,000.	4	3
Between \$10,000 and \$15,000.	6	5
Between \$15,000 and \$25,000.	10	5
Between \$25,000 and \$35,000.	7	7
Between \$35,000 and \$50,000.	14	6
Between \$50,000 and \$75,000.	27	10
Between \$75,000 and \$100,000.	24	7
Between \$100,000 and \$150,000.	20	15
Between \$150,000 and \$200,000.	6	5
Greater than \$200,000.	14	1
Prefer not to answer. (Remember, your response is confidential).	42	20

Table G-20: Question 45: How many vehicles does your household have at home available to use for evacuation?

Response	Respondents who did NOT evacuate	Respondents who did evacuate
Zero	21	4
One	78	44
Two	51	32
Three or More	26	6