



given year. Mortgage lenders require that owners of properties with federally-backed mortgages located within SFHAs purchase and maintain flood insurance policies on their properties. Consequently, newer and recently purchased properties in the community are insured against flooding. Due to the risk of flooding from hurricanes, all property owners in the Town, even if the property is not located in a SFHA, should be encouraged to purchase and maintain flood insurance policies.

### Past Occurrences

Miami-Dade County has sustained flood events severe enough to warrant federal disaster declarations as shown in Table 3.3 within Section 3.1.2. Flooding can occur in Cutler Bay year-around but is most frequent in late winter or early spring and again during the summer which are historically the wettest periods of the year. The summer months often bring persistent thunderstorms and in late summer the heavy rains associated with tropical storms and hurricanes are more prevalent. The average annual rainfall for Cutler Bay is 58 to 60 inches. Past occurrences for tropical storms and hurricanes can be found in Section 3.2.6.

Table 3.14 shows the flood events from causes other than hurricanes reported by the NCDC since 1995 for Miami-Dade County. Table 3.15 shows the SHELDUS flood events from causes other than hurricanes from 1960 to 2013.

**Table 3.14 - NCDC Flooding in Miami-Dade County - 1995 to October 2013**

Location	Date	Event Type	Injuries/Deaths	Damages
E Broward & E Dade	22-Jun-95	Flash Flood	0/0	\$1,500,000
Kendell Dr Area	26-Apr-97	Flash Flood	0/0	\$0
NE Portion	08-Jun-99	Flash Flood	0/0	\$50,000
East Portion	15-Oct-99	Flash Flood	0/0	\$100,000,000
North Miami	09-Dec-02	Flash Flood	0/0	\$50,000
Kendall	28-Sep-04	Flash Flood	0/0	\$50,000
North Miami Beach	20-May-07	Flash Flood	0/0	\$5,000
Miami Beach	20-May-07	Flash Flood	0/0	\$0
Miami	20-May-07	Flash Flood	0/0	\$0
South Miami	05-Jul-07	Flash Flood	0/0	\$0
Biscayne Bay Arpt	04-Oct-08	Flash Flood	0/0	\$1,000
Ojus	09-Oct-08	Flash Flood	0/0	\$10,000
Biscayne Park	05-Jun-09	Flash Flood	0/0	\$50,000
Miami Intl Arpt	17-Dec-09	Flash Flood	0/0	\$50,000
Miami Beach	04-Jun-10	Flash Flood	0/0	\$1,000
Goulds	30-Oct-11	Flash Flood	0/0	\$100,000
Homestead	08-Oct-11	Flash Flood	0/0	\$0
Florida City	16-Sep-98	Flash Flood	0/0	\$0
Miami	14-Apr-00	Flash Flood	0/0	\$10,000
Miami	31-May-00	Flash Flood	0/0	\$5,000
Hialeah Gardens	22-May-12	Flash Flood	0/0	\$0
Hialeah Gardens	22-May-12	Flash Flood	0/0	\$75,000
West Miami	30-Apr-13	Flash Flood	0/0	\$1,000
North Miami Beach	07-Jun-13	Flash Flood	0/0	\$0
Miami Beach	18-Jul-13	Flash Flood	0/0	\$5,000
South Miami	02-Oct-13	Flash Flood	0/0	\$5,000
Florida City	16-Sep-98	Flood	0/0	\$0
Miami	14-Apr-00	Flood	0/0	\$10,000
Miami	31-May-00	Flood	0/0	\$5,000
Miami	31-Oct-94	Urban Flood	0/0	\$50,000
Southern Portion	28-Sep-95	Urban Flood	0/0	\$10,000



Location	Date	Event Type	Injuries/Deaths	Damages
Surfside	21-Aug-97	Urban/Small Stream Flood	0/0	\$0
Countywide	09-Sep-01	Heavy Rain	0/0	\$0
Miami	21-Oct-01	Heavy Rain	0/0	\$0
Homestead	06-Nov-03	Heavy Rain	0/0	\$0
Hialeah	08-Nov-03	Heavy Rain	0/0	\$0
Hialeah	01-Aug-04	Heavy Rain	0/0	\$10,000
Opa Locka	02-Aug-04	Heavy Rain	0/0	\$40,000
Cutler Ridge	11-Jun-05	Heavy Rain	0/0	\$0
North Miami	16-Jun-05	Heavy Rain	0/0	\$30,000
Miami	11-Sep-05	Heavy Rain	0/0	\$0
Hialeah	15-May-06	Heavy Rain	0/0	\$0
Hialeah	16-May-06	Heavy Rain	0/0	\$0
South Miami	26-May-06	Heavy Rain	0/0	\$0
Opa Locka	02-Sep-06	Heavy Rain	0/0	\$100,000
Kendall	16-Nov-06	Heavy Rain	0/0	\$20,000
Coral Gables	25-Nov-09	Heavy Rain	0/0	\$75,000
Perrine	25-Nov-09	Heavy Rain	0/0	\$50,000
Bal Harbour	06-May-11	Heavy Rain	0/0	\$0
Miami Intl Arpt	19-Jun-11	Heavy Rain	0/0	\$0

Source: NCDC

**Table 3.15 - SHELDUS Flooding in Miami-Dade County - 1960 to 2013**

Month	Year	Hazard Type	Inj	Deaths	Crop Damage	Property Damage
March	1995	Coastal	1	0	\$0.00	\$0.00
June	1996	Coastal	0	1	\$0.00	\$0.00
July	1996	Coastal	0	3	\$0.00	\$0.00
June	1998	Coastal	1	1	\$0.00	\$0.00
May	1999	Coastal	0	1	\$0.00	\$0.00
October	1999	Coastal	2	2	\$0.00	\$0.00
January	2000	Coastal	1	0	\$0.00	\$0.00
February	2001	Coastal	1	0	\$0.00	\$0.00
April	2001	Coastal	1	1	\$0.00	\$0.00
May	2002	Coastal	0	1	\$0.00	\$0.00
July	2002	Coastal	1	1	\$0.00	\$0.00
August	2002	Coastal	0	1	\$0.00	\$0.00
August	2003	Coastal	0	1	\$0.00	\$0.00
November	2003	Coastal	0	1	\$0.00	\$0.00
May	2004	Coastal	3	3	\$0.00	\$0.00
November	2005	Coastal	1	1	\$0.00	\$0.00
May	2007	Coastal	2	1	\$0.00	\$0.00
November	2007	Coastal	1	0	\$0.00	\$1,498,053.00
November	2010	Coastal	1	0	\$0.00	\$0.00
April	2012	Coastal	0	0	\$0.00	\$0.00
August	2013	Coastal	0	1	\$0.00	\$0.00
October	1974	Flooding	0	0	\$656.00	\$65,629.00
October	1991	Flooding	0	0	\$0.00	\$42,760.00
June	1995	Flooding	0	0	\$0.00	\$1,146,441.00
September	1995	Flooding	0	0	\$0.00	\$15,285.00
June	1999	Flooding	0	0	\$0.00	\$69,915.00
October	1999	Flooding	0	0	\$279,660,265.00	\$139,830,132.00



Month	Year	Hazard Type	Inj	Deaths	Crop Damage	Property Damage
April	2000	Flooding	0	0	\$0.00	\$13,528.00
May	2000	Flooding	0	0	\$0.00	\$6,764.00
October	2000	Flooding	0	0	\$338,207,027.00	\$304,386,324.00
December	2000	Flooding	0	0	\$17,586,765.00	\$135,282.00
December	2002	Flooding	0	0	\$0.00	\$64,746.00
September	2004	Flooding	0	0	\$0.00	\$61,661.00
May	2007	Flooding	0	0	\$0.00	\$5,617.00
October	2008	Flooding	0	0	\$0.00	\$11,901.00
June	2009	Flooding	0	0	\$0.00	\$54,292.00
December	2009	Flooding	0	0	\$0.00	\$54,292.00
June	2010	Flooding	0	0	\$0.00	\$1,068.00
October	2011	Flooding	0	0	\$0.00	\$103,564.00
May	2012	Flooding	0	0	\$0.00	\$76,098.00
April	2013	Flooding	0	0	\$0.00	\$1,000.00
July	2013	Flooding	0	0	\$0.00	\$5,000.00
October	2013	Flooding	0	0	\$0.00	\$5,000.00
January	1969	Severe Storm/Thunder Storm	0	0	\$0.00	\$3,173.00
February	1969	Severe Storm/Thunder Storm	0	0	\$0.00	\$15,632.00
May	1977	Severe Storm/Thunder Storm	0	0	\$192,208.00	\$0.00
June	1991	Severe Storm/Thunder Storm	0	0	\$0.00	\$85.00
November	2003	Severe Storm/Thunder Storm	0	0	\$253,214.00	\$0.00
February	2004	Severe Storm/Thunder Storm	0	0	\$0.00	\$184,984.00
August	2004	Severe Storm/Thunder Storm	0	0	\$0.00	\$61,661.00
June	2005	Severe Storm/Thunder Storm	0	0	\$0.00	\$35,784.00
September	2006	Severe Storm/Thunder Storm	0	0	\$0.00	\$115,554.00
November	2006	Severe Storm/Thunder Storm	0	0	\$0.00	\$23,110.00
November	2009	Severe Storm/Thunder Storm	0	0	\$0.00	\$135,732.00

Source: SHELDUS, September 2014

The following provides details on flood events detailed in the NCDC database and from members of the FMPC.

**October 2, 2013** - Persistent heavy rains from slow moving showers and thunderstorms produced an isolated area of flash flooding during the late afternoon and early evening. Measured rainfall amounts were in the range of 7 to 10 inches in a matter of just a few hours.

**April 15, 2013** - A weak upper level trough of low pressure moved across South Florida along with a stationary frontal boundary over North Florida resulting in isolated severe thunderstorms over the Miami metropolitan region during the afternoon. Nearly six inches of rain fell on Miami Beach during a short duration and caused significant street flooding.

**October 8, 2011** - Heavy and persistent showers led to flooding over southwestern metro Miami-Dade County. Total rainfall amounts in this area ranged from 5 to 9 inches, with most of this rain falling in a span of 6 hours or less, resulting in significant street flooding.

**June 5, 2009** - Severe flooding affected the mid and South Beach sections of Miami Beach as well as downtown Miami from a nearly stationary thunderstorm originating in Biscayne Park. A total of 9.3 inches fell at the cooperative station on South Beach, most of this falling in less than 3 hours. This caused as much as 3 feet of standing water on streets and garages on South Beach, resulting in many vehicles stalled on streets and road closures across the area. Cars were seen floating down Michigan Avenue at 11th Street. Several businesses had water intrusion along Alton Road and 17th Street. A number of condominium buildings along West Avenue had up to 5 feet of water in the parking garages.

**October 4, 2008** - An area of heavy rain continued to slowly move south to southeast out of Broward County into Miami-Dade County with rainfall estimates from the National Weather Service radar at two to three inches per hour. On Miami Beach, an off-duty weather service employee reported water entering cars, while more reports of the same were received from Key Biscayne. Several roads were closed with 2 to 3 feet of water for several hours.

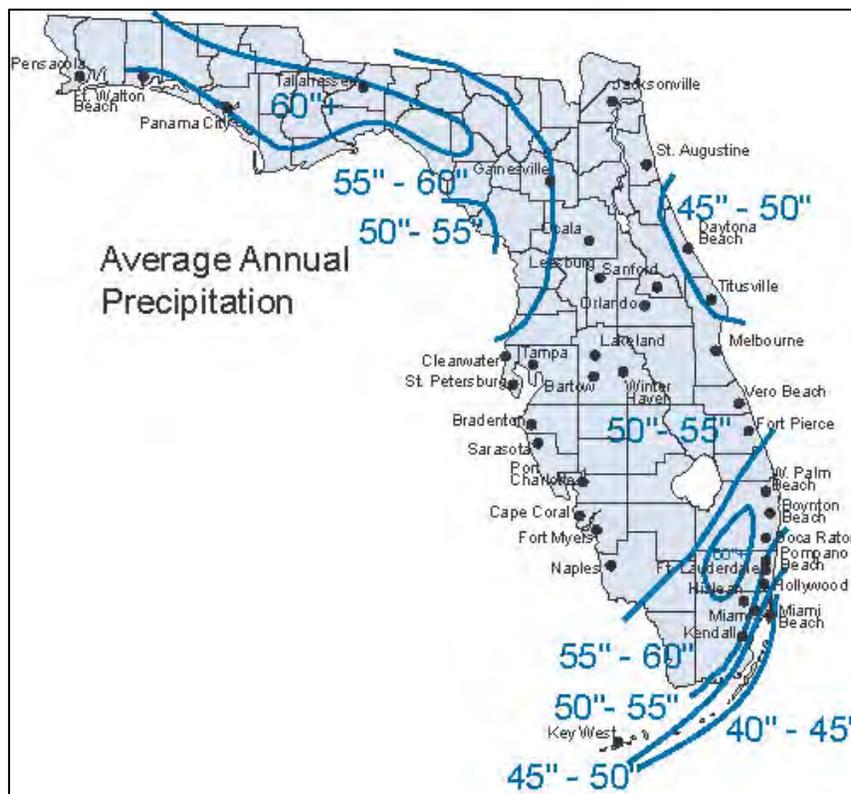
**September 9-12, 2001** - A stalled trough of low pressure across north Florida gradually shifted to south Florida and eventually spawned tropical storm Gabrielle in the east Gulf of Mexico. Before becoming Gabrielle 5 to 10 inches of rain fell across southeast Florida, causing widespread street flooding.

**September 16, 1998** - The ground was well saturated from previous day's rain. Radar rainfall estimated amounts ranging from 4 to 8 inches. Homestead Airforce Base recorded 4.75 inches. At least eight homes were flooded with about 6 inches of water. Widespread street flooding was also reported.

**April 26, 1997** - Twelve inches of rain fell over the area near Kendall Drive and Don Shula Expressway with widespread areas of five to 10 inches of rain. Canals overflowed, water levels entered buildings and numerous vehicles stalled in water.

**Frequency/Likelihood of Future Occurrence**

**Likely** - By definition of the 1-percent-annual-chance flood event, the Town of Cutler Bay has a 1 percent chance of a 100-year or significant flood being equaled or exceeded in any given year. As shown in Figure 3.12, the annual precipitation for Cutler Bay averages 58 to 60 inches. A similar amount of precipitation should be anticipated in the future, and occasional flooding is likely to occur.



Source: Florida Climate Center, Florida State University

**Figure 3.12 - Average Annual Precipitation for Florida**



The depth of flooding from a 100-year (1% annual chance flood) will range from 0 feet to more than 10 feet. This is shown in Figure 3.26 in Section 3.3.4.

### **Climate Change and Flood: 100-/500-year**

With its populous coastal community, porous geology and low topography, Cutler Bay is particularly vulnerable to the effects of climate change and sea level rise. While average annual rainfall may increase or decrease slightly, the intensity of individual rainfall events is likely to increase which can overwhelm stormwater drainage systems. It is possible that average soil moisture and runoff could decline, however, due to increasing temperature, evapotranspiration rates, and spacing between rainfall events.

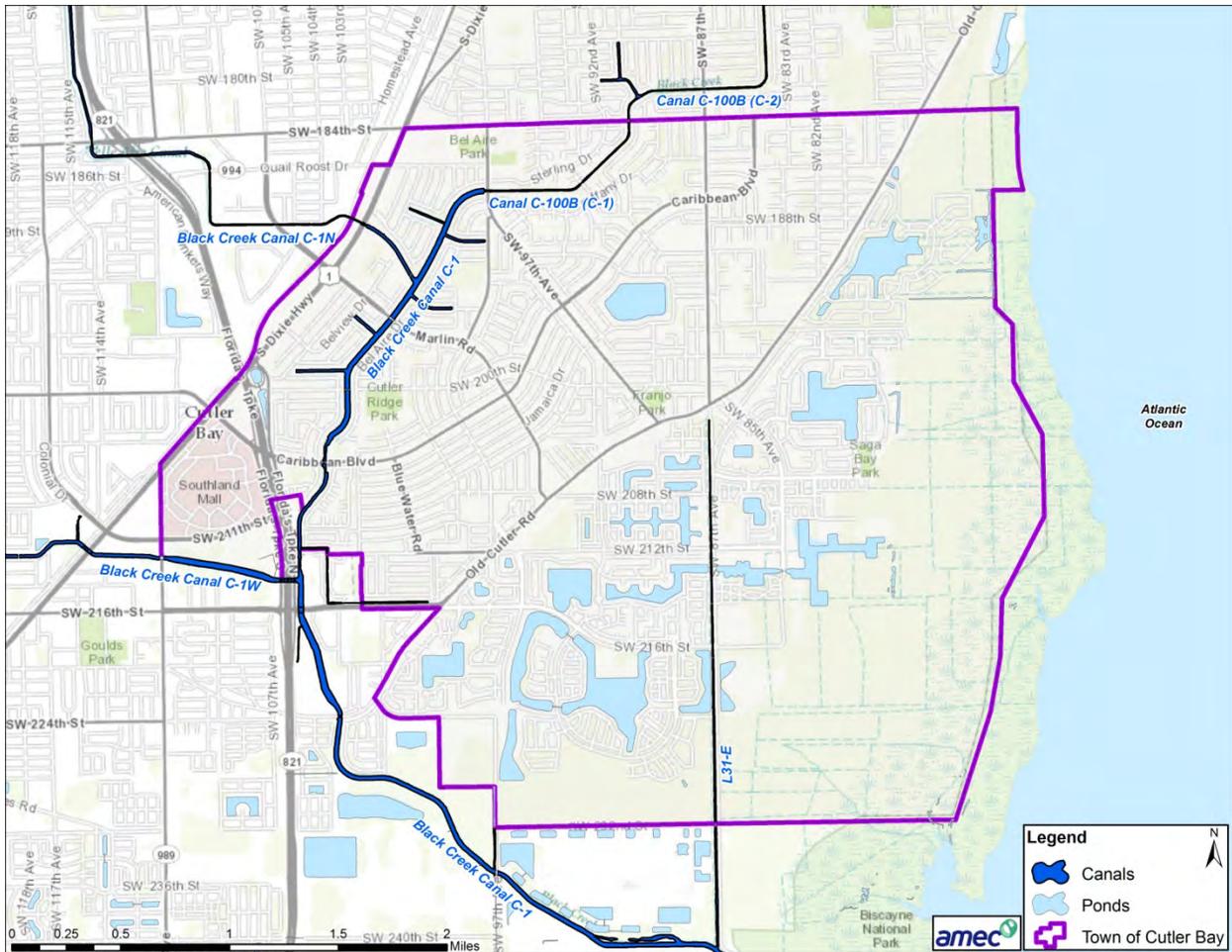
## **3.2.5 Flood: Stormwater/Localized Flooding**

### **Hazard/Problem Description**

Localized stormwater flooding can also occur throughout Cutler Bay. Localized stormwater flooding occurs when heavy rainfall and an accumulation of runoff overburden the stormwater drainage system within the community. Cutler Bay is located along the Atlantic Ocean and Biscayne Bay, and the topography of the area is very flat with elevations generally below 10 feet (NGVD 29). Flooding problems are presented by ponding in the very flat, poorly drained areas and by overflow from the drainage canals that traverse the Town. Stormwater drainage has been an on-going challenge in the Town, particularly the areas of marl and muck soils east of Old Cutler Road.

As shown in Figure 3.13, there are six major canals that lie within and/or border the Town of Cutler Bay: C-100, C100B, C-1, C-1N, C-1W and L31E. These canals provide three main functions:

- To provide drainage and flood protection.
- To supply water for irrigation.
- To maintain a groundwater table elevation that is adequate to prevent saltwater intrusion into local groundwater.



**Figure 3.13 - Cutler Bay Canal System**

### Past Occurrences

Localized stormwater flooding can be associated with a 100-year (1% annual chance flood) and the depth of flooding is often 3 feet which is consistent with AH Zones shown in much of Cutler Bay. Details of past occurrences for localized stormwater flooding are detailed in Section 3.2.4. This is shown in Figure 3.26 in Section 3.3.4. Areas of local stormwater flooding were identified by the FMPC. Figure 3.14 depicts the areas of localized flooding identified by the FMPC. The areas of localized flooding include:

- Sterling Dr and SW 93 St
- Parcels between SW 195 St and SW 196 St
- The parcels bordered by Caribbean Blvd, Anchor Rd, Pan American Dr and Blue Water Rd
- Manta Drive at Old Cutler Rd
- Old Cutler Rd southwest of the intersection of Franjo Rd
- The intersection of SW 89 Ct, Franjo Rd and SW 200 St
- SW 186 St at SW 97<sup>th</sup> Avenue
- SW 77 Ave and SW 188 St through the intersection of SW 78 Ave
- SW 79 Ave at SW 79 Ct
- SW 197 Terrace at SW 196 Terrace
- SW 84 Ave at SW 199 Terrace
- SW 212 St between SW 85 Ave and SW 87 Ave

- SW 92 Ave between Old Cutler Road and SW 208 St
- SW 24 Terrace between SW 97 Ct and SW 97 Pl
- SW 216 St between SW 97 Ave and SW 98 Ct
- SW 97 Ave between SW 219 St and SW 224 St
- The quadrant of parcels bordered by SW 97 Ave, SW 221 Street/Terrace, SW 99 Pl and SW 224 St
- The intersection of SW 92 Ave/SW 93 Path and SW 216 St
- Parcels between SW 216 St and the eastern portion of SW 215 Terrace
- SW 216 St between SW 87 Pl and SW 88 Pl

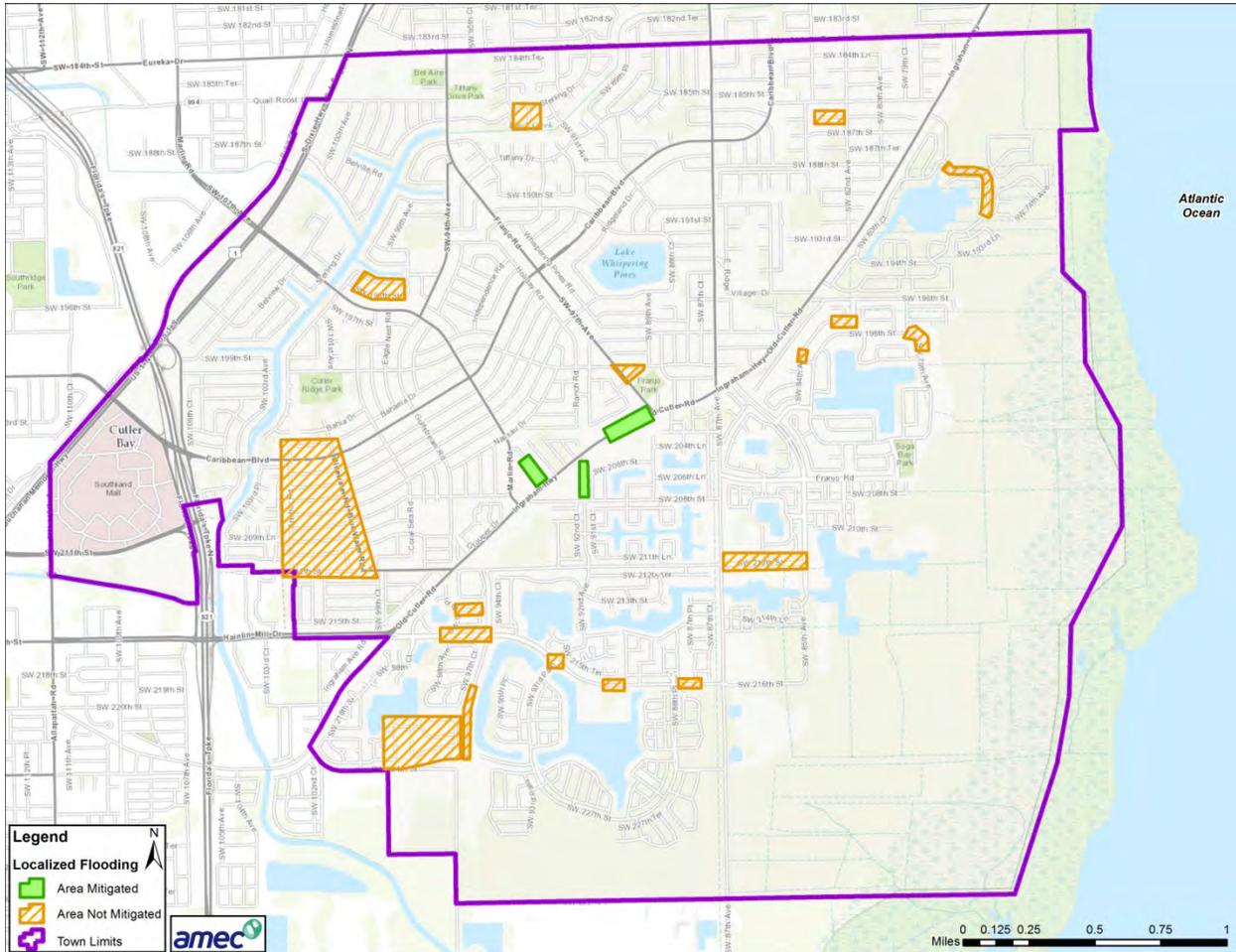


Figure 3.14 - Localized Flooding Identified by the FMPC

Localized flooding may be caused by the following maintenance related issues:

**Clogged Inlets** – debris covering the asphalt apron and the top of grate at catch basin inlets may contribute to an inadequate flow of stormwater into the system which may cause flooding near the structure. Debris within the basin itself may also reduce the efficiency of the system by reducing the carrying capacity.

**Blocked Drainage Outfalls** – debris blockage or structural damage at drainage outfalls may prevent the system from discharging runoff which may lead to a back-up of stormwater within the system.

**Improper Grade** – poorly graded asphalt around catch basin inlets may prevent stormwater from entering the catch basin as designed. Areas of settled asphalt may create low spots within the roadway that allow for areas of ponded water.

**Frequency/Likelihood of Future Occurrence**

**Highly Likely** - Due to the low elevations, a flat terrain, a consistent level of annual precipitation and the tidal influence on canal drainage resulting from heavy rainstorms, tropical storms, and hurricanes, it is highly likely that unmitigated properties will continue to experience localized flooding.

**Climate Change and Flood: Stormwater/Localized Flooding**

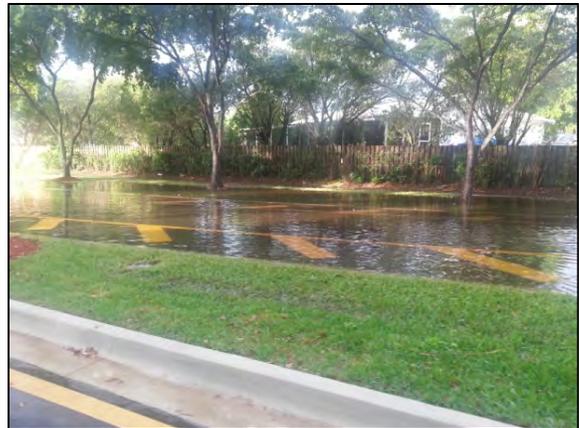
Climate change and sea level rise do have the potential to affect localized flooding in Cutler Bay. The intensity of individual rainfall events is likely to increase which can overwhelm stormwater drainage systems. It is possible that average soil moisture and runoff could decline, however, due to increasing temperature, evapotranspiration rates, and spacing between rainfall events.

**3.2.6 Hurricane and Tropical Storm (including Storm Surge)**

**Hazard/Problem Description**

A hurricane is a type of tropical cyclone or severe tropical storm that forms in the southern Atlantic Ocean, Caribbean Sea, Gulf of Mexico, and in the eastern Pacific Ocean. A typical cyclone is accompanied by thunderstorms, and in the Northern Hemisphere, a counterclockwise circulation of winds near the earth’s surface. All Atlantic and Gulf of Mexico coastal areas are subject to hurricanes. The Atlantic hurricane season lasts from June to November, with the peak season from mid-August to late October.

Hurricanes evolve through a life cycle of stages from birth to death. A tropical disturbance can grow to a more intense stage through an increase in sustained wind speeds. The progression of a tropical disturbance is described below and can be seen in Figure 3.15.

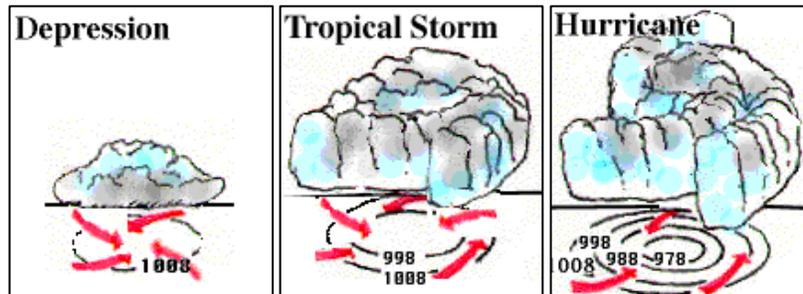


SW 216<sup>th</sup> St and 97<sup>th</sup> Ave



Catalina Subdivision

- **Tropical Depression:** A tropical cyclone with maximum sustained winds of 38 mph (33 knots) or less.
- **Tropical Storm:** A tropical cyclone with maximum sustained winds of 39 to 73 mph (34 to 63 knots).
- **Hurricane:** A tropical cyclone with maximum sustained winds of 74 mph (64 knots) or higher. In the western North Pacific, hurricanes are called typhoons; similar storms in the Indian Ocean and South Pacific Ocean are called cyclones.
- **Major Hurricane:** A tropical cyclone with maximum sustained winds of 111 mph (96 knots) or higher, corresponding to a Category 3, 4 or 5 on the Saffir-Simpson Hurricane Wind Scale.



Source: Department of Atmospheric Sciences at the University of Illinois at Urbana-Champaign

**Figure 3.15 - Life Cycle of a Hurricane**

### ***Tropical Storm***

Tropical depressions and tropical storms are both categorized by the National Weather Service as a tropical cyclone. The differentiation between these two is wind speed and organization:

**Tropical Depression** - a tropical cyclone in which the maximum 1-minute sustained surface wind is 33 knots (38 mph) or less. When viewed from a satellite, tropical depressions appear to have little organization. However, the slightest amount of rotation can usually be perceived when looking at a series of satellite images. Instead of a round appearance similar to hurricanes, tropical depressions look like individual thunderstorms that are grouped together.

**Tropical Storm** - a tropical cyclone in which the maximum 1-minute sustained surface wind ranges from 34 to 63 knots (39 to 73 mph) inclusive. As the storm transitions from tropical depression to tropical storm, the storm itself becomes more organized and begins to become more circular in shape - resembling a hurricane.

While hurricanes pose the greatest threat to life and property, tropical storms and depressions also can be devastating. Floods from heavy rains and severe weather, such as tornadoes, can cause extensive damage and loss of life. Tables 3.17 and 3.18 show the tropical storms that have impacted Miami-Dade County as reported by the NCDC and SHELDUS, respectively.

### ***Hurricane***

A hurricane is a tropical cyclone in which the maximum sustained surface wind is 74 mph or more. Hurricanes are classified by intensity into one of five categories on the Saffir-Simpson Hurricane Wind Scale as shown in Table 3.16, and Cutler Bay can potentially expect a category 5 hurricane. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures.



**Table 3.16 – Saffir-Simpson Hurricane Wind Scale, 2012**

Category	Wind Speed (mph)	Potential Damage
1	74-95	<b>Very dangerous winds will produce some damage:</b> Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110	<b>Extremely dangerous winds will cause extensive damage:</b> Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3	111-129	<b>Devastating damage will occur:</b> Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4	130-156	<b>Catastrophic damage will occur:</b> Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5	≥ 157	<b>Catastrophic damage will occur:</b> A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: National Hurricane Center/NOAA

Wind speed is the determining factor in the scale, as storm surge values are highly dependent on the slope of the continental shelf and the shape of the coastline in the landfall region. The following describes the characteristics of each category storm from the Saffir-Simpson Hurricane Wind Scale Extended Table:

**Category 1 Hurricane - Winds 74 – 95 mph. Very dangerous winds will produce some damage.**

People, livestock, and pets struck by flying or falling debris could be injured or killed. Older (mainly pre-1994 construction) mobile homes could be destroyed, especially if they are not anchored properly as they tend to shift or roll off their foundations. Newer mobile homes that are anchored properly can sustain damage involving the removal of shingle or metal roof coverings, and loss of vinyl siding, as well as damage to carports, sunrooms, or lanais. Some poorly constructed frame homes can experience major damage, involving loss of the roof covering and damage to gable ends as well as the removal of porch coverings and awnings. Unprotected windows may break if struck by flying debris. Masonry chimneys can be toppled. Well-constructed frame homes could have damage to roof shingles, vinyl siding, soffit panels, and gutters. Failure of aluminum, screened-in, swimming pool enclosures can occur. Some apartment building and shopping center roof coverings could be partially removed. Industrial buildings can lose roofing and siding especially from windward corners, rakes, and eaves. Failures to overhead doors and unprotected windows will be common. Windows in high-rise buildings can be broken by



flying debris. Falling and broken glass will pose a significant danger even after the storm. There will be occasional damage to commercial signage, fences, and canopies. Large branches of trees will snap and shallow rooted trees can be toppled. Extensive damage to power lines and poles will likely result in power outages that could last a few to several days.

**Category 2 Hurricane - Winds 96-110 mph. Extremely dangerous winds will cause extensive damage.** There is a substantial risk of injury or death to people, livestock, and pets due to flying and falling debris. Older (mainly pre-1994 construction) mobile homes have a very high chance of being destroyed and the flying debris generated can shred nearby mobile homes. Newer mobile homes can also be destroyed. Poorly constructed frame homes have a high chance of having their roof structures removed especially if they are not anchored properly. Unprotected windows will have a high probability of being broken by flying debris. Well-constructed frame homes could sustain major roof and siding damage. Failure of aluminum, screened-in, swimming pool enclosures will be common. There will be a substantial percentage of roof and siding damage to apartment buildings and industrial buildings. Unreinforced masonry walls can collapse. Windows in high-rise buildings can be broken by flying debris. Falling and broken glass will pose a significant danger even after the storm. Commercial signage, fences, and canopies will be damaged and often destroyed. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks. Potable water could become scarce as filtration systems begin to fail.

**Category 3 Hurricane - Winds 111-129 mph. Devastating damage will occur.** There is a high risk of injury or death to people, livestock, and pets due to flying and falling debris. Nearly all older (pre-1994) mobile homes will be destroyed. Most newer mobile homes will sustain severe damage with potential for complete roof failure and wall collapse. Poorly constructed frame homes can be destroyed by the removal of the roof and exterior walls. Unprotected windows will be broken by flying debris. Well-built frame homes can experience major damage involving the removal of roof decking and gable ends. There will be a high percentage of roof covering and siding damage to apartment buildings and industrial buildings. Isolated structural damage to wood or steel framing can occur. Complete failure of older metal buildings is possible, and older unreinforced masonry buildings can collapse. Numerous windows will be blown out of high-rise buildings resulting in falling glass, which will pose a threat for days to weeks after the storm. Most commercial signage, fences, and canopies will be destroyed. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to a few weeks after the storm passes.

**Category 4 Hurricane - Winds 130 to 156 mph. Catastrophic damage will occur.** There is a very high risk of injury or death to people, livestock, and pets due to flying and falling debris. Nearly all older (pre-1994) mobile homes will be destroyed. A high percentage of newer mobile homes also will be destroyed. Poorly constructed homes can sustain complete collapse of all walls as well as the loss of the roof structure. Well-built homes also can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Extensive damage to roof coverings, windows, and doors will occur. Large amounts of windborne debris will be lofted into the air. Windborne debris damage will break most unprotected windows and penetrate some protected windows. There will be a high percentage of structural damage to the top floors of apartment buildings. Steel frames in older industrial buildings can collapse. There will be a high percentage of collapse to older unreinforced masonry buildings. Most windows will be blown out of high-rise buildings resulting in falling glass, which will pose a threat for days to weeks after the storm. Nearly all commercial signage, fences, and canopies will be destroyed. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Long-term water shortages will increase human suffering. Most of the area will be uninhabitable for weeks or months.



**Category 5 Hurricane - Winds 157 mph or higher. Catastrophic damage will occur.** People, livestock, and pets are at very high risk of injury or death from flying or falling debris, even if indoors in mobile homes or framed homes. Almost complete destruction of all mobile homes will occur, regardless of age or construction. A high percentage of frame homes will be destroyed, with total roof failure and wall collapse. Extensive damage to roof covers, windows, and doors will occur. Large amounts of windborne debris will be lofted into the air. Windborne debris damage will occur to nearly all unprotected windows and many protected windows. Significant damage to wood roof commercial buildings will occur due to loss of roof sheathing. Complete collapse of many older metal buildings can occur. Most unreinforced masonry walls will fail which can lead to the collapse of the buildings. A high percentage of industrial buildings and low-rise apartment buildings will be destroyed. Nearly all windows will be blown out of high-rise buildings resulting in falling glass, which will pose a threat for days to weeks after the storm. Nearly all commercial signage, fences, and canopies will be destroyed. Nearly all trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Long-term water shortages will increase human suffering. Most of the area will be uninhabitable for weeks or months. Hurricane Andrew (1992) is an example of a hurricane that brought Category 5 winds and impacts to coastal portions of Cutler Ridge, Florida with Category 4 conditions experienced elsewhere in south Miami-Dade County.

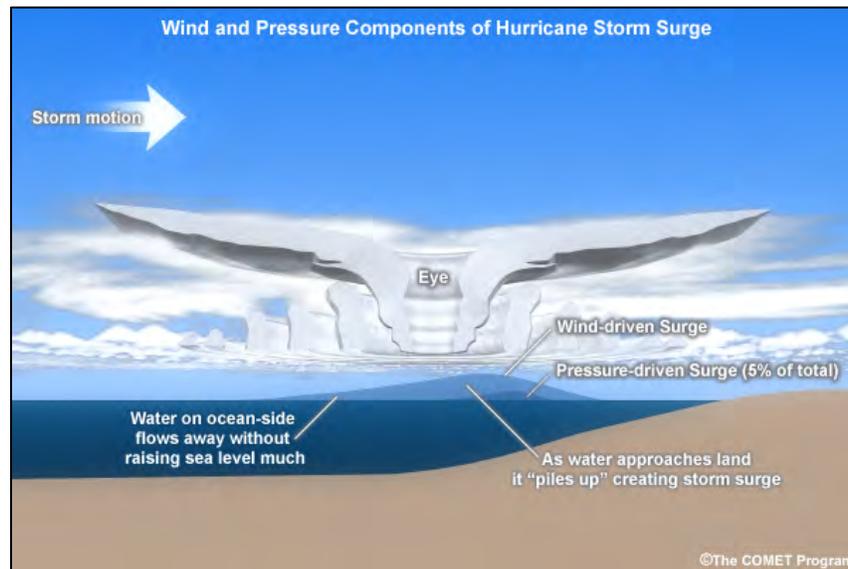
Hurricanes can cause catastrophic damage to coastlines and several hundred miles inland. Hurricanes can produce winds exceeding 157 miles per hour as well as tornadoes and microbursts. Additionally, hurricanes can create storm surges along the coast and cause extensive damage from heavy rainfall. Floods and flying debris from the excessive winds are often the deadly and destructive results of these weather events. Flash flooding can also occur due to intense rainfall.

### ***Storm Surge***

The greatest potential for loss of life related to a hurricane is from the storm surge. Storm surge is simply water that is pushed toward the shore by the force of the winds swirling around the storm as shown in Figure 3.16. This advancing surge combines with the normal tides to create the hurricane storm tide, which can increase the mean water level to heights impacting roads, homes and other critical infrastructure. In addition, wind driven waves are superimposed on the storm tide. This rise in water level can cause severe flooding in coastal areas, particularly when the storm tide coincides with the normal high tides. Because much of the densely populated Atlantic coastline lies less than 10 feet above mean sea level, the danger from storm tides is tremendous.

The storm surge combined with wave action can cause extensive damage, severely erode beaches and coastal highways. With major storms like Katrina, Camille and Hugo, complete devastation of coastal communities occurred. Many buildings withstand hurricane force winds until their foundations, undermined by erosion, are weakened and fail. The combination of storm tides, waves and currents can also damage marinas and boats. In estuaries, salt water intrusion endangers public health, kills vegetation, and can send animals such as snakes and alligators fleeing from flooded areas.

The maximum potential storm surge for a particular location depends on a number of different factors. Storm surge is a very complex phenomenon because it is sensitive to the slightest changes in storm intensity, forward speed, size (radius of maximum winds-RMW), angle of approach to the coast, central pressure (minimal contribution in comparison to the wind), and the shape and characteristics of coastal features such as bays and estuaries. Other factors which can impact storm surge are the width and slope of the continental shelf. A shallow slope will potentially produce a greater storm surge than a steep shelf. For example, a Category 4 storm hitting the Louisiana coastline, which has a very wide and shallow continental shelf, may produce a 20-foot storm surge, while the same hurricane in Miami Beach, Florida, where the continental shelf drops off very quickly, might see an 8 or 9-foot surge.



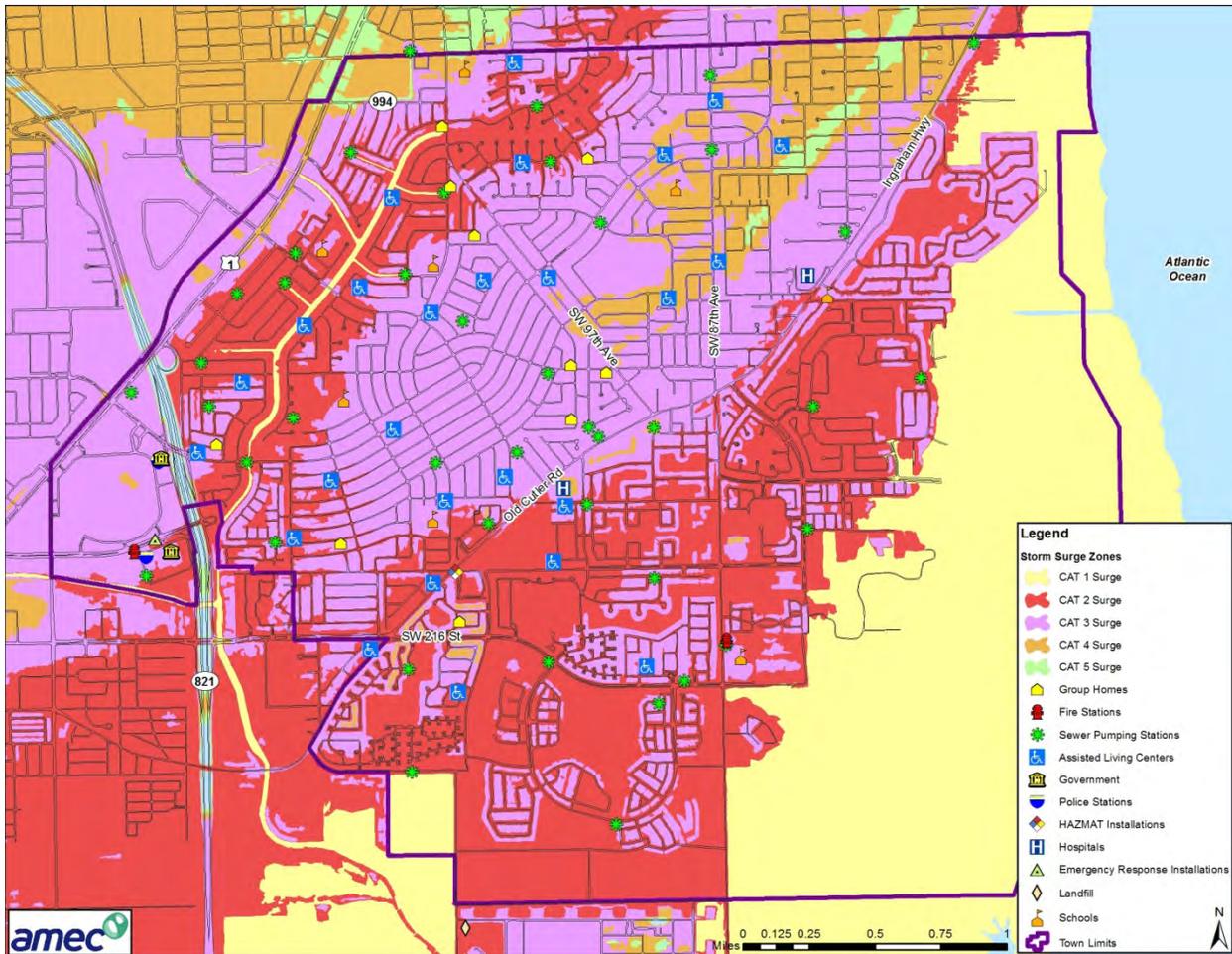
Source: NOAA/The COMET Program

**Figure 3.16 - Components of Hurricane Storm Surge**

### ***Storm Surge Mapping***

The Sea, Lake and Overland Surges from Hurricanes (SLOSH) model is a computerized numerical model developed by the National Weather Service (NWS) to estimate storm surge heights resulting from historical, hypothetical, or predicted hurricanes by taking into account the atmospheric pressure, size, forward speed, and track data. These parameters are used to create a model of the wind field which drives the storm surge. The SLOSH model consists of a set of physics equations which are applied to a specific locale's shoreline, incorporating the unique bay and river configurations, water depths, bridges, roads, levees and other physical features.

Anticipated SLOSH model surge elevations for Category 1-5 hurricanes are shown for Cutler Bay in Figure 3.17. The feature set depicting surge zones in this figure was created using a Surge Modeling application created for the Florida Statewide Regional Evacuation Update Study. The data was derived from National Hurricane Center SLOSH model runs on all the NOAA SLOSH basins throughout Florida. The runs create outputs for all different storm simulations from all points of the compass. Each direction has a MEOW (maximum envelope of water) for each category of storm (1-5), and all directions combined result in a MOMs (maximum of maximums) set of data. The MOMs are used in this surge model.



Source: Florida Division of Emergency Management (<http://www.floridadisaster.org>)

**Figure 3.17 – Category 1 through Category 5 Storm Surge Zones for Cutler Bay**

### Past Occurrences

The following is a description of past occurrences of hurricanes and tropical storms from the Miami-Dade County Local Mitigation Strategy (LMS) and NCDC. Table 3.17 shows hurricane and tropical storm data reported by NCDC since 1950 for Miami-Dade County. Table 3.18 shows SHELUDS events related to hurricanes and tropical storms from 1960 to 2012. Table 3.19 shows storm surge data reported by NCDC since 1950 for Miami-Dade County. Major disaster declarations for hurricanes and tropical storms in Miami-Dade County can be found in Table 3.3. Figure 3.18 reflects past track maps of U.S. land falling major hurricanes as provided by the National Hurricane Center.

**October 1999** - Hurricane Irene (DR-1306) developed and started a path towards south Florida. Initial projections were correct in stating the hurricane would impact the west coast of Florida, and Irene traveled through the state and, on October 15, passed just to the west of Miami-Dade County. Although the hurricane did not pass directly through the county and no exceptionally high winds were experienced, the heavy rainfall associated with this storm did hit Miami-Dade County, and the impacts were severe. Some roads were impassible for weeks, electricity was out in certain areas, and residents and businesses suffered heavy losses.

**October 2000** - a low-pressure system, later to become Tropical Storm Leslie, developed off the west coast of Cuba, and headed toward South Florida (DR-1345). Water managers and weather officials



closely tracked the storm, and preemptive measures were taken to start moving water out of the canals. Once the storm passed over south Florida, it exploded, dumping 14 to 18 inches of rainfall over a linear area in the center of Miami-Dade County.

**September 2004** - Hurricane Jeanne formed from a tropical depression just east of the Leeward Islands on September 13. She moved across Puerto Rico and Hispaniola then turned north into the Atlantic and became a hurricane on September 20. Property damage from storm surge and winds at the coast occurred to condos, marinas, piers, seawalls, bridges and docks, as well as to boats and a few coastal roadways.

**August 2005** - Hurricane Katrina was every bit as much a flood event as it was a windstorm. Rainfall amounts were excessive across portions of south Miami-Dade County causing flooding of structures, vehicles, crop lands and nurseries. A maximum storm total amount of 16.33 inches, of which 15.10 inches fell in a 24-hour period, was measured by a cooperative observed in Perrine. Other heavy storm total amounts in south Miami-Dade County included 14.04 inches at Homestead Air Reserve Base, 12.25 inches near Florida City and 11.13 inches near Cutler Ridge.

**Table 3.17 - NCDC Hurricane/Tropical Storm Data for Miami-Dade County, 1950-2013**

Location	Date	Event Type	Deaths/ Injuries	Property Damage	Crop Damage
Miami-Dade Coastal Zone	07/10/1996	Hurricane	2/0	\$0	\$0
Miami-Dade Coastal Zone	09/25/1998	Hurricane	0/0	\$5,000,000	\$15,000,000
Miami-Dade Coastal Zone	09/13/1999	Hurricane	0/0	\$0	\$0
Miami-Dade Coastal Zone	10/14/1999	Hurricane	0/0	\$140,000,000	\$230,000,000
Miami-Dade Coastal Zone	11/05/2001	Hurricane	0/0	\$10,000	\$0
Miami-Dade Coastal Zone	09/04/2004	Hurricane	0/0	\$34,000,000	\$0
Miami-Dade Coastal Zone	09/25/2004	Hurricane	0/0	\$10,000,000	\$0
Miami-Dade Coastal Zone	07/08/2005	Hurricane	0/0	\$0	\$0
Miami-Dade Coastal Zone	08/25/2005	Hurricane	6/0	\$64,000,000	\$423,000,000
Miami-Dade Coastal Zone	10/24/2005	Hurricane	2/0	\$0	\$0
Miami-Dade Coastal Zone	9/24/1998	Tropical Storm	0/0	\$0	\$0
Miami-Dade Coastal Zone	9/25/1998	Tropical Storm	0/0	\$0	\$0
Miami-Dade Coastal Zone	11/4/1998	Tropical Storm	0/0	\$0	\$0
Miami-Dade Coastal Zone	11/4/1998	Tropical Storm	0/0	\$0	\$0
Miami-Dade Coastal Zone	9/20/1999	Tropical Storm	0/0	\$0	\$0
Miami-Dade Coastal Zone	9/20/2005	Tropical Storm	0/0	\$0	\$0
Miami-Dade	8/29/2006	Tropical Storm	0/0	\$0	\$0



Location	Date	Event Type	Deaths/ Injuries	Property Damage	Crop Damage
Coastal Zone					
Miami-Dade Coastal Zone	8/29/2006	Tropical Storm	0/0	\$0	\$0
Miami-Dade Coastal Zone	10/30/2007	Tropical Storm	0/0	\$0	\$0
Miami-Dade Coastal Zone	8/18/2008	Tropical Storm	0/0	10,000	
Miami-Dade Coastal Zone	8/18/2008	Tropical Storm	0/0	\$0	\$0
Miami-Dade Coastal Zone	8/18/2008	Tropical Storm	0/0	\$0	\$0
Miami-Dade Coastal Zone	8/18/2008	Tropical Storm	0/0	\$0	\$0
Miami-Dade Coastal Zone	9/8/2008	Tropical Storm	0/0	\$0	\$0
Miami-Dade Coastal Zone	9/8/2008	Tropical Storm	0/0	\$0	\$0
Miami-Dade Coastal Zone	9/8/2008	Tropical Storm	0/0	\$0	\$0
Miami-Dade Coastal Zone	7/23/2010	Tropical Storm	0/0	2,000	
Miami-Dade Coastal Zone	8/26/2012	Tropical Storm	0/0	\$0	\$0
Miami-Dade Coastal Zone	8/26/2012	Tropical Storm	0/0	\$0	\$0
Miami-Dade Coastal Zone	8/26/2012	Tropical Storm	0/0	100,000	\$0
Miami-Dade Coastal Zone	10/25/2012	Tropical Storm	0/0	\$0	\$0
<b>Total:</b>				<b>\$253,122,000</b>	<b>\$668,000,000</b>

Source: NCDC, April 2014

**Table 3.18- SHELUDS Hurricane/Tropical Storm Data for Miami-Dade County - 1960 to 2013**

Month	Year	Hazard Type	Injuries	Fatalities	Crop Damage	Property Damage
August	1964	Hurricane/Tropical Storm	0	0	\$2,504,913.00	\$25,049,139.00
October	1964	Hurricane/Tropical Storm	2	0	\$0.00	\$1,633,639.00
September	1965	Hurricane/Tropical Storm	0	0	\$0.00	\$10,875,677.00
June	1966	Hurricane/Tropical Storm	0	0	\$0.00	\$678,304.00
October	1966	Hurricane/Tropical Storm	4	2	\$513,573.00	\$513,573.00
June	1968	Hurricane/Tropical Storm	0	0	\$0.00	\$8,163,617.00
October	1968	Hurricane/Tropical Storm	0	0	\$0.00	\$643,669.00
June	1972	Hurricane/Tropical Storm	1	0	\$415.00	\$83,181.00
September	1979	Hurricane/Tropical Storm	0	0	\$348,779.00	\$3,487,797.00
August	1981	Hurricane/Tropical Storm	0	0	\$985,685.00	\$98,568.00
August	1985	Hurricane/Tropical Storm	0	0	\$0.00	\$161,569.00
October	1987	Hurricane/Tropical Storm	0	0	\$0.00	\$14,647.00
August	1992	Hurricane/Tropical Storm	0	3	\$415,105,133.00	\$10,377,628,331.00
November	1994	Hurricane/Tropical Storm	0	2	\$3,274,806.00	\$3,274,806.00
August	1995	Hurricane/Tropical Storm	0	0	\$218,369.00	\$131,021.00
July	1996	Hurricane/Tropical Storm	0	2	\$0.00	\$0.00



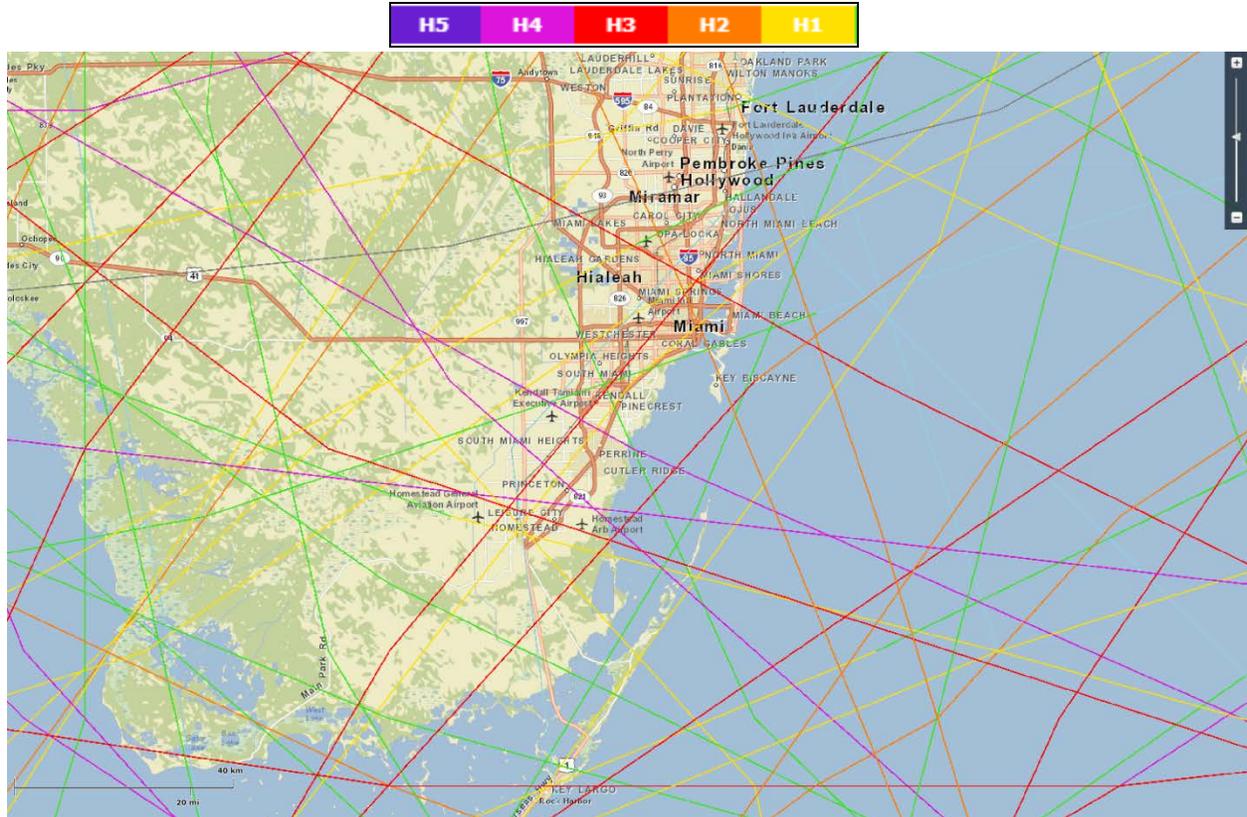
Month	Year	Hazard Type	Injuries	Fatalities	Crop Damage	Property Damage
September	1998	Hurricane/Tropical Storm	0	0	\$10,718,880.00	\$182,220,966.00
November	1998	Hurricane/Tropical Storm	9	0	\$4,083,383.00	\$6,125,074.00
September	1999	Hurricane/Tropical Storm	0	0	\$0.00	\$160,222.00
October	1999	Hurricane/Tropical Storm	1	0	\$157,541,949.00	\$122,118,315.00
November	2001	Hurricane/Tropical Storm	0	0	\$0.00	\$21,923.00
September	2004	Hurricane/Tropical Storm	0	0	\$25,897,813.00	\$207,305,832.00
August	2005	Hurricane/Tropical Storm	3	3	\$168,187,081.00	\$39,760,539.00
October	2005	Hurricane/Tropical Storm	1	1	\$0.00	\$2,982,040,457.00
August	2008	Hurricane/Tropical Storm	0	0	\$0.00	\$3,606.00
July	2010	Hurricane/Tropical Storm	0	0	\$0.00	\$1,068.00
August	2012	Hurricane/Tropical Storm	0	0	\$0.00	\$262,117.00
October	2012	Hurricane/Tropical Storm	0	0	\$0.00	\$676.00
<b>Total:</b>					<b>\$789,380,779.00</b>	<b>\$13,972,458,333.00</b>

Source: SHELDUS, September 2014

**Table 3.19 - NCDC Storm Surge Data for Miami-Dade County, 1950-2013**

Location	Date	Event Type	Deaths/ Injuries	Property Damage	Crop Damage
Miami-Dade Coastal Zone	10/24/2005	Storm Surge/Tide	0/0	\$0	\$0
Miami-Dade Coastal Zone	10/30/2007	Storm Surge/Tide	0/0	\$0	\$0
Miami-Dade Coastal Zone	11/01/2007	Storm Surge/Tide	0/0	\$0	\$0
Miami-Dade Coastal Zone	08/26/2012	Storm Surge/Tide	0/0	\$0	\$0
Miami-Dade Coastal Zone	10/26/2012	Storm Surge/Tide	0/0	\$0	\$0
<b>Total:</b>				<b>\$0</b>	<b>\$0</b>

Source: NCDC, April 2014



Source: NOAA/National Hurricane Center

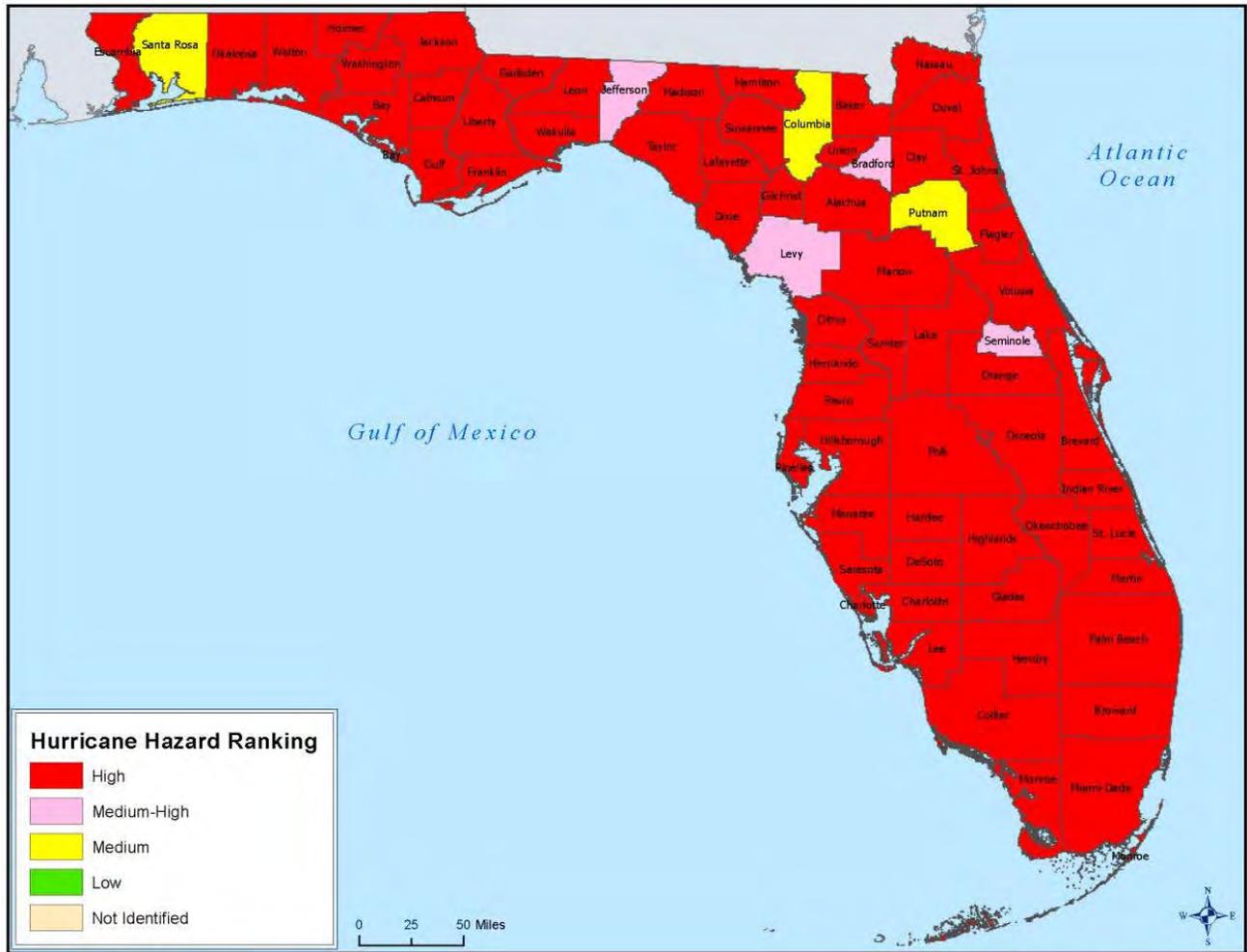
**Figure 3.18 - Past Track Map of U.S. Hurricanes Impacting Cutler Bay**

## Frequency/Likelihood of Future Occurrence

### *Hurricane and Tropical Storm*

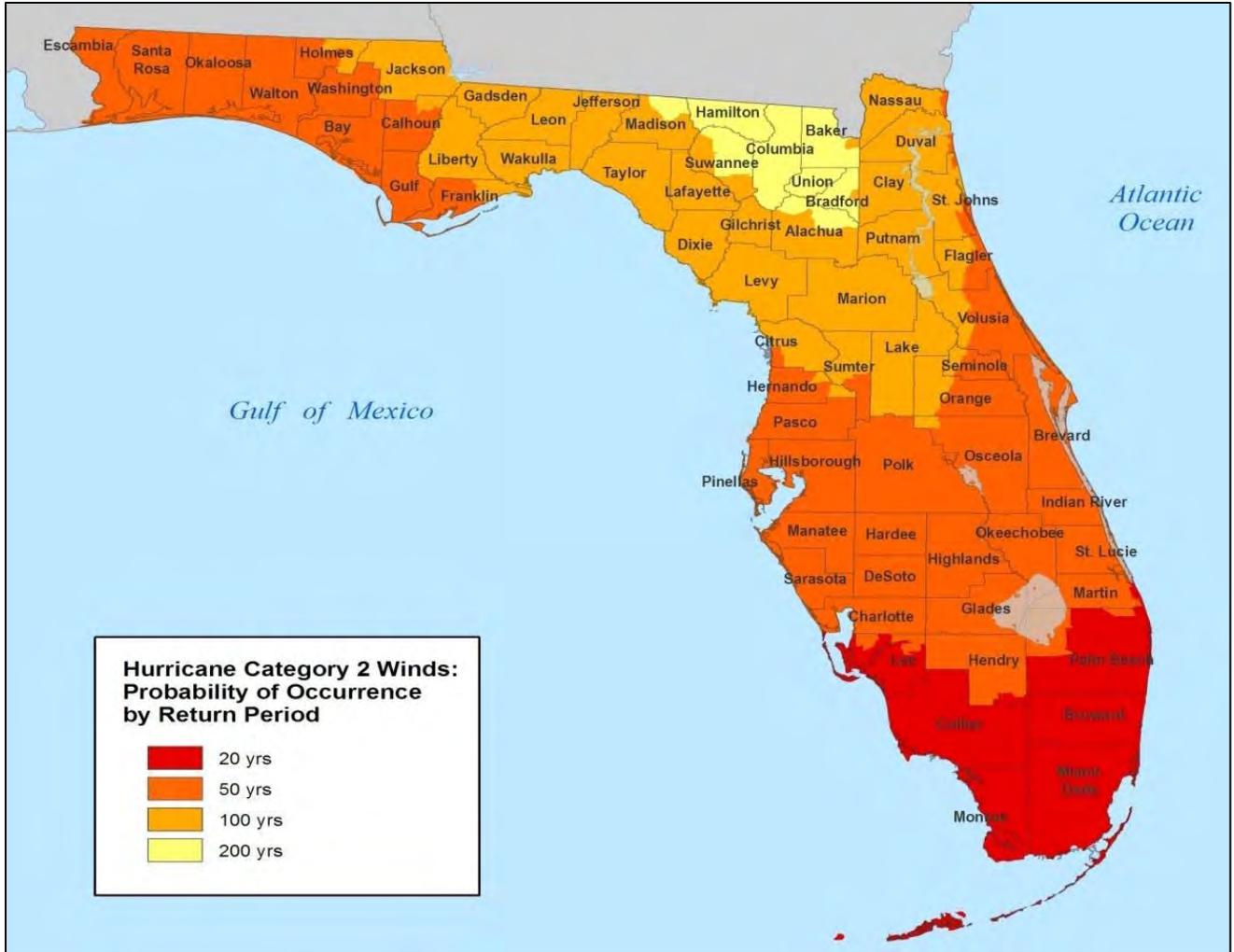
**Likely** – Given the 31 hurricane and tropical storm occurrences recorded by the NCDC over a period of 16 years (1996- 2012), 1.9 hurricane or tropical storm events affect Miami-Dade County on average each year. According to a vulnerability analysis completed for the State of Florida Hazard Mitigation Plan, Miami-Dade County is considered a high-risk jurisdiction as shown in Figure 3.19.

Figure 3.20 contains a summary of the probability of occurrence that each county has based on geographic location for a return period of 20, 50, 100 or 200 years for a Category 2 hurricane; Miami-Dade County has a probability of experiencing a Category 2 hurricane at least once every 20 years. Figure 3.21 contains a summary of the probability of occurrence that each county has based on geographic location for a return period of 200, 500, 1,000 or greater than 1,000 years for a Category 5 hurricane; the Cutler Bay area within Miami-Dade County has a probability of experiencing a Category 5 hurricane at least once every 200 years.



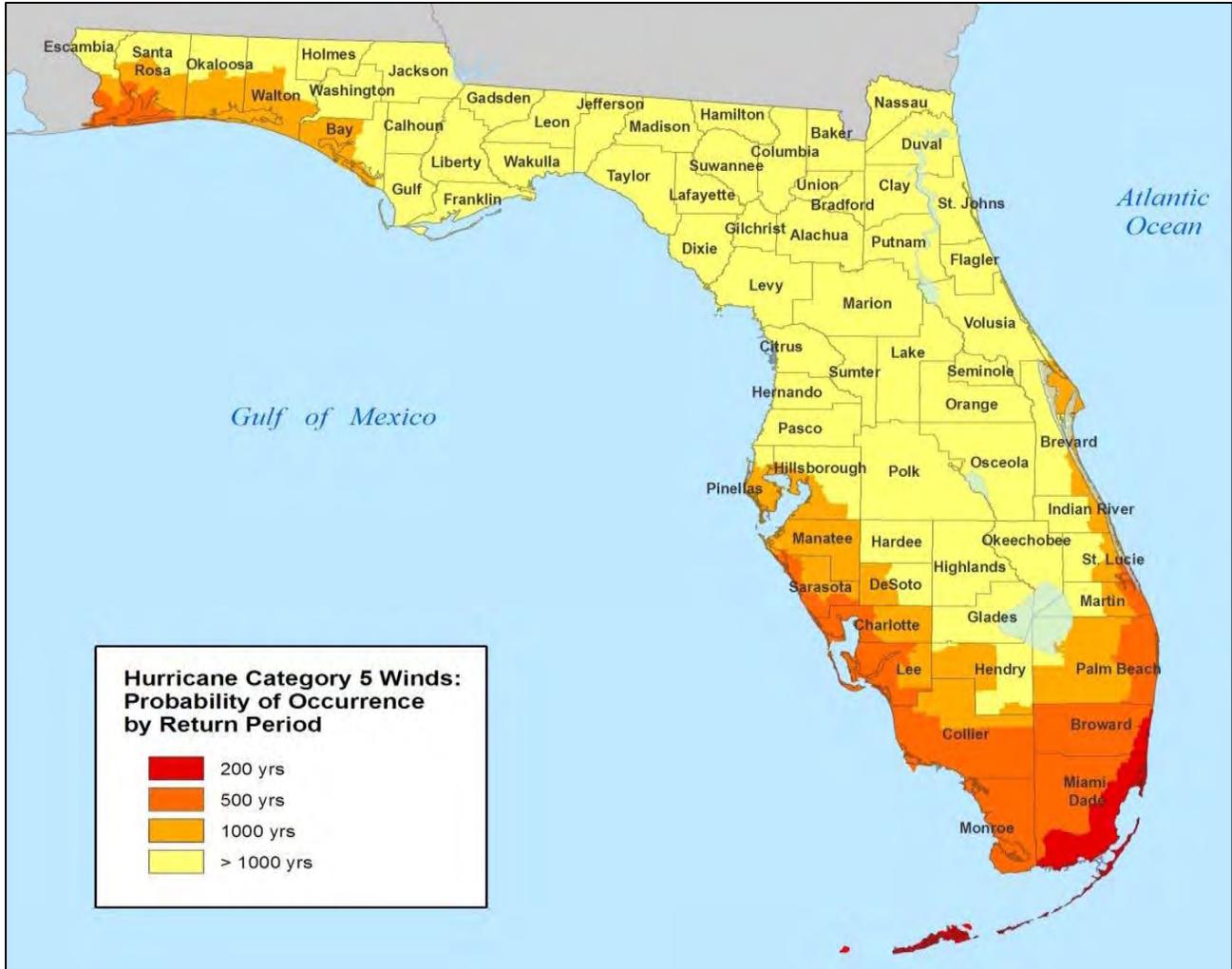
Source: State of Florida Enhanced Hazard Mitigation Plan

**Figure 3.19 – Hurricane Hazard Ranking by County**



Source: State of Florida Enhanced Hazard Mitigation Plan

**Figure 3.20 - Hurricane Category 2 Probability of Occurrence**



Source: State of Florida Enhanced Hazard Mitigation Plan

**Figure 3.21 - Hurricane Category 5 Probability of Occurrence**

### **Coastal Storm Surge**

**Likely** – Given the 5 storm surge occurrences recorded by the NCDC over a period of seven years (2005-2012), 0.7 coastal storm surge events affect Miami-Dade County on average each year.

### **Climate Change and Hurricane and Tropical Storms**

One of the primary factors contributing to the origin and growth of tropical storm and hurricanes systems is water temperature. Sea surface temperature may increase significantly in the main hurricane development region of the North Atlantic during the next century as well as in the Gulf of Mexico.

Sea level change will be particularly important in influencing storm surge flooding in the Cutler Bay area, since the area is already subject to flooding from above normal tides, surge and rainfall events from hurricanes and less powerful tropical storms. As a result of sea-level rise, flooding from just high tide events is becoming more common. The 7-foot storm surge in Miami-Dade County from Hurricane Wilma (Category 5) has a likelihood of occurring once every 76 years; a 2 foot sea level rise would increase the likelihood to once every 5 years (WRI, 2014).



### **3.2.7 Assessment of Areas Likely to Flood**

The following targeted areas are identified by the FMPC as areas likely to flood in the future. Some of these areas are already experiencing flooding but others are not. For example, changes in floodplain development, the watershed, population in combination with climate change and sea level rise will make these targeted areas more likely to flood in the future.

#### **Identified Area #1: 100yr SFHAs**

According to a September 11, 2009 Flood Insurance Study prepared by FEMA, approximately half of the Town is already located within a Special Flood Hazard Area (SFHA). Given that the population of Cutler Bay is projected to increase by 50% between 2010 and 2020, changes in floodplain development and development within the watershed in general is likely to increase the size of the SFHAs due to an increase in impervious area. Furthermore, with its porous geology and low topography, Cutler Bay's infrastructure and groundwater are particularly vulnerable to the effects of climate change and sea level rise.

#### **Identified Area #2: Areas of Localized Stormwater Flooding**

Due to the low elevations, a flat terrain, a consistent level of annual precipitation and the tidal influence on canal drainage resulting from heavy rainstorms, tropical storms, and hurricanes; it is highly likely that unmitigated properties will continue to experience localized flooding. The projected 50% increase in population by 2020 will likely lead to new development. An increase in impervious area will only exacerbate the localizing flooding issues unless measures are taken to reduce the volume of runoff. Furthermore, the intensity of individual rainfall events is likely to increase in the future due to climate change which will further overwhelm stormwater drainage systems.

#### **Identified Area #3: Repetitive Loss Areas**

Properties categorized as repetitive loss properties have a greater need for flood protection. Repetitive loss can be attributed to development within the 100-yr floodplain as well as localized stormwater flooding. As mentioned above, both types of flooding are likely to increase in the future due to development in the floodplain/watershed as well as due to the effects of climate change and sea level rise. Therefore, it is very likely that repetitive loss properties will continue to flood in the future.

#### **Identified Area #4: Zone X (Unshaded)**

There are 3,535 improved parcels within Cutler Bay that are located outside of the SFHA with a total value of \$606,893,164. Only 9% of buildings within the X Zone are insured, and as the repetitive loss figures in Section 3.3 show below, flooding is not limited to the 100-yr flood zones. As mentioned above, changes in floodplain development and development within the watershed in general are likely to increase the size of the SFHAs due to an increase in impervious area. Therefore, the Zone X area is likely subject to future flood risk.

#### **Identified Area #5: The Entire Town of Cutler Bay**

Sea level change will be particularly important in influencing storm surge flooding in the Cutler Bay area. A 2 foot sea level rise would increase the likelihood of a Category 5 hurricane to once every 5 years (WRI, 2014). As shown in Section 3.3 below, almost the entire Town becomes vulnerable to property damaging flooding from a Category 3 or stronger hurricane.



### 3.2.8 Flood Hazards Profile Summary

Table 3.20 summarizes the results of the hazard profile for the Town of Cutler Bay based on hazard identification data and input from the FMPC. For each hazard profiled within Section 3.2, this table includes the likelihood of future occurrence and whether or not the hazard is considered a priority for the Town.

**Table - 3.20 Summary of Flood Hazard Profile Results**

<b>Hazard</b>	<b>Likelihood of Future Occurrence</b>	<b>Priority Hazard</b>
Climate Change and Sea Level Rise	Occasional	Y
Coastal/Canal Bank Erosion	Likely	Y
Dam/Levee Failure	Unlikely	N
Flood: 100-/500-year	Likely	Y
Flood: Stormwater/Localized Flooding	Highly Likely	Y
Hurricane and Tropical Storms (including Storm Surge)	Likely	Y



### 3.3 Vulnerability Assessment

**Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction’s vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. Plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. The plan should describe vulnerability in terms of:**

A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;

(B): An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate; and

(C): Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

The FMPC conducted a vulnerability assessment of the hazards identified as a priority in order to assess the impact that each hazard would have on the Town. The vulnerability assessment quantifies, to the extent feasible using best available data, assets at risk to natural hazards and estimates potential losses. Vulnerability assessments followed the methodology described in the FEMA publication *Understanding Your Risks—Identifying Hazards and Estimating Losses*. The vulnerability assessment first describes the total vulnerability and values at risk and then discusses vulnerability by hazard.

Data used to support this assessment included the following:

- County GIS data (hazards, base layers, and assessor’s data)
- Hazard layer GIS datasets from federal agencies
- Written descriptions of inventory and risks provided by the Miami-Dade County Local Mitigation Strategy and State Hazard Mitigation Plan
- Other Existing plans and studies provided by the Town

#### Cutler Bay Assets at Risk

Miami-Dade County’s parcel layer was used as the basis for the inventory of developed parcels. Table 3.21 shows the count, land value, improved value, content value and total value of parcels in Cutler Bay.

**Table 3.21 - Cutler Bay Property Assets at Risk by Property Type**

Land Use	Total Parcel Count	Improved Parcel Count	Land Value	Improved Value	Estimated Content Value	Total Value <sup>1</sup>
Residential	12,575	12,552	\$397,212,144	\$1,198,688,315	\$599,344,158	\$1,798,032,473
Commercial	86	84	\$133,843,386	\$83,764,330	\$83,764,330	\$167,528,660
Education	10	10	\$15,522,287	\$47,013,077	\$47,013,077	\$94,026,154
Government	87	13	\$49,412,594	\$36,347,156	\$36,347,156	\$72,694,312
Religious	8	8	\$7,175,576	\$12,534,413	\$12,534,413	\$25,068,826
Other	590	31	\$85,073,136	\$30,292,386	\$42,500,066	\$72,792,452
<b>Total</b>	<b>13,356</b>	<b>12,698</b>	<b>\$688,239,123</b>	<b>\$1,408,639,677</b>	<b>\$821,503,199</b>	<b>\$2,230,142,876</b>

Source: Miami-Dade County 2013 Tax Assessor’s Data

<sup>1</sup>Total value does not include land value.

## Critical Facility Inventory

Of significant concern with respect to any disaster event is the location of critical facilities in the planning area. Critical facilities are often defined as those essential services and facilities in a major emergency which, if damaged, would result in severe consequences to public health and safety or a facility which, if unusable or unreachable because of a major emergency, would seriously and adversely affect the health, safety, and welfare of the public. Critical facilities in Cutler Bay are shown in Figure 3.22.

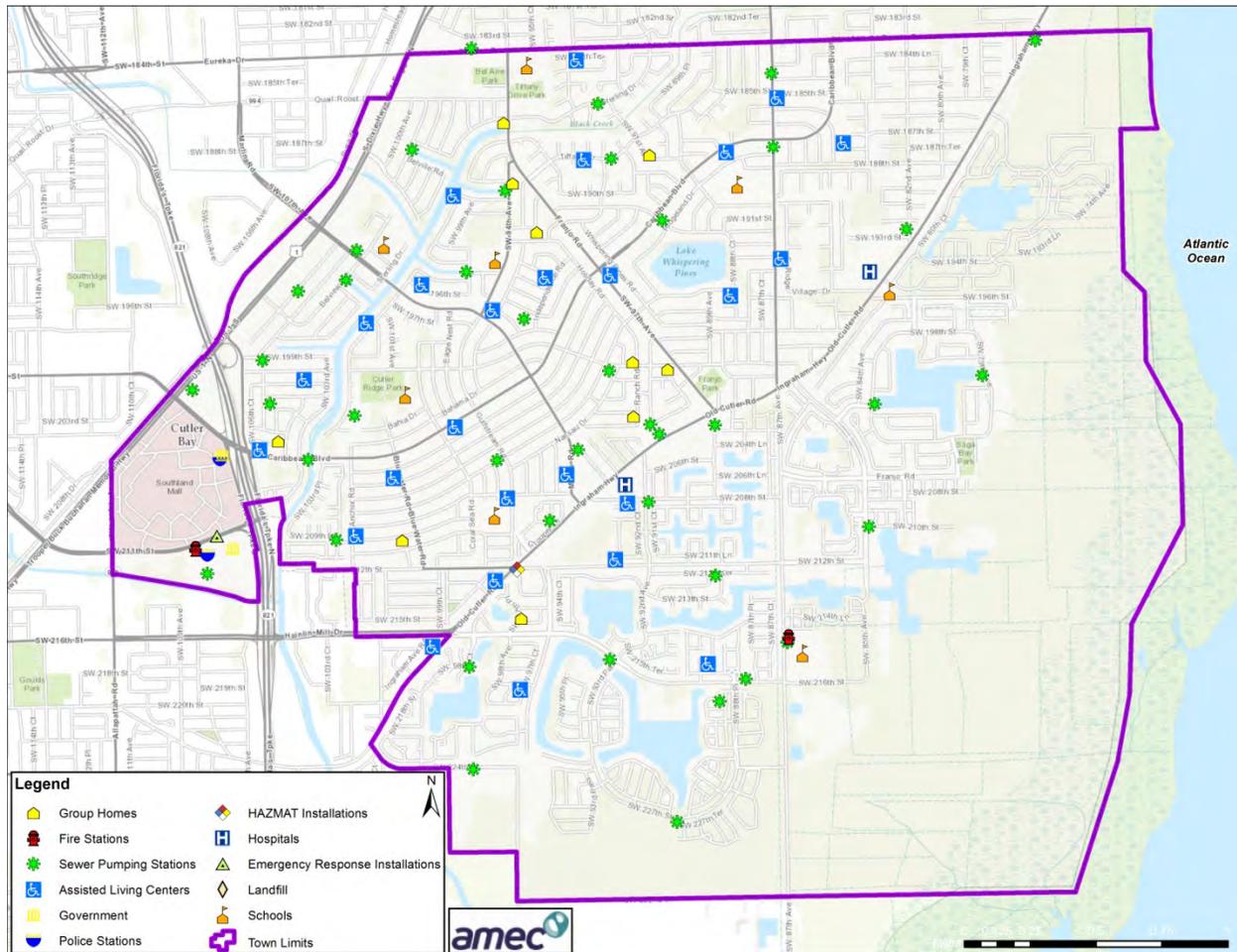


Figure 3.22- Cutler Bay Critical Facilities

## Cultural, Historic and Natural Resources

### *Historic and Archaeological Resources*

Old Cutler Road, a designated historic roadway, traverses the Town. The Old Cutler Road zoning overlay district addresses preservation and enhancement of the historic and community character along this corridor. There are no other designated historic or archaeological districts or sites in the Town at present. Most development in the Town occurred after 1950, with only 106 housing units having been built prior to 1939.

### *Natural Features and Resources*

The Town of Cutler Bay, like Miami-Dade County as a whole, contains and/or is proximate to numerous environmentally sensitive areas and resources, including two national parks and an aquatic preserve. The Town's eastern boundary abuts Biscayne National Park, and includes 735.9 acres of lands in parks,



preserves or conservation areas and 515.41 acres of protected vacant lands. These lands are primarily located in the eastern portion of the Town adjacent or proximate to Biscayne National Park. In addition, many areas in the eastern portion of the Town are targeted for acquisition for conservation and/or other public purposes. These areas are denoted with a cross-hatch on the future land use map shown in Figure 3.24. Although the Town has a significant coastline along Biscayne Bay, it does not have a developed waterfront; nor can its waterfront be developed in the future. The Town's major natural resources and features are described as follows.

### ***Parks, Preserve and Conservation***

A total of 735.9 acres (11%) of the Town's land area are in public parks, or reserved for environmental and conservation purposes. These lands include the seven public parks located within the Town's boundaries, and wetland and water conservation areas located between the developed areas east of Old Cutler Road and Biscayne National Park. A total of 352.8 acres (5%) are in inland waters, including canals, man-made lakes and drainage features.

### ***Water Bodies and Floodplains***

The Town contains 354.6 acres of coastal waters and 317.0 acres of inland waters in man-made lakes and inland waters, including canals. The Town is traversed by six major canals that lie within and/or border the Town: C-100, C100B, C-1, C-1N, C-1W and L31E. These canals provide important flood protection and drainage functions to the Town and surrounding areas. The Town's flood zones are shown in Figure 3.11. As can be seen, most of the Town is located within the 100-year floodplain.

### ***Natural and Beneficial Functions***

Wetlands as well as floodplains are both important natural assets to the Town of Cutler Bay. The Town contains significant coastal wetlands adjacent to Biscayne National Park. These wetlands are an important component of South Florida's ecosystem that will be conserved and, where appropriate, restored. Approximately 1,430 acres of these wetlands are in public ownership, and all are designated for Conservation purposes on the Future Land Use Map shown as Figure 3.24. The value in these resources can be better realized by the integration of floodplain management efforts with other community goals and objectives.

Wetlands function as natural sponges that trap and slowly release surface water, rain, snowmelt, groundwater and flood waters. Trees, root mats, and other wetland vegetation will slow the speed of floodwaters and distribute them more slowly over the floodplain. This combined water storage and braking action lowers flood heights and reduces erosion. Wetlands within and downstream of urban areas are particularly valuable, counteracting the greatly increased rate and volume of surface-water runoff from pavement and buildings. The holding capacity of wetlands helps control floods and prevents water logging of crops. Preserving and restoring wetlands, together with other water retention, can often provide the level of flood control otherwise provided by expensive dredge operations and levees.



The Cutler Wetlands is home to many plants and animals including some mangrove forests. Key Biscayne has one of the largest and longest mangrove forest still left on the east coast of the United States. The word mangrove is used to describe several trees, not closely related to one another, that flourish in salty environments.



The Town of Cutler Bay has restored a 54 acre wetland track located at SW 224<sup>th</sup> Street and 97<sup>th</sup> Avenue. This project cleared invasive vegetation to provide a permanent habitat for birds and other habitat. Over 150 species have been observed (in both non-passerines and passerines).

**Soils and Minerals**

The Town is comprised of tidal marl and muck, marl, and urban soils. In general, tidal marl and muck is unsuitable for development and characteristic of wetlands, while marl often requires special treatment prior to construction. Marl soils are calcareous

(limestone derived) soils that characterize lands that are or were historically flooded during the summer and dry during the winter, and that exhibit poor drainage. Urban soils refer to man-made or significantly altered soils resulting from development. The areas of the Town east of Old Cutler Road are characterized by marl soils, while the coastal wetlands adjacent to Biscayne National Park are tidal marl and muck. The Town is underlain by Miami Limestone. There are no mineral extraction areas in the Town.

**Growth and Development Trends**

The Town of Cutler Bay incorporated as Miami-Dade County’s newest municipality in November 2005. It comprised most of two Census Designated Places, Cutler Ridge and Lakes by the Bay, and a strip of unincorporated Miami-Dade County south of 224 Street. The Census 2010 figures showed a population of 40,286 persons and 14,620 housing units in the Town. The average household size at the time of the 2010 Census was 3.15 persons per household.

The Town’s population estimates and projections are shown in Table 3.22 as presented in the Town’s Comprehensive Growth Management Plan dated April 2008. Between 2000 and 2010, the population of the area that incorporated as the Town of Cutler Bay increased by 24.8%. The population projections for Cutler Bay were made by projecting the Town’s share of the Miami-Dade County population projected for Minor Statistical Area 7.1, a statistical area that encompasses the Town.

Most of Cutler Bay has already been developed. But there are a few tracts of land to the south and east which can be developed into the future. Fortunately much of the eastern portion of the town must remain undeveloped because of the Cutler Wetlands. The future land use map directs the type of development for those properties which remain undeveloped.

Much of the current re-development has been occurring along US 1 where commercial development occurs. Some commercial properties have been demolished and rebuilt and others have been refurbished. Fortunately most of this area along US 1 is in an X-Zone which is out of a designated floodplain.

**Table 3.22 - Population Projections for the Town of Cutler Bay**

	2015	2020
Town of Cutler Bay	50,000	60,000
MSA 7.1	59,520	75,555
Town % of MSA 7.1 Population	84%	80%

Source: Town of Cutler Bay Comprehensive Growth Management Plan, April 2008



## Land Use

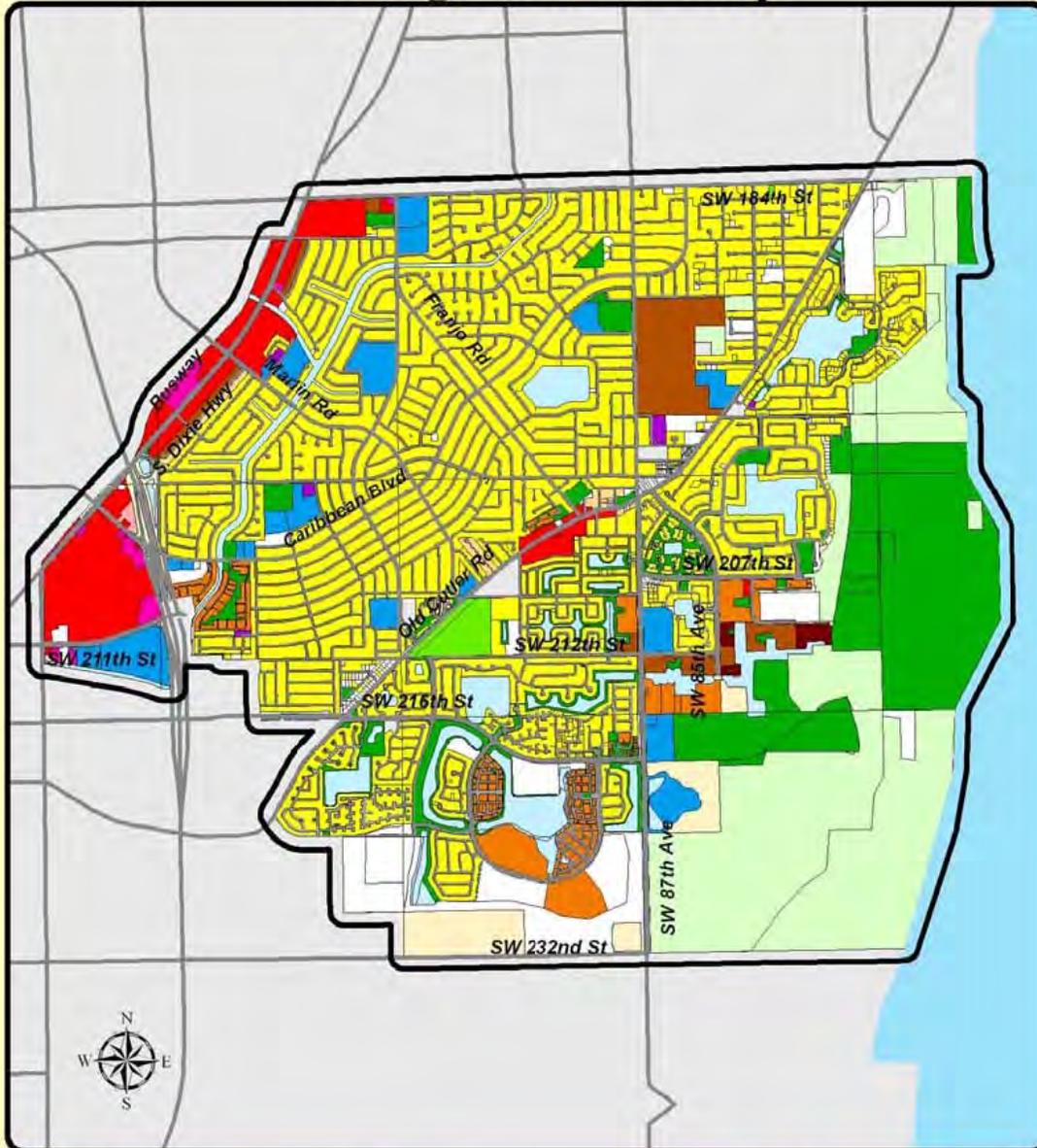
As noted in the Growth Management Plan, the Town of Cutler Bay was substantially built-out at the time of its incorporation in 2005, and has a limited supply of vacant developable land. Single family residential development is the predominant land use, with commercial development concentrated along US-1 and Old Cutler Road. Due to these factors, the guiding principles of the Future Land Use Element and the Town’s planning program are preservation and enhancement of existing residential neighborhoods, resource protection and enhancement, and redevelopment of commercial areas as mixed-use activity centers. Table 3.23 reflects existing land uses within the Town by category and acreage. Figures 3.23 and 3.24 reflect existing and future land use within Cutler Bay, respectively.

**Table 3.23- Existing Land Use in the Town of Cutler Bay**

<b>Land Use</b>	<b>Acres</b>
Single Family Residential	2,130.8 (33%)
Duplex	21.7 (.3%)
Townhouses	167.0 (3%)
Low-Density Multi-Family	139.3 (2%)
High Density Multi-Family	14.6 (.2%)
Transient Residential (Hotel/Motel)	3.6 (.06%)
Commercial	249.6 (4%)
Office	26.7 (.4%)
Industrial	0.0
Institutional	197.5 (2%)
Communications, Utilities, Terminals	9.6 (.1%)
Parks, Preserves and Conservation	735.9 (11%)
Agriculture	36.5 (.6%)
Vacant Protected, Privately Owned	907.2 (14%)
Vacant, Government Owned	118.3 (2%)
Vacant Unprotected	375.9 (6%)
Streets, Roads, Expressways, Ramps	1,036.1 (16%)
Inland Water	352.8 (5%)
<b>Total</b>	<b>6,523.1</b>

Source: Cutler Bay Comprehensive Growth Management Plan, 2008

## Town of Cutler Bay Existing Land Use Map



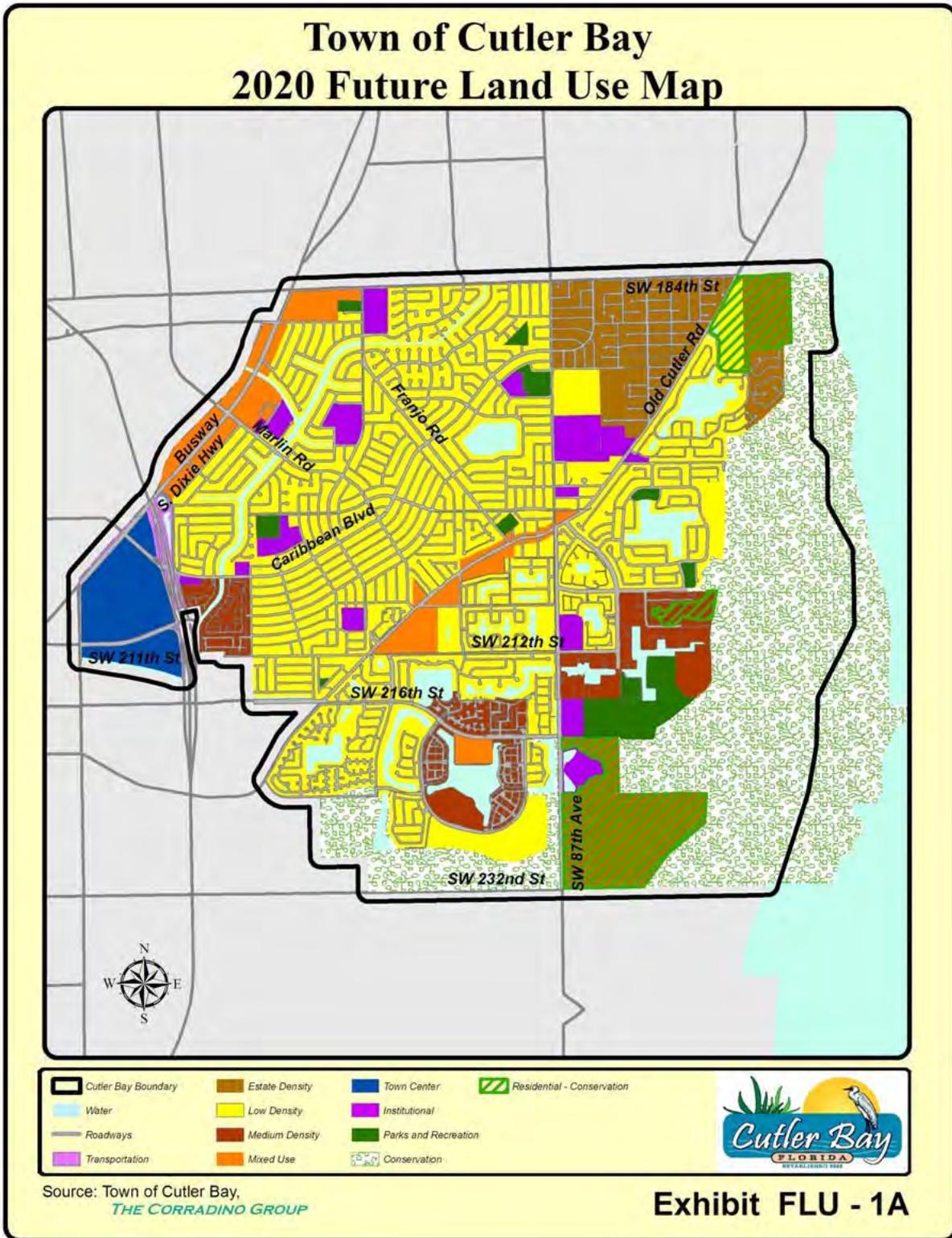
CUTLER BAY BOUNDARY	OFFICE	OCEAN, BAY WATERS
SINGLE-FAMILY	INSTITUTIONAL	PARKS, PRESERVES, CONSERVATION AREAS
TWO-FAMILY DUPLEXES	INDUSTRIAL EXTRACTION	WATER CONSERVATION AREAS
MOBILE HOME PARKS	INDUSTRIAL	VACANT, GOVERNMENT OWNED
TOWNHOUSES	AIRPORTS, PORTS	VACANT, UNPROTECTED, PRIVATELY OWNED
LOW-DENSITY MULTI-FAMILY	COMMUNICATIONS, UTILITIES, TERMINALS	INLAND WATERS
HIGH-DENSITY MULTI-FAMILY	STREETS, ROADS, EXPRESSWAYS, RAMPS	
TRANSIENT-RESIDENTIAL (HOTEL, MOTEL)	STREETS, EXPRESSWAYS R/W	
COMMERCIAL, SHOPPING CENTERS, STADIUMS	AGRICULTURE	

Source: Miami-Dade County,  
THE CORRADINO GROUP

**Exhibit FLU - 2**

Source: Cutler Bay Comprehensive Growth Management Plan, 2008

**Figure 3.23- Cutler Bay Existing Land Use Map**



Source: Cutler Bay Comprehensive Growth Management Plan, 2008

**Figure 3.24 - Cutler Bay Future Land Use Map**



### 3.3.1 Vulnerability of Cutler Bay to Specific Hazards

The Disaster Mitigation Act regulations require that the FMPC evaluate the risks associated with each of the hazards identified in the planning process. This section summarizes the possible impacts and quantifies the Town's vulnerability to each of the hazards identified as a priority hazard in Table 3.20 in Section 3.2.7 Flood Hazards Profile Summary. The hazards evaluated as part of this vulnerability assessment include:

- Climate Change and Sea Level Rise
- Coastal/Canal Bank Erosion
- Flood: 100-/500-year
- Flood: Stormwater/Localized Flooding
- Hurricane and Tropical Storms (including storm surge)

Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Extremely Low** - The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
- **Low** - Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium** - Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **High** - Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- **Extremely High** - Very widespread with catastrophic impact.

Vulnerability can be quantified in those instances where there is a known, identified hazard area, such as a mapped floodplain. In these instances, the numbers and types of buildings subject to the identified hazard can be counted and their values tabulated. Other information can be collected in regard to the hazard area, such as the location of critical community facilities (e.g., a fire station), historic structures, and valued natural resources (e.g., an identified wetland or endangered species habitat). Together, this information conveys the impact, or vulnerability, of that area to that hazard.

### 3.3.2 Climate Change and Sea Level Rise Vulnerability Assessment

**Likelihood of Future Occurrence**—Occasional

**Vulnerability**—Low

Cutler Bay, due to its location on the Atlantic Coast, is vulnerable to the potential impacts of climate change and sea level rise. The climate change hazard profile in Section 3.2.1 discusses how climate-driven hazards such as hurricanes and flooding are likely to increase in frequency, and possibly intensity, in the future. Thus the 25-year flood of today may become the 10 year event in the future. The reader should refer to the vulnerability assessment discussions on erosion (Section 3.3.3), flood (Section 3.3.4), hurricane (Section 3.3.6) for the current exposure and risk to these hazards with the perspective that climate change has the potential to exacerbate the existing risk and vulnerabilities. This section will focus on an assessment of direct impacts from sea level rise, using best available data. The potential impacts of



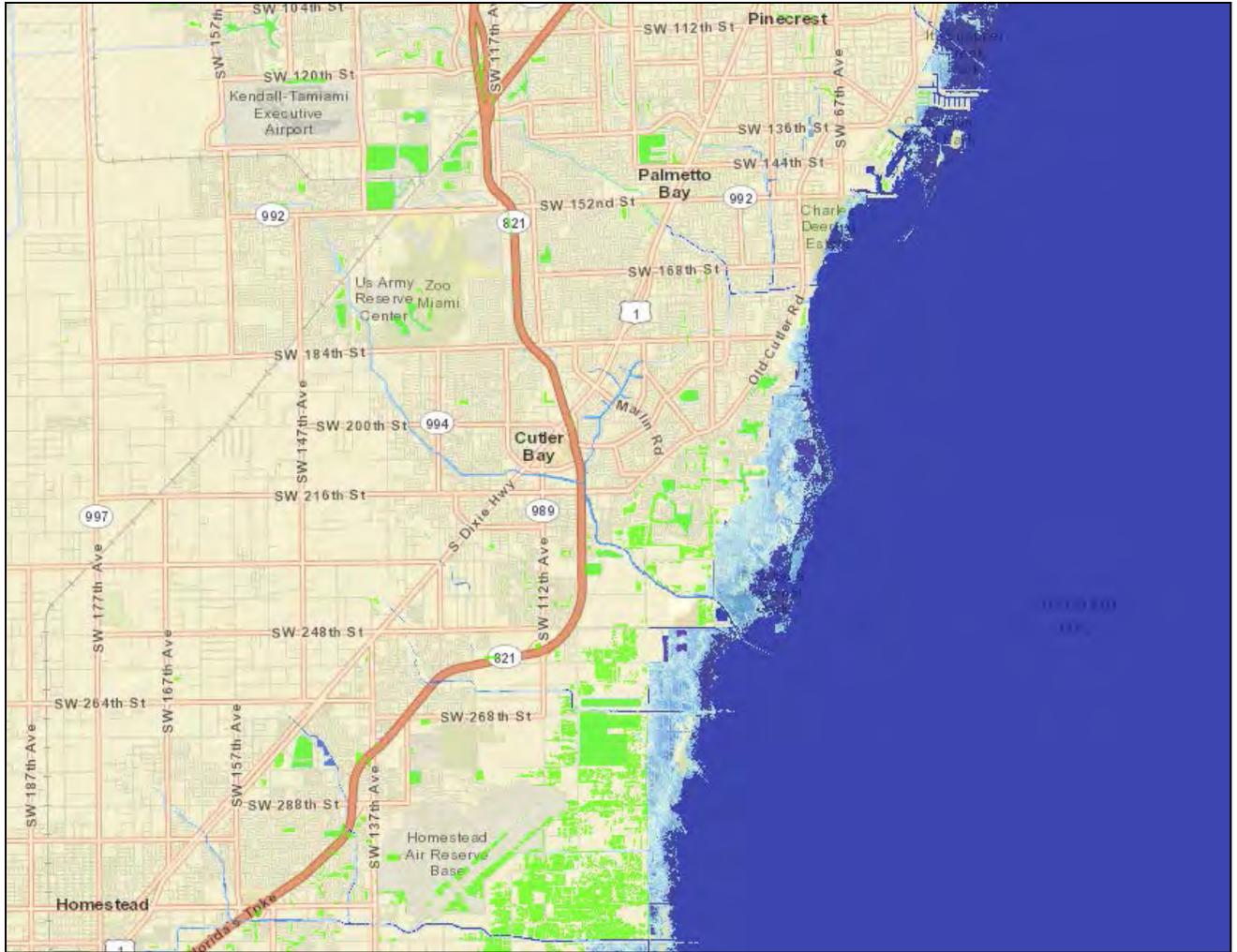
climate change and sea level rise include increased flooding frequency, potential damage to critical infrastructure, and increasing public costs associated with flood insurance claims, infrastructure repair and maintenance, environmental impacts and increased costs associated with emergency management efforts.

### ***Sea Level Rise***

The potential impacts to buildings, assets, and infrastructure from climate change and sea level rise will be negligible based on the buffer from the Atlantic Ocean by the Key Biscayne National Park and the Cutler wetlands; however, limited increases in the water level of canals may be an issue in the future. Sea level rise can have the following impacts on property and infrastructure in Cutler Bay:

- Coastal infrastructure: bridges, docks, piers
- Jettys/erosion control structures
- Roads and bridges
- Utility infrastructure
- Erosion hazard zones
- Built environment including residential development
- Natural resources
- Recreational facilities and amenities such as beaches, public access points, and parks
- Salt water intrusion into water supply
- Loss of property and property tax revenue due to inundation

As discussed in Section 3.2.1, the USACE projection for sea level rise in southeast Florida is 3-7 inches by 2030 and 9-24 inches by 2060. NOAA Coastal Services Center provides a sea level rise and coastal flooding impacts viewer in order to assess how sea level rise will impact coastal communities. Figure 3.25 reflects the impact of a one-foot sea level rise on Cutler Bay using the coastal flooding impacts viewer provided by NOAA. The sea levels represent inundation at high tide, and areas that are hydrologically connected are shown in shades of blue (darker blue = greater depth). The low-lying areas, displayed in green, are hydrologically "unconnected" areas that may flood. Table 3.24 provides an exposure analysis based on the elevation of land that structures are located on relative to local high tide. The results do not factor in structure elevation.



Source: <http://www.csc.noaa.gov/digitalcoast/tools/slrviewer>

**Figure 3.25- One-Foot Sea Level Rise Impact on Cutler Bay**



**Table 3.24 - Sea Level Rise and Coastal Flood Exposure in Cutler Bay**

		Elevation relative to local high tide line (Mean Higher High Water)									
Unit		< 1ft	< 2ft	< 3ft	< 4ft	< 5ft	< 6ft	< 7ft	< 8ft	< 9ft	< 10ft
<b>BY TOTALS</b>											
<b>High social vulnerability population</b>	Count	859	1236	1468	1900	3423	5341	7318	9449	10767	11484
<b>Medium social vulnerability population</b>	Count	5	10	22	91	539	2604	6342	9700	11347	11825
<b>Low social vulnerability population</b>	Count	830	913	1014	1238	2036	5021	8366	10727	12119	12879
<b>Property value</b>	\$Million	169	253	310	398	641	1195	1918	2524	2898	3101
<b>Population</b>	Count	1694	2159	2504	3229	5998	12966	22026	29877	34232	36188
<b>Caucasian population</b>	Count	1281	1628	1887	2451	4649	10160	17424	23725	27235	28819
<b>Population of color</b>	Count	465	597	693	868	1503	3125	5144	6875	7823	8247
<b>African-American population</b>	Count	349	454	530	662	1127	2273	3654	4842	5505	5801
<b>Asian population</b>	Count	48	57	64	85	166	389	678	919	1054	1114
<b>Hispanic population</b>	Count	970	1250	1451	1868	3340	7066	12001	16382	18681	19643
<b>Native American population</b>	Count	13	19	22	26	45	100	179	241	279	296
<b>Homes</b>	Count	712	937	1096	1373	2404	4908	8079	10837	12359	13045
<b>Hospitals</b>	Count	0	0	0	0	0	0	0	0	0	1
<b>Schools</b>	Count	0	0	0	0	0	0	1	6	10	12
<b>Colleges and Universities</b>	Count	0	0	0	0	0	0	0	1	1	2
<b>Libraries</b>	Count	0	0	0	0	0	0	0	0	1	1
<b>Houses of worship</b>	Count	0	0	0	0	0	2	2	3	3	4
<b>Government buildings</b>	Count	0	0	0	0	0	0	0	2	5	6
<b>Roads</b>	Miles	0	0	0	5	24	63	97	113	122	127
<b>Federal roads</b>	Miles	0	0	0	0	0	0	0	0	0	1
<b>Local roads</b>	Miles	0	0	0	5	24	63	97	113	122	125
<b>Secondary roads</b>	Miles	0	0	0	0	0	0	0	0	0	1
<b>Passenger stations</b>	Count	0	0	0	0	0	0	0	1	1	1
<b>Intercity bus stations</b>	Count	0	0	0	0	0	0	0	1	1	1
<b>Transit passenger stations</b>	Count	0	0	0	0	0	0	0	1	1	1
<b>Power plants</b>	Count	0	0	0	0	0	0	0	1	1	1
<b>Commercial &amp; industrial power plants</b>	Count	0	0	0	0	0	0	0	1	1	1
<b>EPA listed sites</b>	Count	0	0	0	2	2	4	7	13	20	24
<b>NPDES sites</b>	Count	0	0	0	0	0	1	1	5	7	8
<b>RADINFO sites</b>	Count	0	0	0	0	0	1	4	6	11	14



<b>Hazardous waste sites</b>	Count	0	0	0	0	0	1	4	6	11	14
<b>Minor hazwaste source sites</b>	Count	0	0	0	0	0	0	3	4	6	7
<b>Unspecified hazardous waste sites</b>	Count	0	0	0	0	0	1	1	2	5	7
<b>Wastewater sites</b>	Count	0	0	0	0	0	1	1	5	7	8
<b>Nonmajor wastewater sites</b>	Count	0	0	0	0	0	1	1	5	7	8
<b>Sewage plants</b>	Count	0	0	0	2	2	2	2	2	2	2
<b>Land</b>	Acres	619	834	915	1036	1345	2095	3126	4059	4646	4967
<b>Protected land</b>	Acres	247	406	445	460	469	475	483	493	500	505
<b>Local protected land</b>	Acres	36	66	74	78	84	88	96	106	113	118
Source: Climate Central 2014, Findings from Surging Seas (SurgingSeas.org)											



### 3.3.3 Coastal/Canal Bank Erosion Vulnerability Assessment

**Likelihood of Future Occurrence—Likely**  
**Vulnerability—Low**

#### *Coastal Erosion*

The severity of coastal erosion is typically measured through a quantitative assessment of annual shoreline change for a given beach cross-section profile (feet or meters per year) over a long period of time. Erosion rates vary as a function of shoreline type and are influenced primarily by episodic events, but can be used in land use and hazard management to define areas of critical concern. A report completed in June 2012 by the Florida Department of Environmental Protection (DEP), Division of Water Resource Management, titled “Critically Eroded Beaches in Florida” which inventoried critically eroded areas along the Atlantic and Gulf coasts did not identify any areas of erosion within the Cutler Bay planning area. Fortunately, Biscayne National Park forms the eastern boundary of the Cutler Bay planning area along Biscayne Bay. The shoreline in this area is protected from coastal erosion by the absence of development and the tangled root systems of the mangroves that are preserved in this area. **Because of this buffer (including the Cutler wetlands), no damage to insurable buildings, infrastructure, or assets within Cutler Bay is expected.**

#### *Canal Bank Erosion*

Cutler Bay has experienced limited canal bank erosion in the past. Canal bank erosion is a natural process, but acceleration of this natural process leads to a disproportionate sediment supply, stream channel instability, land loss, habitat loss and other adverse effects. Erosion has occurred and will occur as a matter of course on an occasional basis in all canal bank areas. **As a result, no damage to insurable buildings, infrastructure, or assets have been identified within Cutler Bay and none is expected.**

### 3.3.4 Flood: 100-/500-year Vulnerability Assessment

**Likelihood of Future Occurrence—Likely**  
**Vulnerability—High**

Flood damage is directly related to the depth of flooding by the application of a depth damage curve. In applying the curve, a specific depth of water translates to a specific percent damage to the structure which translates to the same percentage of the structure’s replacement value. As previously shown in Figure 3.11, a large portion of the Town is located in areas vulnerable to 100-year flooding under normal flood circumstances.

#### **Methodology**

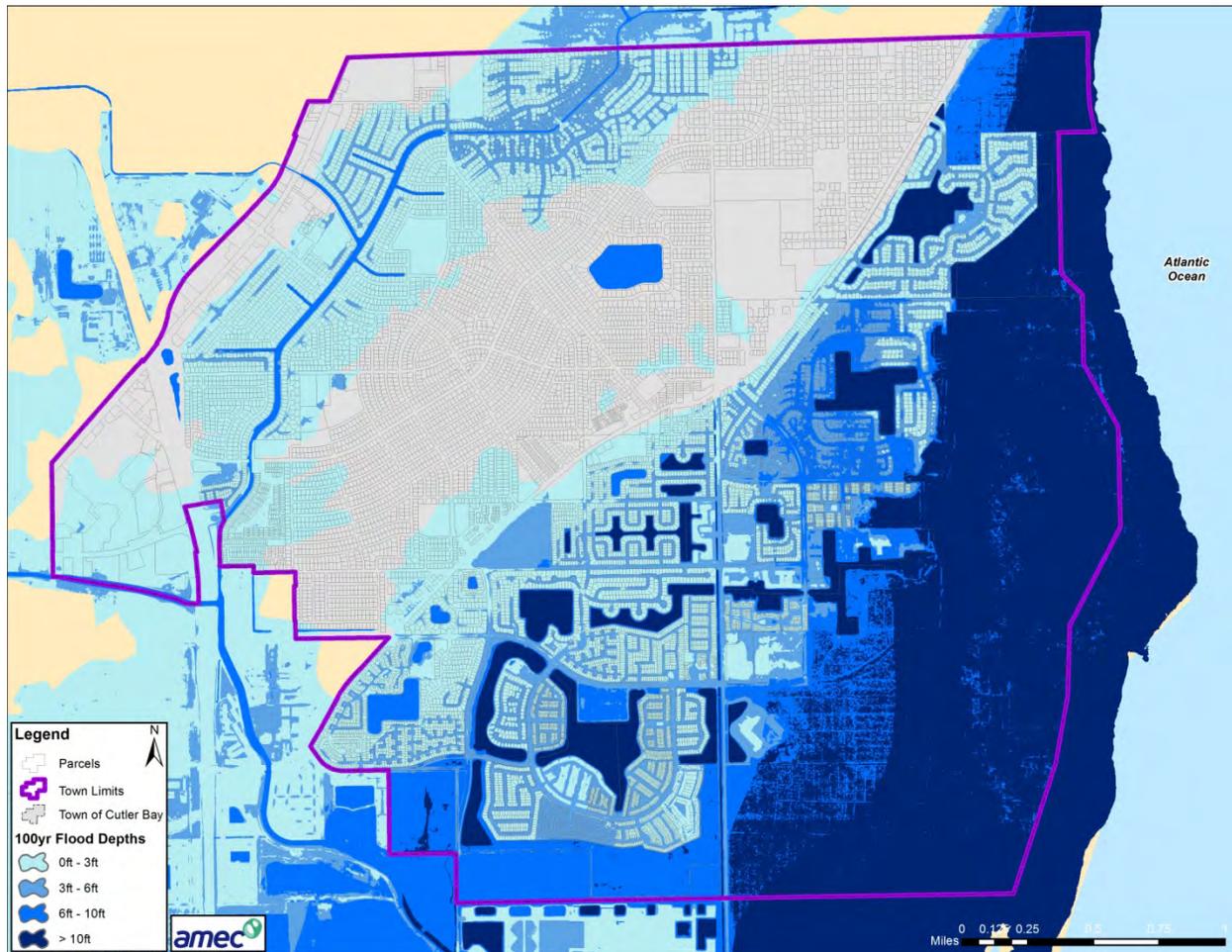
Parcel counts by FEMA flood zone were determined using a spatial intersection of the tax parcels, provided by the Town of Cutler Bay, and the effective FEMA flood zones provided in the Miami-Dade County FEMA DFIRM Database, effective 9/11/2009. This methodology was used to determine whether a parcel is affected by multiple flood zones. In the case of parcels affected by multiple zones, the entire parcel assessment value was applied to the flood zone covering the majority of the parcel in order to provide exposure estimates for each FEMA flood zone. In order to determine the correct occupancy class for each parcel, the County Land Use Codes (CLUC) provided in the Cutler Bay tax parcel data were translated into FEMA Hazus specific occupancy classes (i.e. RES1, COM4, EDU2, etc.). These were translated to ensure the correct depth damage factor was applied to the parcel based on its occupancy class to ensure a more accurate damage assessment of the parcel.

Table 3.25 shows the correlation between BFEs and average flood depth. Figure 3.26 depicts the depth of flooding that can be expected within the Town of Cutler Bay during the 100-year flood event.

**Table 3.25 - Effective DFIRM BFE and Average Depth**

Effective DFIRM BFE (ft)	Average Depth (ft)
7	4
8	3
9	2.5
10	5.5
11	8
12	11
13	12
14	13
15	14.5
16	16
17	17
18	18

Source: FEMA DFIRM September 11, 2009



**Figure 3.26 - 100-yr Flood Depths for Cutler Bay**



Table 3.26 provides the depth damage factors that were used in calculating flood losses for the Town. These depth damage factors were developed based on the USACE Galveston District depth damage curves used in Hazus. All depths assume the structure has no basement.

**Table 3.26 - Cutler Bay Flood Loss Damage Factors**

Depth (ft)	Percent Damaged (%)					
	Residential	Commercial	Religious	Government	Education	Other
0	10	1	0	0	0	1
1	21	9	10	5	5	10
2	27	14	11	8	7	12
3	32	16	11	13	9	15
4	37	18	12	14	9	19
5	43	20	12	14	10	22
6	46	23	13	15	11	26
7	50	26	14	17	13	30
8	54	30	14	19	15	35
9	58	34	15	22	17	39
10	60	38	17	26	20	42
11	63	42	19	31	24	48
12	67	47	24	37	28	50
13	70	51	30	44	33	51
14	74	55	38	51	39	53
15	79	58	45	59	45	54
16	82	61	52	65	52	55
17	83	64	58	70	59	55
18	84	67	64	74	64	56

Source: FEMA estimated damage factors

Content values estimations are based on FEMA Hazus methodologies of estimating value as a percent of improved structure values by property type. Table 3.27 shows the breakdown of the different property types in Cutler Bay and their estimated content replacement value percentages.

**Table 3.27 - Content Replacement Factors**

Property Type	Content Replacement Values
Residential	50%
Commercial	100%
Cultural and Parks	100%
Education	100%
Government	100%
Recreation and Entertainment	100%
Religion	100%
Medical	150%
Transportation	150%
Utilities and Communication	150%

Source: Hazus 2.1

**Values at Risk**

The loss estimate for flood is based on the total of improved and contents value. The land value is represented in the flood tables, but these values are only present to show the value of the land and are not



included in any of the loss estimates as generally the land is not subject to loss from floods. It is important to note that information on those properties mitigated (e.g., floodproofed or elevated) in the SFHA was not available for analysis, thus the resulting flood damage loss estimates could be lower than actual figures. Once the potential value of affected parcels was calculated, damage factors were applied to obtain loss estimates by flood zone.

Table 3.28 is a summary table that shows the count and improved value of parcels that fall within the 1% annual chance floodplain by land use type. Parcels outside the floodplain are also shown (Zone X). Based on this analysis, 9,163 improved parcels fall within the 1% annual chance floodplain for a total value of \$1,623,249,713. Additionally, there are 3,535 improved parcels outside of the SFHA with a value of \$606,893,164.

**Table 3.28 - Property Value Estimates by Flood Zone and Property Type**

Land Use	Total Parcel Count	Improved Parcel Count	Land Value	Improved Value	Estimated Content Value	Total Value <sup>1</sup>	Loss Estimate
<b>Zone AE</b>							
Residential	7,381	7,358	\$189,993,609	\$705,569,438	\$352,784,719	\$1,058,354,157	\$261,106,766
Commercial	22	21	\$17,417,323	\$19,542,291	\$19,542,291	\$39,084,582	
Education	5	5	\$5,937,286	\$25,894,629	\$25,894,629	\$51,789,258	\$7,271,837
Government	74	10	\$48,896,706	\$36,339,568	\$36,339,568	\$72,679,136	\$6,315,052
Religious	2	2	\$3,651,250	\$7,704,012	\$7,704,012	\$15,408,024	
Other	379	6	\$50,937,103	\$18,521,560	\$25,386,774	\$43,908,334	
<b>Total</b>	<b>7,863</b>	<b>7,402</b>	<b>\$316,833,277</b>	<b>\$813,571,498</b>	<b>\$467,651,993</b>	<b>\$1,281,223,491</b>	<b>\$274,693,655</b>
<b>Zone VE</b>							
Residential	0	0	\$0	\$0	\$0	\$0	\$0
Commercial	0	0	\$0	\$0	\$0	\$0	\$0
Education	0	0	\$0	\$0	\$0	\$0	\$0
Government	2	0	\$40,000	\$0	\$0	\$0	\$0
Religious	0	0	\$0	\$0	\$0	\$0	\$0
Other	0	0	\$0	\$0	\$0	\$0	\$0
<b>Total</b>	<b>2</b>	<b>0</b>	<b>\$40,000</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
<b>Zone AH</b>							
Residential	1,726	1,726	\$60,652,913	\$141,869,952	\$70,934,976	\$212,804,928	\$22,307,541
Commercial	16	16	\$64,955,934	\$37,093,710	\$37,093,710	\$74,187,420	
Education	5	5	\$9,585,001	\$21,118,448	\$21,118,448	\$42,236,896	\$1,035,099
Government	3	2	\$24,315	\$5,266	\$5,266	\$10,532	\$2,352
Religious	5	5	\$3,187,726	\$4,283,971	\$4,283,971	\$8,567,942	
Other	92	7	\$12,171,349	\$1,878,702	\$2,339,802	\$4,218,504	\$237,225
<b>Total</b>	<b>1,847</b>	<b>1,761</b>	<b>\$150,577,238</b>	<b>\$206,250,049</b>	<b>\$135,776,173</b>	<b>\$342,026,222</b>	<b>\$23,582,217</b>
<b>Zone X</b>							
Residential	3,468	3,468	\$146,565,622	\$351,248,925	\$175,624,463	\$526,873,388	\$0
Commercial	48	47	\$51,470,129	\$27,128,329	\$27,128,329	\$54,256,658	\$0
Education	0	0	\$0	\$0	\$0	\$0	\$0
Government	8	1	\$451,573	\$2,322	\$2,322	\$4,644	\$0
Religious	1	1	\$336,600	\$546,430	\$546,430	\$1,092,860	\$0
Other	119	18	\$21,964,684	\$9,892,124	\$14,773,490	\$24,665,614	\$0
<b>Total</b>	<b>3,644</b>	<b>3,535</b>	<b>\$220,788,608</b>	<b>\$388,818,130</b>	<b>\$218,075,034</b>	<b>\$606,893,164</b>	<b>\$0</b>

Source: Miami-Dade County 2013 Tax Assessor's Data, FEMA 2009 DFIRM

<sup>1</sup>Total value does not include land value.



Table 3.29 shows a summary of flood loss estimate values by flood zone. This table is arranged by the 1% annual chance flood zones (AE, VE and AH Zones) and the Zone X flood zone (unshaded) combined.

**Table 3.29 – Summary of Flood Loss Estimates by Flood Zone**

Flood Zone	Total Parcel Count	Improved Parcel Count	Land Value	Improved Value	Estimated Content Value	Total Value <sup>1</sup>	Loss Estimate
Zone AE	7,863	7,402	\$316,833,277	\$813,571,498	\$467,651,993	\$1,281,223,491	\$274,693,655
Zone VE	2	0	\$40,000	\$0	\$0	\$0	\$0
Zone AH	1,847	1,761	\$150,577,238	\$206,250,049	\$135,776,173	\$342,026,222	\$23,582,217
Zone X	3,644	3,535	\$220,788,608	\$388,818,130	\$218,075,034	\$606,893,164	\$0
<b>Total</b>	<b>13,356</b>	<b>12,698</b>	<b>\$688,239,123</b>	<b>\$1,408,639,677</b>	<b>\$821,503,199</b>	<b>\$2,230,142,876</b>	<b>\$298,275,872</b>

Source: Miami-Dade County 2013 Tax Assessor's Data, FEMA 2009 DFIRM

<sup>1</sup>Total value does not include land value.

Table 3.30 shows the loss ratio for the flood damage assessment. The loss ratio is the loss estimate divided by the total potential exposure (i.e., total of improved and contents value for all parcels located within the 1% annual chance flood zone) and displayed as a percentage of loss. FEMA considers loss ratios greater than 10% to be significant and an indicator a community may have more difficulties recovering from a flood.

**Table 3.30 – 1-Percent-Annual-Chance Loss Ratio**

Flood Zone	Total Parcel Count	Improved Parcel Count	Land Value	Improved Value	Estimated Content Value	Total Value <sup>1</sup>	Loss Estimate	Loss Ratio
1% Annual Chance	9,712	9,163	\$467,450,515	\$1,019,821,547	\$603,428,166	\$1,623,249,713	\$298,275,872	18.4%

Source: Miami-Dade County 2013 Tax Assessor's Data, FEMA 2009 DFIRM

<sup>1</sup>Total value does not include land value.

### Flooded acres

Also of interest is the land area affected by the various flood zones. The following is an analysis of flooded acres in the Town in comparison to total area within the Town limits.

### Methodology

GIS was used to calculate acres flooded by FEMA flood zones and land use categories. The Cutler Bay parcel layer and effective DFIRM were intersected and the flooded parcel area was calculated in acres. The flood zone was assigned to any given parcel based on the intersection of the parcel with a flood zone. Parcels can be located in multiple flood zones, and only the flooded acreage within the parcel was counted for each flood zone.

### Limitations

One limitation to be made from this analysis is that the parcel layer does not include right-of-way areas. Due to this, there are voids of land that are not accounted for; therefore, this analysis only represents total parcel acres. Tables 3.31 and 3.32 represent a detailed and summary analysis of total improved flooded acres by land use and FEMA DFIRM flood zone, respectively.



**Table 3.31 - Total Parcel Acres to Flooded Acres by Land Use**

Land Use	Total Parcel Acres	Improved Flooded Acres
Residential	2,286	2,284
Commercial	334	240
Education	105	105
Government	1,458	96
Religious	46	46
Other	1,363	72
<b>Total</b>	<b>5,593</b>	<b>2,843</b>

Source: Miami-Dade County 2013 Tax Assessor's Data, FEMA 2009 DFIRM

**Table 3.32 - Total Parcel Acres to Flooded Acres by Flood Zone**

Flood Zone	Total Parcel Acres	Improved Flooded Acres
Zone AE	3,804	1,298
Zone VE	36	0
Zone AH	474	427
Zone X	1,278	1,118
<b>Total</b>	<b>5,593</b>	<b>2,843</b>

Source: Miami-Dade County 2013 Tax Assessor's Data, FEMA 2009 DFIRM

### Population at Risk

A separate analysis was performed to determine the population at risk to the 1% annual chance flood zones (AE, VE and AH Zones) and the Zone X flood zone (unshaded) combined. Using GIS, the DFIRM flood zones were overlaid on the improved residential parcel data. Those residential parcels that intersected the flood zones were counted and multiplied by the Census Bureau household factor for Cutler Bay (3.15). In the case of residential parcels intersected by multiple flood zones, the parcel was assigned to the flood zone covering the majority of the parcel area. As shown in Table 3.33, there is an estimated total population of 39,539 at risk within the 1% annual chance and Zone X flood zones.

**Table 3.33 - Cutler Bay Population at Risk to Flood**

Flood Zone	Residential Property Count	Population
Zone AE	7,358	23,178
Zone VE	0	0
Zone AH	1,726	5,437
Zone X	3,468	10,924
<b>Total</b>	<b>12,552</b>	<b>39,539</b>

Source: Miami-Dade County 2013 Tax Assessor's Data, FEMA 2009 DFIRM, U.S. Census Bureau

### Critical Facilities at Risk

A separate analysis was performed to determine critical facilities in the 1% and 0.2% annual chance floodplains. Using GIS, the DFIRM flood zones were overlaid on the critical facility location data. Figure 3.27 shows critical facilities and DFIRM flood zones. Figure 3.28 shows critical facilities and 100-yr flood depth. Table 3.34 details critical facilities by facility type, flood zone, replacement value, and base flood elevation.

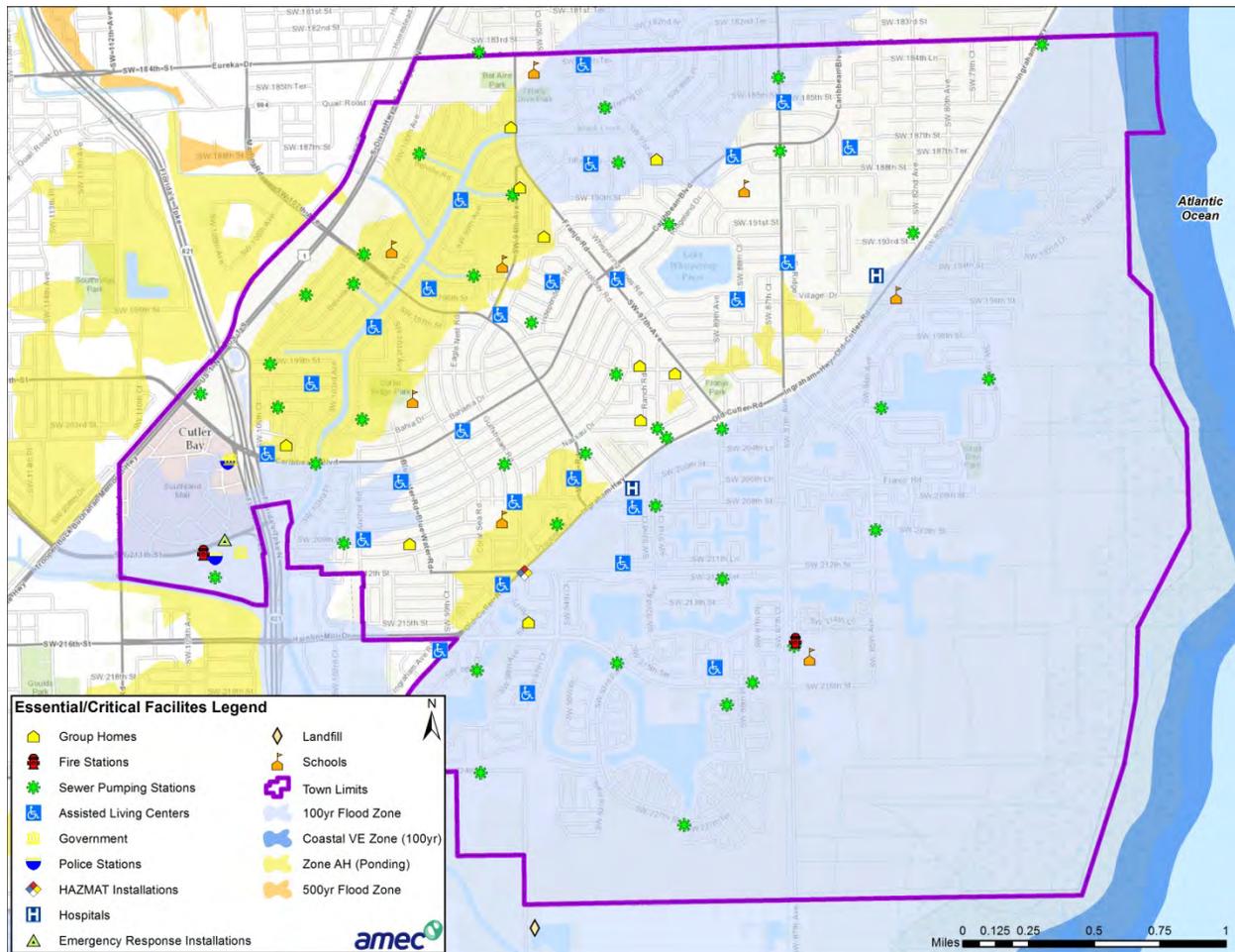
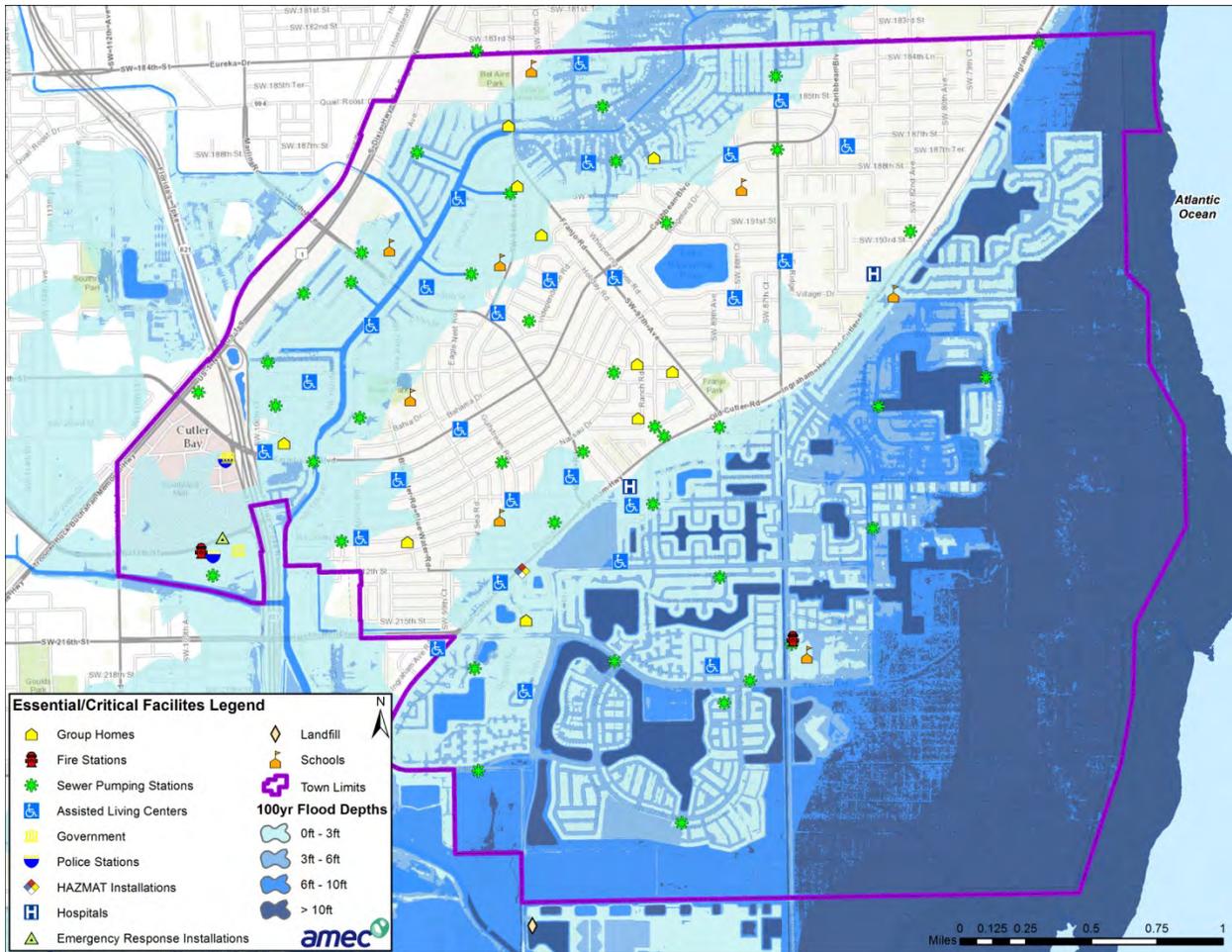


Figure 3.27 - Critical Facilities Located within FEMA Flood Zones



**Figure 3.28 - Critical Facilities and 100-yr Flood Depths**

**Table 3.34 - Critical Facilities by Flood Zone**

Facility	Facility Type	Address/Coordinates	Base Flood Elevation	Estimated Base Flood Depth (ft)
Whigham Elementary	School	21545 SW 87TH AVE	10	1.4
Whigham Learning Facility	School	8035 SW 196TH ST	10	1.8
Cutler Ridge Police Department	Police	10800 SW 211TH ST	8	-0.8
Health South	Hospital	20601 Old Cutler Road	8	-4.3
Sunrise Opp. Inc	Group Home	9031 SW 187TH TER	9	2.1
Sunrise Opp. Inc	Group Home	9765 SW 215TH LN	8	-2.7
Government Center	Government	10710 SW 211TH ST	8	-1.0
Miami-Dade Fire Rescue Station #34	Fire Station	10850 SW 211TH ST	8	1.7
Miami-Dade Fire Rescue Station #55	Fire Station	21501 SW 87TH AVE	10	2.4
Miami-Dade County Vehicle Maintenance and Fueling STATION # 0000	Emergency Response	10740 SW 211TH ST	8	1.0
	Pumping Station	25.5780418887, -80.335607265	8	-2.8



Facility	Facility Type	Address/Coordinates	Base Flood Elevation	Estimated Base Flood Depth (ft)
STATION # 0516	Pumping Station	25.5718213242, -80.358665971	8	0.4
STATION # 0517	Pumping Station	25.599175859, -80.316013918	11	-0.9
STATION # 0540	Pumping Station	25.5647702475, -80.3506026716	8	2.8
STATION # 0577	Pumping Station	25.5591182348, -80.3504109597	9	4.8
STATION # 0583	Pumping Station	25.5651354841, -80.3420700352	10	4.1
STATION # 0603	Pumping Station	25.5699842703, -80.3665117279	8	2.0
STATION # 0507	Pumping Station	25.5791569173, -80.325911715	11	7.0
STATION # 0609	Pumping Station	25.5807257714, -80.3193452238	12	7.1
STATION # 0610	Pumping Station	25.5724004713, -80.326280969	11	5.8
STATION # 0702	Pumping Station	25.562801377, -80.3353984572	10	2.1
STATION # 1046	Pumping Station	25.564029218, -80.333814522	10	4.1
STATION # 1096	Pumping Station	25.566043441, -80.3312723754	10	2.4
STATION # 0578	Pumping Station	25.5762412461, -80.3603545312	8	0.5
STATION # 1058	Pumping Station	25.5927725768, -80.3418306472	9	3.8
STATION # 1059	Pumping Station	25.5957996885, -80.3426335791	9	3.7
STATION # 1067	Pumping Station	25.5974283551, -80.3320636885	9	2.9
STATION # 1109	Pumping Station	25.569742077, -80.3356234062	10	4.1
STATION # 1111	Pumping Station	25.5561730858, -80.3380277234	10	1.1
STATION # 1119	Pumping Station	25.5738188941, -80.3396769694	8	2.3
Nuestro Hogar ALF, Inc.	Assisted Living	9384 SW 184TH TER	9	2.2
Paradise Villa	Assisted Living	21164 SW 92ND PL	9	2.4
Welcome Home Alf	Assisted Living	8950 SW 215TH TER	10	1.9
Blue Point Home Care	Assisted Living	21910 SW 97TH CT	9	2.7
Bertha Elderly Care	Assisted Living	10051 HAITIAN DR	8	0.9
Harmony Family Home	Assisted Living	9245 SW 208TH TER	8	1.2
Bell Luna Retirement Home	Assisted Living	18700 SW 93RD CT	9	2.6
Guardian Angel ALF	Assisted Living	10265 NICARAGUA DR	8	2.0
South Dade Landfill	Land Fill	23707 SW 97TH AVE	10	10.6
Florida City Gas Sub Station #3	Hazardous Materials	21210 SW 97TH CT	8	2.0
Bel-Aire Elementary	School	10205 SW 194TH ST	8	0.7
Gulfstream Elementary	School	20900 SW 97TH AVE	7	-0.1
Cutler Ridge Middle	School	19400 GULFSTREAM RD	7	-1.1
A Guardian Group Home	Group Home	9700 STERLING DR	9	2.5
All Care Residential	Group Home	18901 SW 97TH AVE	7	0.8
Cutler Bay Group Home	Group Home	10471 SW 204TH TER	8	-0.9
Sunrise Opp. Inc	Group Home	9500 SW 191ST TER	7	0.8
STATION # 0684	Pumping Station	25.5728159418, -80.3456865725	7	0.3
STATION # 0708	Pumping Station	25.5793439657, -80.3626482243	8	1.3
STATION # 1051	Pumping Station	25.5933140321, -80.3539410799	9	2.7
STATION # 1060	Pumping Station	25.5877828731, -80.357346647	8	0.7
STATION # 1052	Pumping Station	25.5861430145, -80.35800235	8	2.0
STATION # 1053	Pumping Station	25.5817407306, -80.363100133	8	2.3
STATION # 1054	Pumping Station	25.5910182764, -80.3482829249	7	0.8
STATION # 1055	Pumping Station	25.5865631643, -80.3506789532	7	1.5
STATION # 1057	Pumping Station	25.5786682255, -80.3575210256	7	2.8
STATION # 1064	Pumping Station	25.585540855, -80.3609082363	8	3.3
Living Well Alf	Assisted Living	21280 OLD CUTLER RD	8	0.8
Best ALF	Assisted Living	19010 BEL AIRE DR	7	2.1



Facility	Facility Type	Address/Coordinates	Base Flood Elevation	Estimated Base Flood Depth (ft)
Marlin Retirement	Assisted Living	20610 MARLIN RD	7	-0.7
Bel Aire Retirement Home	Assisted Living	9955 SW 196TH ST	7	0.5
The Haven	Assisted Living	10601 CARIBBEAN BLVD	8	0.4
Bertha Elderly Care #2	Assisted Living	10411 SW 200TH TER	8	-0.2
Roadesk One Inc.	Assisted Living	9700 MONTEGO BAY DR	7	0.2
Bel-View ALF Corp	Assisted Living	19768 BEL AIRE DR	7	1.5
Whispering Pines Elementary	School	18929 SW 89TH RD	0	0.0
Cutler Ridge Elementary	School	20210 CORAL SEA RD	0	0.0
Our Lady of the Holy Rosary	School	9500 SW 184 St	0	0.0
Cutler Bar Police Department	Police	10720 CARIBBEAN BLVD	0	0.0
Purdue Medical Center	Hospital	19590 OLD CUTLER RD	0	0.0
Campos Fleitas	Group Home	9010 SW 200TH ST	0	0.0
Lizi's Garden Group Home	Group Home	9220 NAUTILUS DR	0	0.0
Mains'L	Group Home	19930 HOLIDAY RD	0	0.0
Sierra Developmental Enterprises	Group Home	10030 NICARAGUA DR	0	0.0
Town Hall	Government	10720 CARIBBEAN BLVD	0	0.0
STATION # 0703	Pumping Station	25.5801111216, -80.3673550039	0	0.0
STATION # 0704	Pumping Station	25.5810698987, -80.3420264795	0	0.0
STATION # 0705	Pumping Station	25.583955011, -80.3471810578	0	0.0
STATION # 0744	Pumping Station	25.5767251636, -80.3439340344	0	0.0
STATION # 0750	Pumping Station	25.5775604992, -80.3389947083	0	0.0
STATION # 1074	Pumping Station	25.5888040764, -80.3239094689	0	0.0
STATION # 0701	Pumping Station	25.5761588458, -80.3488635508	0	0.0
STATION # 0706	Pumping Station	25.5933671459, -80.3319936837	0	0.0
STATION # 0707	Pumping Station	25.5893458306, -80.3387680387	0	0.0
STATION # 0734	Pumping Station	25.5780921499, -80.3395428582	0	0.0
STATION # 1063	Pumping Station	25.5988967107, -80.3502983712	0	0.0
Bel-Air Alf II Inc.	Assisted Living	19431 FRANJO RD	0	0.0
Genesis Care Centers	Assisted Living	8395 SW 187TH TER	0	0.0
Good Time Home Care	Assisted Living	8640 SW 185TH ST	0	0.0
Bel-Air ALF Inc.	Assisted Living	8830 CARIBBEAN BLVD	0	0.0
Precious Moments ALF	Assisted Living	9480 DANA RD	0	0.0
Kenneth Home Inc.	Assisted Living	9760 MEMORIAL RD	0	0.0
Old Cutler Retirement Home	Assisted Living	21640 OLD CUTLER RD	0	0.0
Whispering Pines Home Care	Assisted Living	8830 SW 196TH DR	0	0.0
Caribbean ALF	Assisted Living	9860 CARIBBEAN BLVD	0	0.0
East Ridge Retirement Village	Assisted Living	19301 SW 87TH AVE	0	0.0

Source: Miami-Dade County 2013 Tax Assessor's Data, FEMA 2009 DFIRM

Note: Depths derived from Miami-Dade County 2009 LiDAR Data

## Policies and Procedures for Critical Facilities and Infrastructure

Many of the critical facilities and infrastructure in Cutler Bay are located within the 1% annual chance flood area (AE and AH-Zones). Some of these facilities have a depth of flooding which can create problems for the functionality of the building. Many of these facilities are privately owned such as assisted living centers which require the owner to either provide flood proofing or other retrofitting measures. Many of the facilities which are publically-owned don't have many options to be relocated,



since approximately 65% of the community is in a designated floodplain. The mitigation action plan identifies a specific measure to protect vulnerable critical facilities.

### Future Development

A GIS analysis was performed to quantify parcels within future development areas that are located within a special flood hazard area.

### Methodology

The 2013 Miami-Dade County’s parcel layer was used to identify potential areas of future development located within FEMA flood zones. Parcel counts by FEMA flood zone were determined using a spatial intersection of the tax parcels and the effective flood hazard area provided in the Miami-Dade County FEMA DFIRM Database, effective 9/11/2009. In the event that a parcel was affected by multiple zones, the flood zone covering the majority of the parcel was assigned to the parcel. Table 3.35 delineates the future development areas by flood zone and land use.

**Table 3.35 - Future Land Use and FEMA Flood Zones**

<b>Future Land Use</b>	<b>Unimproved Parcel Count</b>	<b>Land Value</b>
<b>Zone AE</b>		
Residential	23	\$565,104
Commercial	1	\$0
Education	0	\$0
Government	64	\$23,875,078
Religious	0	\$0
Other	373	\$36,770,011
<b>Total</b>	<b>461</b>	<b>\$61,210,193</b>
<b>Zone VE</b>		
Residential	0	\$0
Commercial	0	\$0
Education	0	\$0
Government	2	\$40,000
Religious	0	\$0
Other	0	\$0
<b>Total</b>	<b>2</b>	<b>\$40,000</b>
<b>Zone AH</b>		
Residential	0	\$0
Commercial	0	\$0
Education	0	\$0
Government	1	\$16,465
Religious	0	\$0
Other	85	\$2,684,398
<b>Total</b>	<b>86</b>	<b>\$2,700,863</b>
<b>Zone X</b>		
Residential	0	\$0
Commercial	1	\$0
Education	0	\$0
Government	7	\$449,820
Religious	0	\$0
Other	101	\$10,359,376
<b>Total</b>	<b>109</b>	<b>\$10,809,196</b>

Source: Miami-Dade County 2013 Tax Assessor’s Data, FEMA 2009 DFIRM, Cutler Bay Future Land Use Data

### Flood Insurance Analysis

One valuable source of information on flood hazards is current flood insurance data for activity policies and past claims. Flood insurance is required as a condition of federal aid or a mortgage or loan that is federally insured for a building located in a FEMA flood zone. Figure 3.29 shows the location of active flood insurance policies as well as policies with claims.

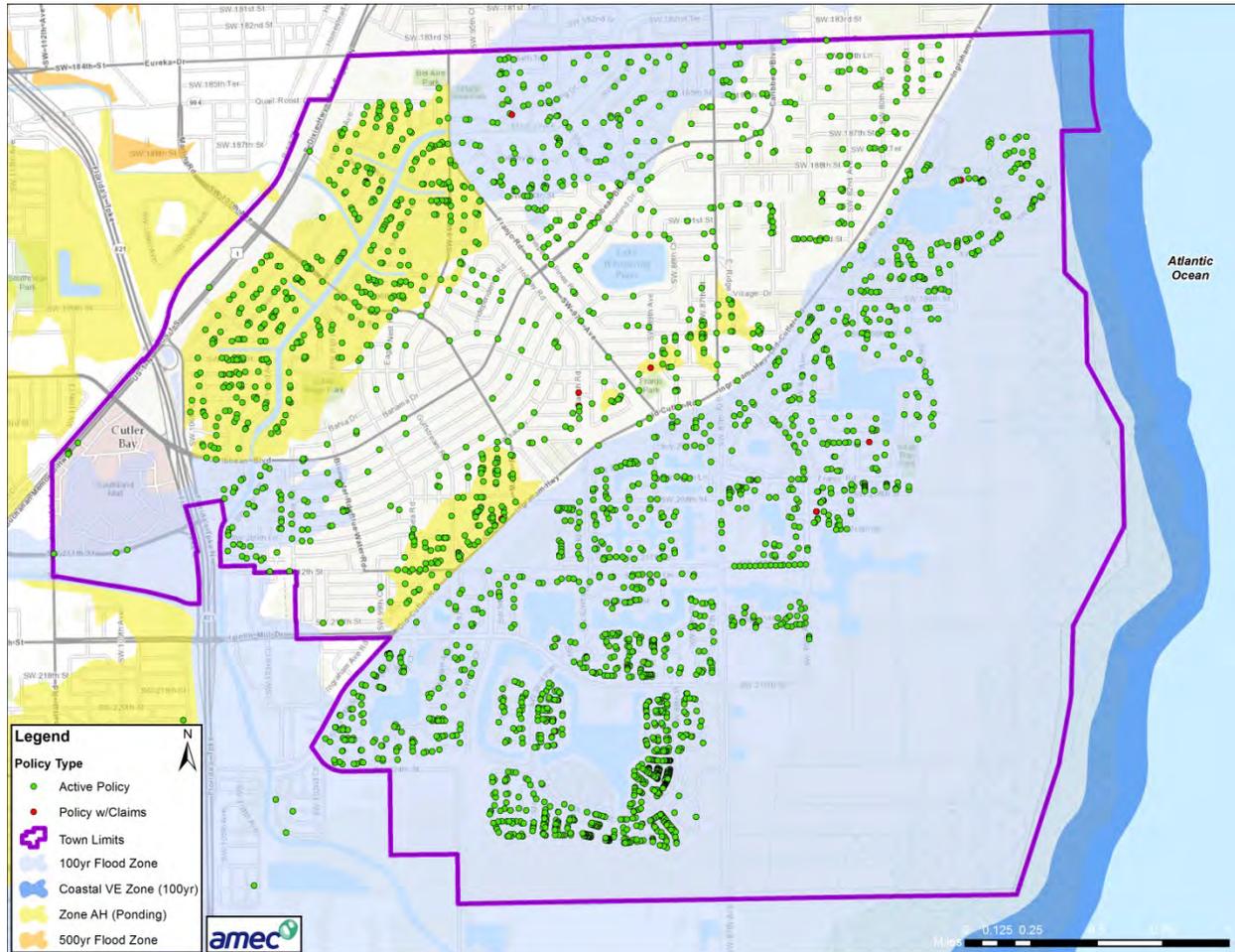


Figure 3.29 - Cutler Bay Flood Insurance Policies in Force

Table 3.36 summarizes key statistics of policies in force and past claims by flood zone.

Table 3.36 - NFIP Policy and Claims Data by Flood Zone

Flood Zone	Number of Policies in Force	Total Premium	Total Coverage	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	2,482	\$1,433,176	\$517,974,300	1	\$6,388
AH Zones	535	\$196,197	\$127,246,300	1	\$37,858
V01-30 & VE Zones	0	\$0	\$0	0	\$0
B, C & X Zone	0	\$0	\$0	0	\$0



Flood Zone	Number of Policies in Force	Total Premium	Total Coverage	Number of Closed Paid Losses	Total of Closed Paid Losses
Standard	5	\$5,990	\$1,223,300	1	\$46,367
Preferred	303	\$119,419	\$86,823,000	1	\$37,327
<b>Total</b>	<b>3,325</b>	<b>\$1,754,782</b>	<b>\$733,266,900</b>	<b>4</b>	<b>\$127,940</b>

Source: FEMA Community Information System, April 2014

Table 3.37 compares the number of policies in force with the number of buildings located within each flood zone in order to examine the percentage of buildings that are insured within each zone.

**Table 3.37 - Percentage of Buildings Insured**

Flood Zone	Number of Policies in Force	Number of Buildings	% Insured
AE Zone	2,482	7,402	33.5%
AH Zone	535	1,761	30.4%
VE Zone	0	0	0%
X Zone	308	3,535	8.7%
<b>Total</b>	<b>3,325</b>	<b>12,698</b>	<b>26.2%</b>

Source: FEMA Community Information System, April 2014

The notable statistic in Table 3.37 is that while there are 9,163 buildings located within the 100-yr flood zone (AE, AH and VE Zones), only 33% of these buildings carry an active flood insurance policy. Furthermore, only 9% of buildings within the X Zone are insured, and as the repetitive loss figures show below, flooding is not limited to the 100-yr flood zones.

Table 3.38 compares number of buildings present, number of policies in force, total coverage and a calculation of loss estimate values for the 100-yr flood.

**Table 3.38 - Flood Loss Estimates by Flood Zone**

Flood Zone	Number of Buildings	Number of Policies in Force	Total Value <sup>1</sup>	Total Coverage	Loss Estimate
AE Zone	7,402	2,482	\$1,281,223,491	\$517,974,300	\$274,693,655
AH Zone	1,761	535	\$342,026,222	\$127,246,300	\$23,582,217
VE Zone	0	0	\$0	\$0	\$0
<b>Total</b>	<b>9,163</b>	<b>3,017</b>	<b>\$1,623,249,713</b>	<b>\$645,220,600</b>	<b>\$298,275,872</b>

Source: Miami-Dade County 2013 Tax Assessor's Data, FEMA 2009 DFIRM

<sup>1</sup>Total value does not include land value.

The above analysis of existing flood insurance coverage shows that existing building coverage does exceed the loss estimate for the 100-yr flood zone; however, this statistic does not take into account the large number of uninsured properties (67%) that would have no coverage in the event of a flood loss. Total building content value within the 100-yr flood zone is estimated at \$603,428,166. An analysis of NFIP data through December 2011 showed active policies with building contents coverage totaling \$56,094,000.

### Repetitive Loss Analysis

An analysis of repetitive loss was completed to examine repetitive loss properties against FEMA flood zones. **All 16 unmitigated repetitive loss properties located within the Town of Cutler Bay are residential.**

### Methodology

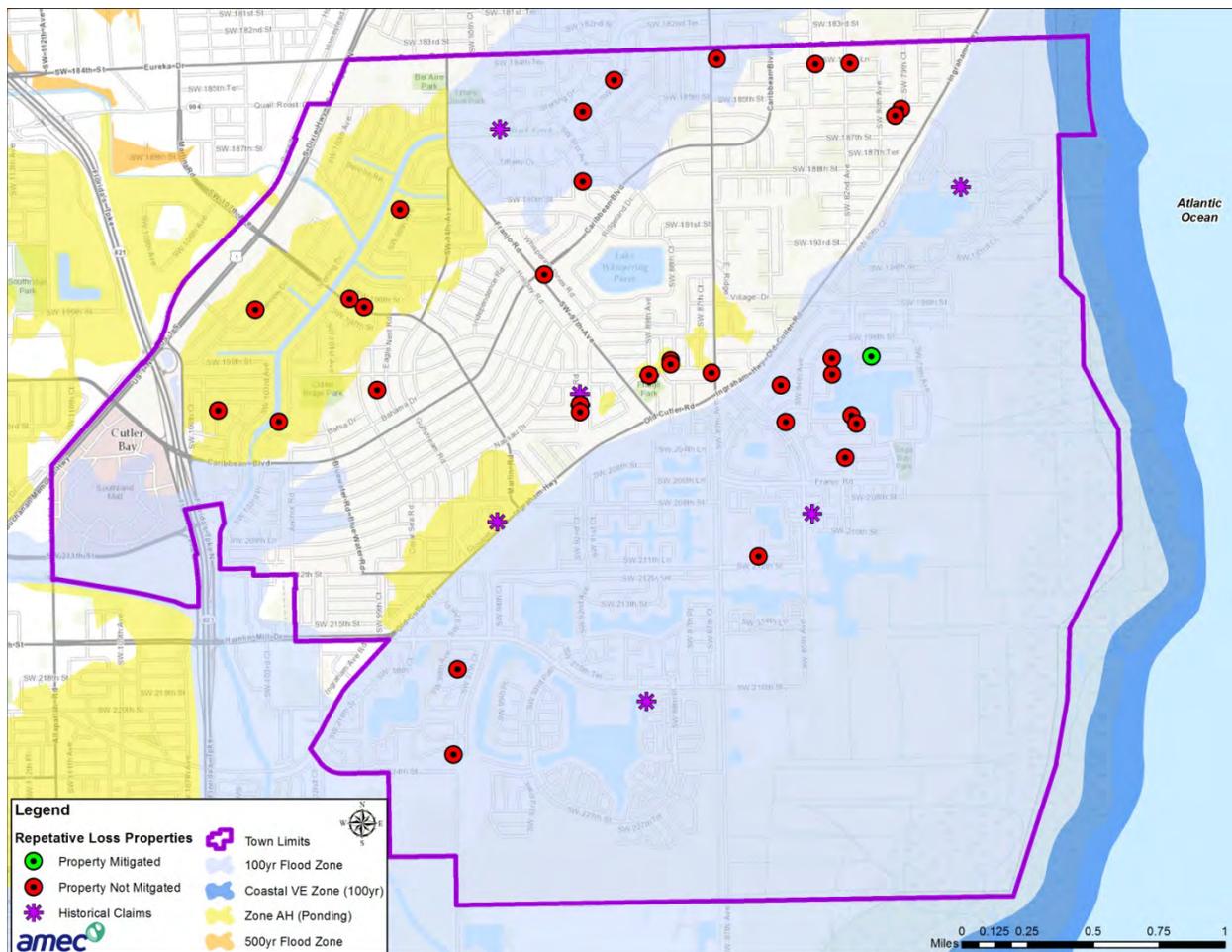
According to 2014 NFIP records, there is one mitigated property with a total payment of \$25,945 and 32 unmitigated properties with a total payment of \$1,816,483 with the Town of Cutler Bay. Table 3.39 details repetitive loss building counts, FEMA flood zones and total payment.

**Table 3.39 - Repetitive Loss Summary Table (Unmitigated Properties)**

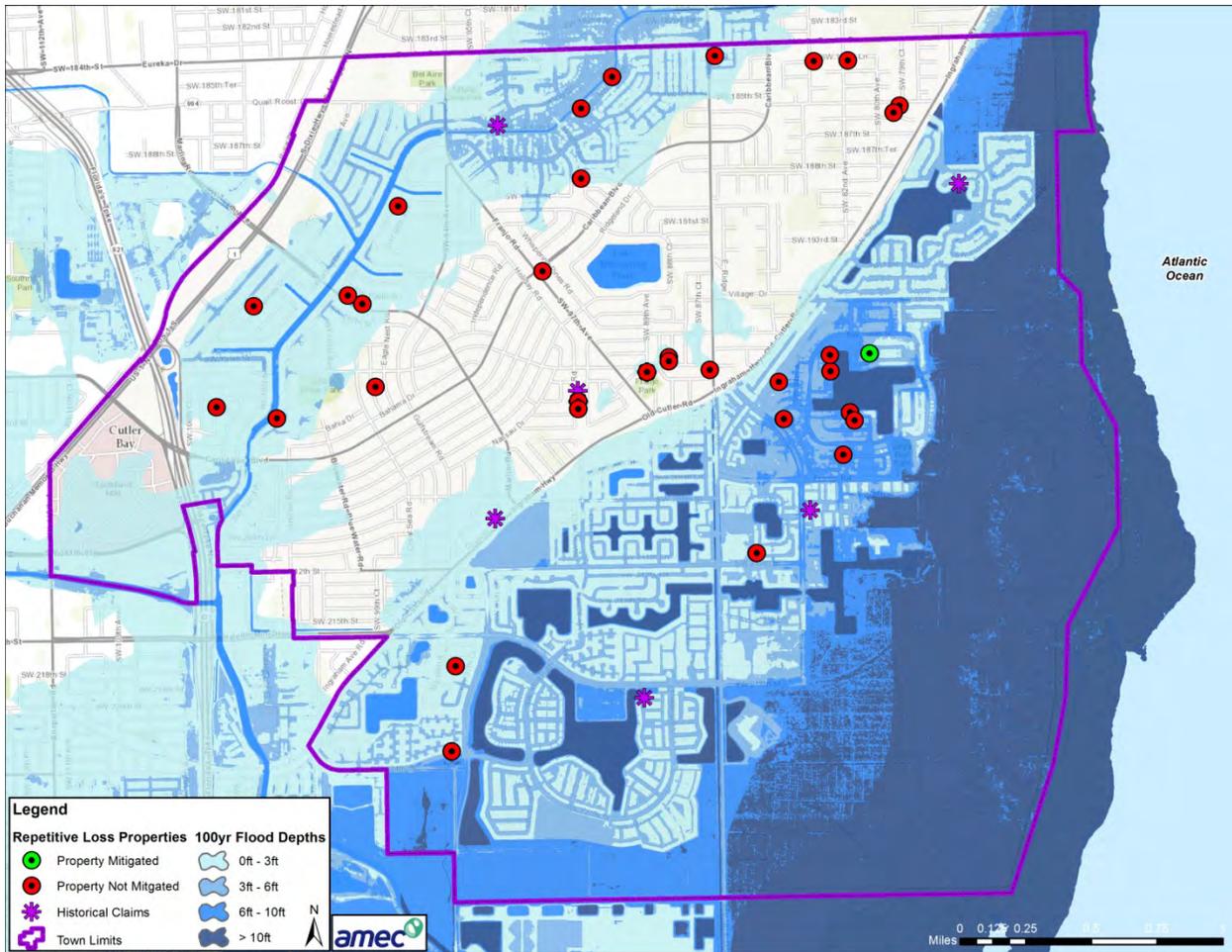
Flood Zone	Building Count		Total Building Payment	Total Content Payment	Total Paid
	Insured	Uninsured			
AE	9	13	\$627,757	\$281,284	\$909,041
AH	1	0	\$60,925	\$24,443	\$85,369
A10	1	0	\$28,856	\$0	\$28,856
X	5	3	\$516,088	\$277,129	\$793,217
<b>Total</b>	<b>16</b>	<b>16</b>	<b>\$1,233,626</b>	<b>\$582,856</b>	<b>\$1,816,483</b>

Source: NFIP Repetitive Loss Data 2014

Figure 3.30 illustrates the location of the repetitive loss properties separated out by the classification of mitigated or unmitigated in relation to the known flood hazard areas within Cutler Bay. Figure 3.31 illustrates the location of these properties in relation to the 100-yr flood depth.



**Figure 3.30- Repetitive Loss Properties and Flood Zones**



**Figure 3.31 - Repetitive Loss Properties and 100-yr Flood Depth**

### 3.3.5 Flood: Stormwater/Localized Flooding Vulnerability Assessment

**Likelihood of Future Occurrence**—Highly Likely  
**Vulnerability**—Medium

Localized flooding also occurs at various times throughout the year with several areas of primary concern to the Town. Localized flooding and ponding affect streets and property. Based on figure 3.32, there appears to be a correlation between areas of localized stormwater flooding and repetitive loss properties. Stormwater and localized flooding can often be attributed to the 100-year (1% annual chance flood) and some of the assets identified in Section 3.3.4 can be impacted from localized stormwater flooding. No direct damage of insurable buildings (other than potentially repetitive loss single-family structures) have been identified as being damaged by localized stormwater flooding. Areas of localized flooding identified by the FMPC are summarized below:

- Sterling Dr and SW 93 St
- Parcels between SW 195 St and SW 196 St
- The parcels bordered by Caribbean Blvd, Anchor Rd, Pan American Dr and Blue Water Rd
- Manta Drive at Old Cutler Rd
- Old Cutler Rd southwest of the intersection of Franjo Rd
- The intersection of SW 89 Ct, Franjo Rd and SW 200 St

- SW 186 St at SW 97<sup>th</sup> Avenue
- SW 77 Ave and SW 188 St through the intersection of SW 78 Ave
- SW 79 Ave at SW 79 Ct
- SW 197 Terrace at SW 196 Terrace
- SW 84 Ave at SW 199 Terrace
- SW 212 St between SW 85 Ave and SW 87 Ave
- SW 92 Ave between Old Cutler Road and SW 208 St
- SW 24 Terrace between SW 97 Ct and SW 97 Pl
- SW 216 St between SW 97 Ave and SW 98 Ct
- SW 97 Ave between SW 219 St and SW 224 St
- The quadrant of parcels bordered by SW 97 Ave, SW 221 Street/Terrace, SW 99 Pl and SW 224 St
- The intersection of SW 92 Ave/SW 93 Path and SW 216 St
- Parcels between SW 216 St and the eastern portion of SW 215 Terrace
- SW 216 St between SW 87 Pl and SW 88 Pl

Figure 3.32 depicts localized flooding, repetitive loss areas and flood zones. Figure 3.33 depicts localized flooding, repetitive loss areas and the depth of flooding that can be expected from the 100-yr flood event. The impacts to insurable buildings, infrastructure, and other assets are identified in Section 3.3.4.

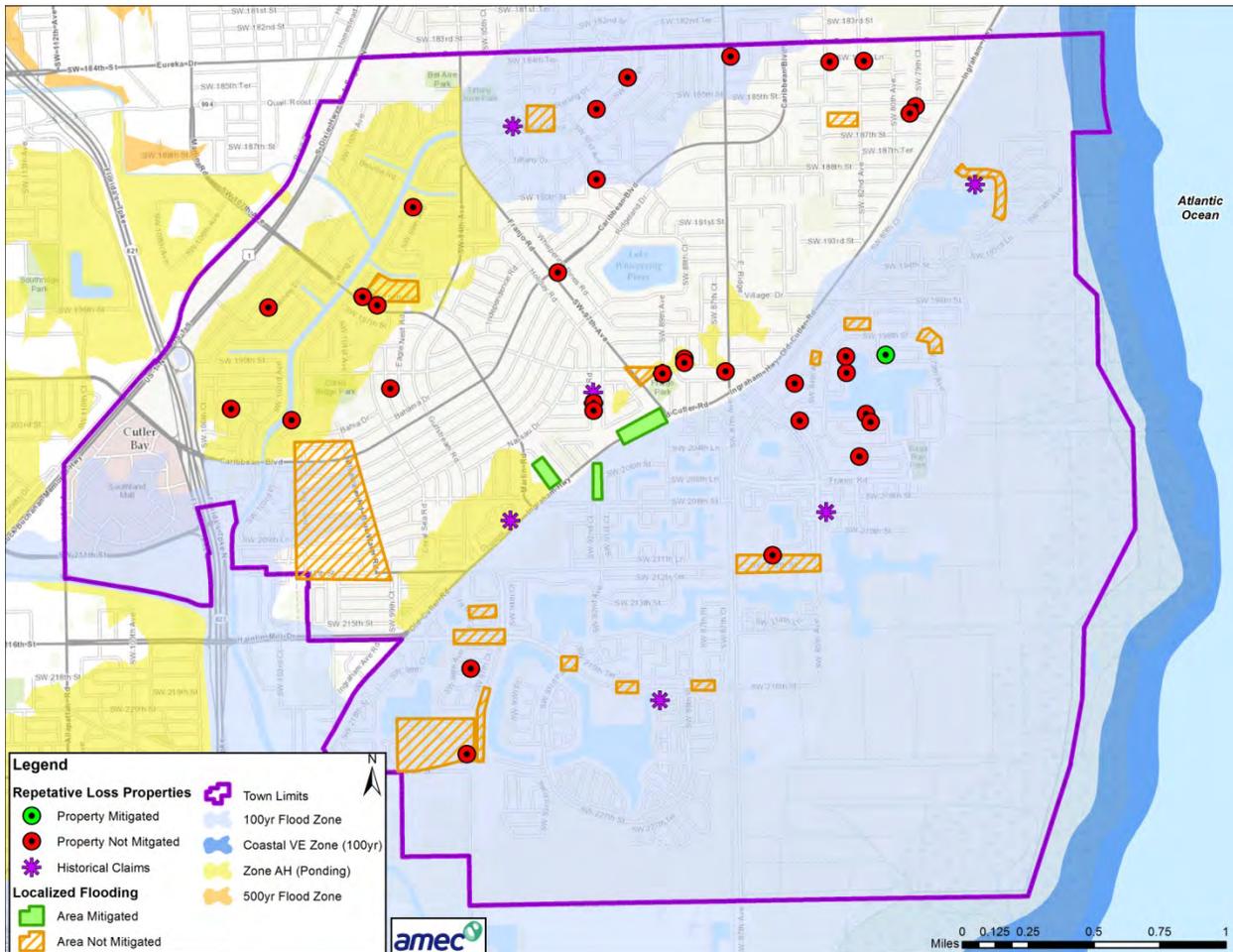
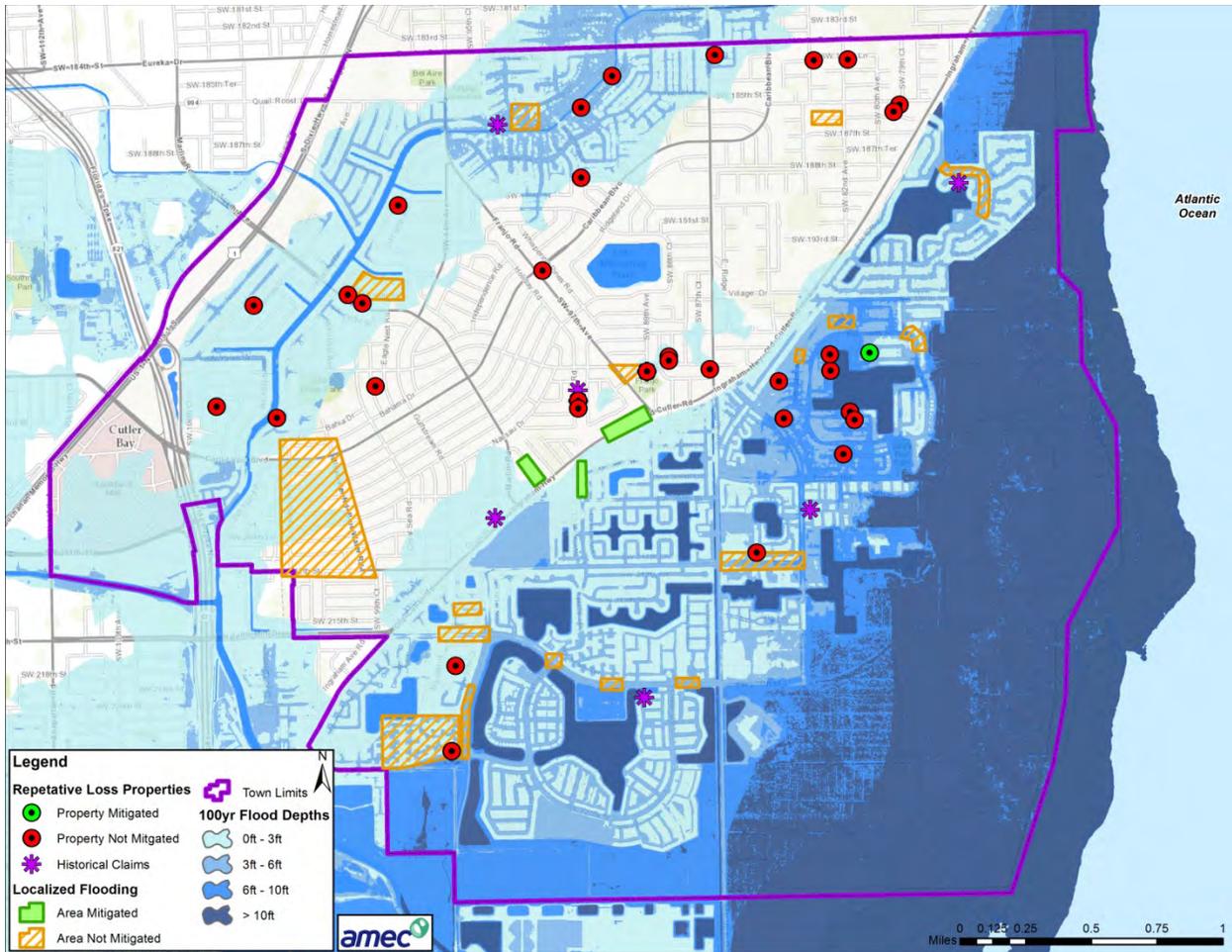


Figure 3.32- Localized Flooding, Repetitive Loss Areas and Flood Zones



**Figure 3.33 - Repetitive Loss, Localized Flooding and 100-yr Flood Depth**

### 3.3.6 Hurricane and Tropical Storm Vulnerability Assessment

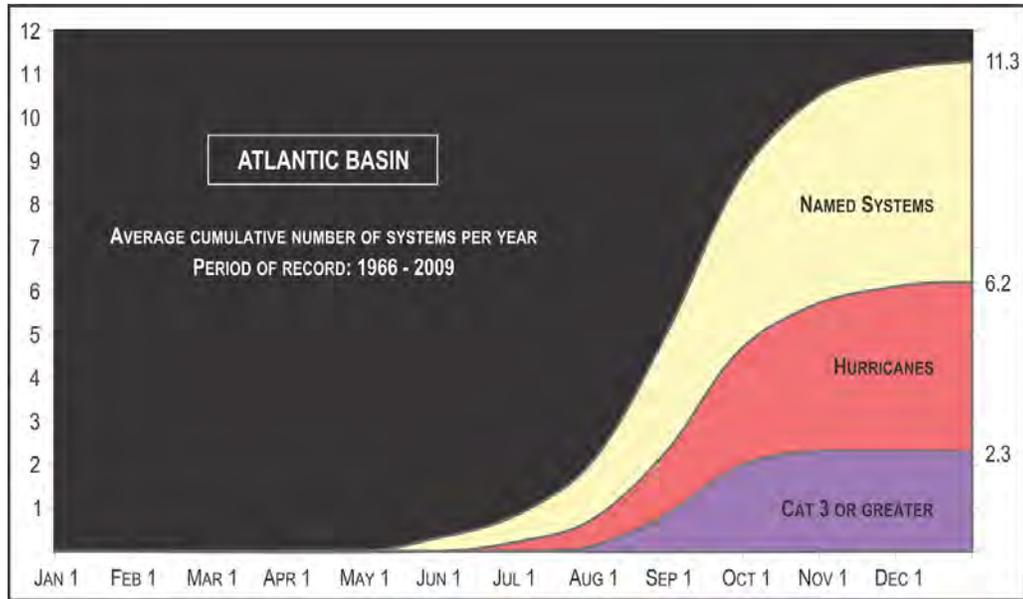
#### Likelihood of Future Occurrence—Likely Vulnerability—High

The heavy rains associated with tropical weather systems are not only responsible for major flooding in areas where the storm initially strikes, but can also affect areas hundreds of miles inland. Torrential rains from hurricanes and tropical storms can produce extensive urban and riverine flooding, especially if the storm systems are large and slow moving. Winds from these storms located offshore can drive ocean water up the mouth of a river or canal, compounding the severity of inland overbank flooding.

In addition to the combined destructive forces of wind, rain, and lightning, hurricanes can cause a surge in the ocean, which can raise the sea level as high as 25 feet or more in the strongest hurricanes. As a hurricane approaches the coast, its winds drive water toward the shore. Once the edge of the storm reaches the shallow waters of the continental shelf, the water begins to pile up. Winds of hurricane strength eventually force the water onto the shore. At first, the water level climbs slowly, but as the eye of the storm approaches, water rises rapidly. Furthermore, storm surge can also cause extensive damage on the backside of a hurricane as storm surge waters are sucked back out to sea.



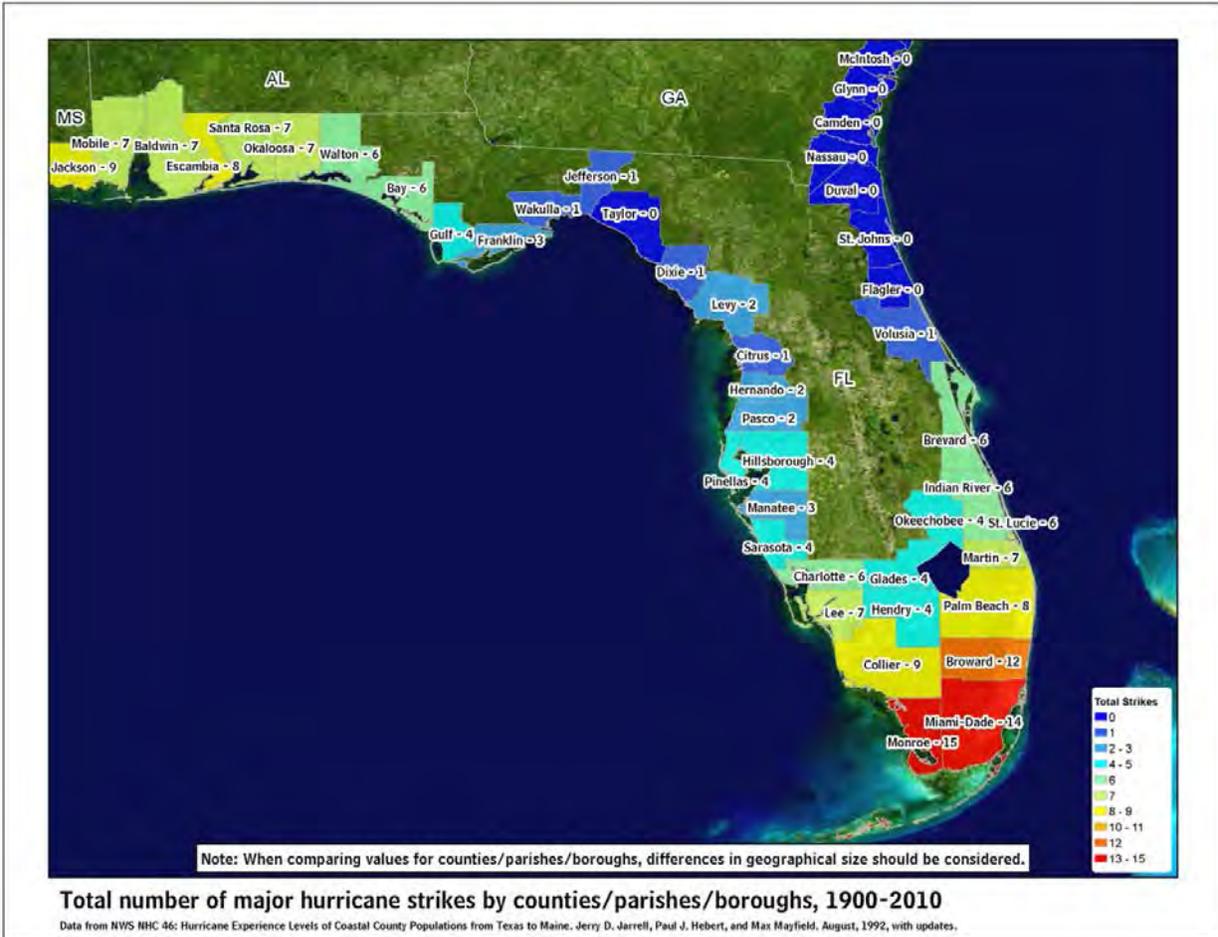
The Atlantic hurricane season runs from June 1st to November 30<sup>th</sup>. The Atlantic basin includes the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico. Figure 3.34 shows the progress of a typical hurricane season in terms of the total number of tropical systems and hurricanes produced throughout the year in the Atlantic basin. The curves represent the average cumulative production of all named tropical systems, all hurricanes, and those hurricanes which were Category 3 or stronger in those basins.



Source: NOAA/National Hurricane Center

**Figure 3.34 – Average Number of Tropical Storms Per Year (Atlantic Basin)**

Figure 3.35 represents the average number of hurricane strikes for Miami-Dade County from 1900-2010.



Source: NOAA/National Hurricane Center

**Figure 3.35 – Major Hurricane Strikes – Miami-Dade County**

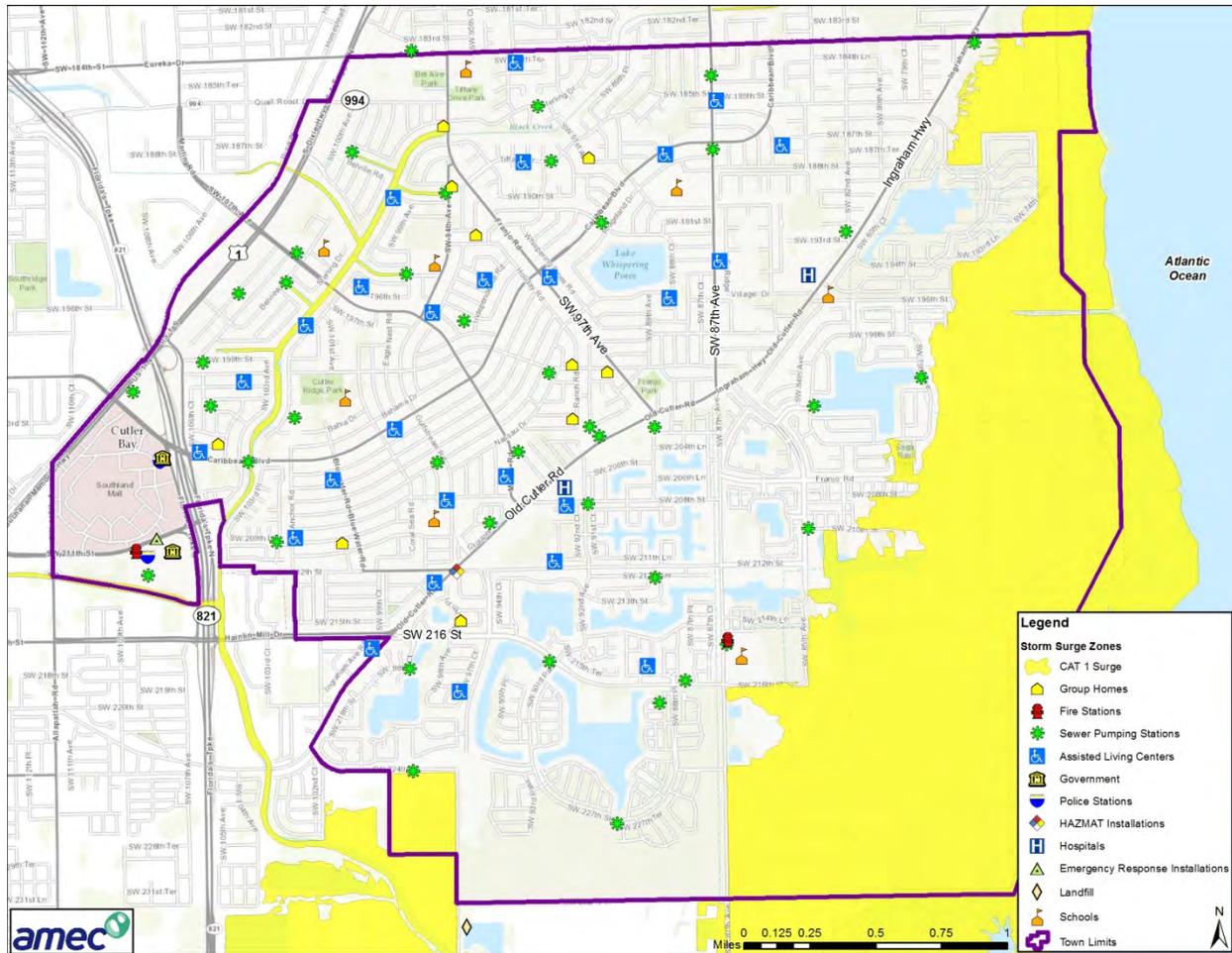
### Methodology

A hurricane surge analysis was conducted by intersecting the parcel layer provided by Miami-Dade County with the polygon shapefile for each hurricane surge layer. The polygon shapefiles depicting each hurricane surge zone were created using a Surge Modeling application created for the Florida Statewide Regional Evacuation Update Study. The data was derived from National Hurricane Center SLOSH model runs on all the NOAA SLOSH basins throughout Florida. The runs create outputs for all different storm simulations from all points of the compass. Each direction has a MEOW (maximum envelope of water) for each category of storm (1-5), and all directions combined result in a MOMs (maximum of maximums) set of data. The MOMs are used in this surge model. The application uses three input parameters or data: elevation (from LIDAR), SLOSH basin results, and contiguous shoreline or sea polygons.

### Assets at Risk

Figures 3.36 through 3.40 and Tables 3.40 through 3.44 provide a summary of assets at risk to hurricane surge based on each hurricane category. The assets at risk estimate for each hurricane category is based on the total of improved and contents value. The value of land is not included in the loss estimates as generally the land is not subject to loss from hurricane and tropical storm damage. When compared to the

vulnerability of predicted flood level models (SLOSH) resulting from hurricane storm surge, almost the entire Town becomes vulnerable to property damaging flooding from a Category 3 or stronger hurricane. Based on NOAA's Storm Surge Inundation (SLOSH Maximum of Maximums – worst case including high tide) Mapping concludes that in a category 1 hurricane, Cutler Bay can expect up to 3 feet of surge.



Source: Florida Division of Emergency Management (<http://www.floridadisaster.org>)

**Figure 3.36 - Category 1 Storm Surge Impact in Cutler Bay**

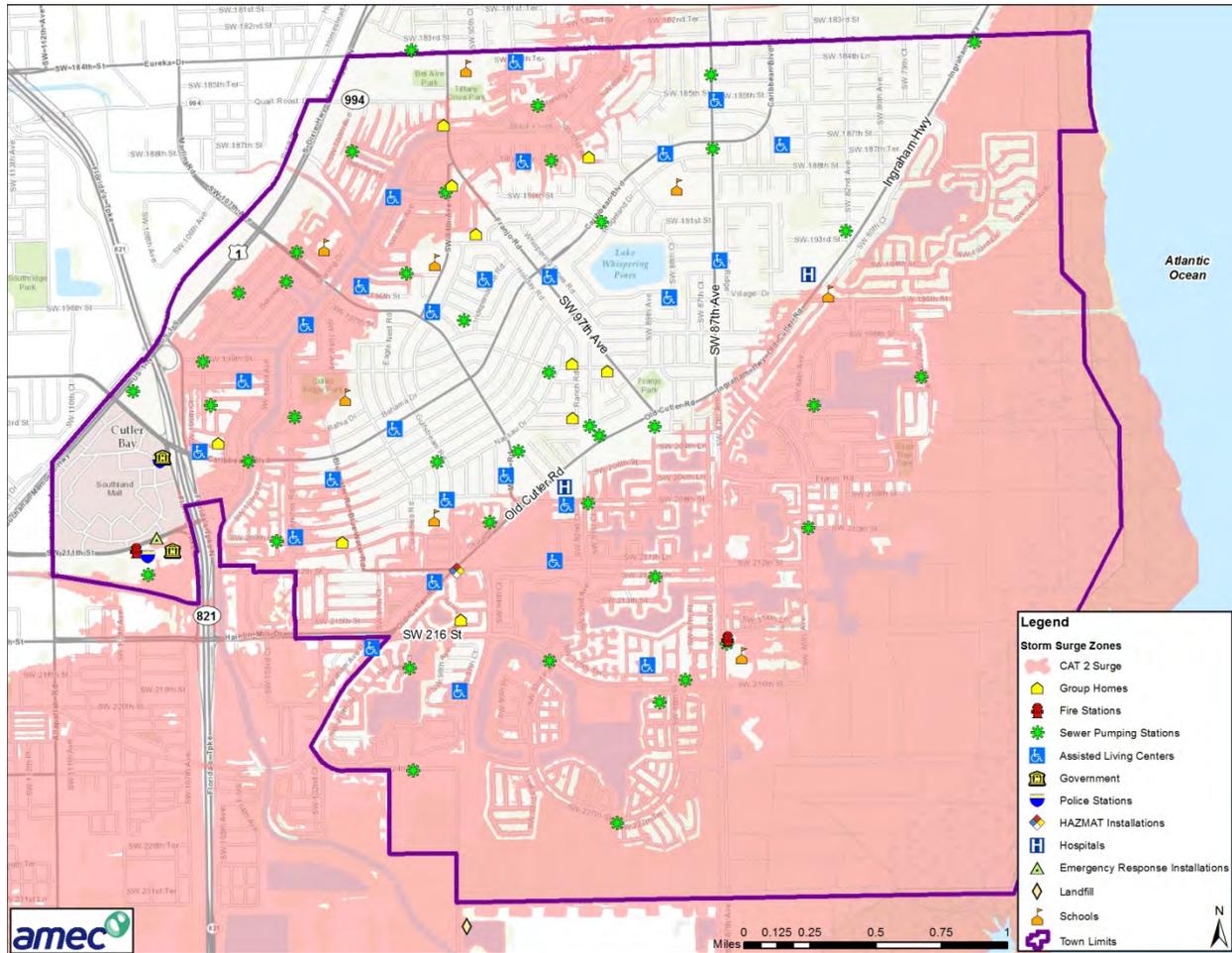
**Table 3.40 – Cutler Bay Assets at Risk to Category 1 Storm Surge**

Land Use	Total Parcel Count	Improved Parcel Count	Land Value	Improved Value	Estimated Content Value	Total Value <sup>1</sup>
Residential	131	131	\$10,088,847	\$36,473,796	\$18,236,898	\$54,710,694
Commercial	0	0	\$0	\$0	\$0	\$0
Education	0	0	\$0	\$0	\$0	\$0
Government	50	2	\$32,322,041	\$8,043,297	\$8,043,297	\$16,086,594
Religious	0	0	\$0	\$0	\$0	\$0
Other	113	0	\$10,552,203	\$28,264	\$28,264	\$56,528
<b>Total</b>	<b>294</b>	<b>133</b>	<b>\$52,963,091</b>	<b>\$44,545,357</b>	<b>\$26,308,459</b>	<b>\$70,853,816</b>

Source: Miami-Dade County 2013 Tax Assessor's Data, NOAA, FDEM

<sup>1</sup>Total value does not include land value.

In a category 2 hurricane, Cutler Bay can expect greater than 3 feet (but less than 6 feet) of storm surge based on NOAA's Storm Surge Inundation Mapping.



Source: Florida Division of Emergency Management (<http://www.floridadisaster.org>)

**Figure 3.37 - Category 2 Storm Surge Impact in Cutler Bay**

**Table 3.41 - Cutler Bay Assets at Risk to Category 2 Storm Surge**

Land Use	Total Parcel Count	Improved Parcel Count	Land Value	Improved Value	Estimated Content Value	Total Value <sup>1</sup>
Residential	8,394	8,371	\$225,410,153	\$775,162,872	\$387,581,436	\$1,162,744,308
Commercial	13	12	\$27,537,135	\$14,216,393	\$14,216,393	\$28,432,786
Education	9	9	\$12,322,287	\$42,153,052	\$42,153,052	\$84,306,104
Government	77	10	\$46,475,637	\$35,654,656	\$35,654,656	\$71,309,312
Religious	6	6	\$6,511,468	\$11,265,018	\$11,265,018	\$22,530,036
Other	461	6	\$51,115,775	\$14,339,906	\$21,153,079	\$35,492,985
<b>Total</b>	<b>8,960</b>	<b>8,414</b>	<b>\$369,372,455</b>	<b>\$892,791,897</b>	<b>\$512,023,634</b>	<b>\$1,404,815,531</b>

Source: Miami-Dade County 2013 Tax Assessor's Data, NOAA, FDEM

<sup>1</sup>Total value does not include land value.