Broward County
Emergency Management

ENHANCED LOCAL MITIGATION STRATEGY (ELMS)

for
Broward County
and its
Municipalities

September 2017

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Preface

The Broward County Local Mitigation Strategy (LMS) was developed in 1997, 1998, 1999, and 2004, 2009, 2012 and 2017. It was first adopted in March 2000, a follow-up revision was then adopted by the Broward County Board of County Commissioners (BOCC) in April 2005 (Resolution #2005-344), and finally, the most recent official submission to FEMA was adopted by Resolution by the BOCC on January 5, 2010 (Resolution 2010-015). This document was reviewed by the Florida Division of Emergency Management for compliance and consistency with the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended by Section 322 of the Disaster Mitigation Act of 2000 (P.L. 106-390); the National Flood Insurance Act of 1968, as amended by the National Flood Insurance Reform Act of 2004 (P.L. 108-264); and 44 Code of Federal Regulations (CFR) Part 201 – Mitigation Planning, inclusive of all amendments through September 16, 2009.

In some chapters of the updated Broward County LMS for the year 2009, the data originally submitted in 2004 remained in the LMS as they identify the background and development of the LMS. In 2011-2012, at the County's initiative, the LMS was again updated. The County included enhanced components beyond FEMA's and the State of Florida's planning requirements to produce an "Enhanced LMS" (ELMS). The 2017 update of the plan further expands the hazard identification and vulnerability assessment components to examine new emerging threats and hazards for possible inclusion. The ELMS conforms to the scope of work items in the FEMA mitigation grant, while also closely mirroring the FEMA Enhanced State Mitigation Plan regulations (where appropriate for locals) and the State's preliminary draft Enhanced Plan Guidance. For facilitating the ELM planning process and preparing the ELMS plan, the County hired a consulting firm to oversee the development of it.

Overall, the ELMS has been the County's strategy for positive change for the County's mitigation program in multiple ways. For the ELMS, a beneficial cost-effectiveness screening tool and a framework for a more robust integration of hazard mitigation into the county's core civic business processes (e.g., comprehensive planning, capital improvement funding) was created. The ELMS has also been the drive of more involved mitigation partnering opportunities for the Emergency Management Division, Risk Management Division, the County's property insurer, and the Broward County Government Operations Climate Change group [for more information on the Climate Change, see the "Sea Level Rise/Climate Change" subsection in Chapter 4; for more information on the County's Climate Change group, see the Capability Assessment subsection of Chapter 6]. These partnerships are broadening the reach of mitigation beyond emergency management to other vital county decision-making and investment processes. For example, the County is seeking to better integrate mitigation into yearly, on-going decisions about county growth, investment, and redevelopment, as well as partnering with other successful efforts, like climate change adaptation that share similar goals.

The ELMS process has helped and will continue to explore short term and long term strategies and mitigation opportunities on a longer time horizon (i.e., 10 to 20 years) than the required 5-year update, for which the initial steps should be started immediately. For example, climate change action efforts may take longer to plan and implement as well as measures included for funding under the Capital Improvement Plan (CIP), which is typically a 10-year horizon. The following list includes the primary ELMS components that will lead to more robust integrated mitigation efforts in the County:

INCREASED MITIGATION EFFECTIVENESS	HOW ACCOMPLISHED
A more detailed look at the County's risk to natural hazards	➢ New sea level rise subsection ➢ Detailed economic hot spot analysis describing risk in key economic areas ➢ Updated Hazus runs for wind and flood hazards ➢ Updated hazard profile information
Emphasis on collaboration and coordination with other agencies and organizations, especially municipalities, the private sector and other similar groups(Climate Change Government Action Group)	➢ Reinforce the Climate Change Task Force's Adaptation Action Areas for long term planning ➢ Coordination with Risk Management and county insurer to collaborate on additional mitigation ➢ Reinvigorated Private Sector Committee ➢ Encourage municipalities to increase CRS class rating and provide training/awareness opportunities ➢ Multiple opportunities and forums for discussing risk, actions, and priorities
Integration into other pre- and post- disaster recovery processes	➢ Better integration with recovery planning (all documents under the Broward County Recovery Plan. These include the Recovery Support Functions (RSF), the Recovery Framework, Damage Assessment and Infrastructure. ➢ Quickly identify opportunities to do Public Assistance 406 Mitigation by providing training on eligible projects, pre-identification of potential projects, when to identify and implement projects, and how to potentially comingle with other funding sources to maximize disaster resiliency ➢ Prepare post-disaster SOP for vulnerable facilities ➢ Disaster Housing (integration of Housing Vulnerability into ELMS) ➢ Identify in Continuity of Operations (COOP) plans facilities that need additional mitigation to preserve function in post-disaster environment
Integration into community planning processes	➢ County seeks to find ways to better integrate mitigation into comprehensive planning and capital improvement planning ➢ County encourages municipalities to follow this process and provides tools to do so
Development of innovative tools to increase local mitigation funding	➢ Support future reorganization of the Mitigation Assessment Team (MAT) tool, which provides a mechanism for considering

INCREASED MITIGATION EFFECTIVENESS	HOW ACCOMPLISHED
	mitigation for each community investment (not just post-disaster and mitigation grants); helps instill a mindset to always consider mitigation)
Continued use of the Loss Estimation Tool to better evaluate mitigation project ideas for FEMA funding	➢ Loss Estimation Tool (LET), which helps screening of potential mitigation projects to measure cost-effectiveness for FEMA mitigation programs ➢ Revise project prioritization criteria to better identify high quality, eligible-type, and effective hazard mitigation grant projects
Review past mitigation actions to better define and validate their effectiveness *Exercise of recovery and mitigation actions, strategies, and objectives to increase likelihood of success in post-disaster environment*	➢ Reinforce important mitigation funding opportunities like Public Assistance 406 program in immediate recovery ➢ Include hazard mitigation in emergency management training classes to heighten awareness for increasing the likelihood of project identification during response and recovery ➢ Identify key officials and issues ➢ Establish support networks ➢ Increase the effectiveness of working relationships

The following are the most prevalent benefits of the ELMS for Broward County:

- Better educated and aware agencies and municipalities
- More channels for hazard mitigation integration and intra-county coordination (e.g., project identification, outreach and education, county funded mitigation, recovery, community planning processes, federal grants)
- Establishment of working relationships pre-disaster with multiple key stakeholders
- More community funding to mitigation: 1) piggyback on the county insurer's requirements; 2) look for mitigation opportunities in CIP process; 3) partner with County Government Operations Climate Change and LEED group
- Initial screening of mitigation project candidates focuses County and municipal efforts on project ideas more likely to be eligible under FEMA programs
- Increased discussion of best practices and lessons learned including input from jurisdictions and organizations outside of Broward
- Increased participation in CRS

- Using the EMAP Hazard Mitigation standards as a benchmark and best practices. Ensuring the ELMS continues to meet the EMAP Hazard Mitigation standards augments the existing mitigation program and develops a greater ability to recover more quickly from disasters.

- Creation of a more robust and comprehensive hazard mitigation program in Broward County that will make the County and its municipalities more disaster resistant and resilient

During the ELMS development in 2016-2017, the Preface and Chapters 1 through 7 were updated as were several of the Appendices (see below). As part of the 2017 update, Appendix K (formerly the EMAP Crosswalk) became the Hazards Summary Profile that was cited as a best practice from an assessor during the Program's onsite EMAP assessment. The synopsis of the changes and additions to the 2012 ELMS are identified as follows:

Chapter 1 - Introduction

Description of additions to the LMS document as a result of the ELMS planning process.

Chapter 2 - Broward County Profile

The Broward County Profile was revised with updated demographic and economic data to reflect current conditions in Broward County.

Chapter 3 - Planning Process

The original Planning Process and the 2002 update remains part of the LMS documentation, as it gives a history of the development of the LMS. In 2009, the chapter was revised to further define the LMS Working Group and the new Executive Committee. This chapter was again updated in 2011-2012 and again in the 2017 update to incorporate findings from meetings that occurred during the ELMS planning process, which includes an emphasis on the CRS program and engagement with the Planning Subcommittee to oversee the plan update cycle.

Chapter 4 - Risk Assessment

This chapter underwent major revisions and updates in 2009, 2011-2012 and again in 2017 to more accurately depict risk for Broward County and its municipalities to all hazards. Where noteworthy hazard events occurred since the last plan update, this information was recorded (through July 2017). In June 2017, a county-wide Hazard and Vulnerability Assessment Workshop was conducted with all stakeholders and yielded a corrective actions document. The risk data in the tables and figures were evaluated for current validity. If key risk data was insufficient, the information was updated. This chapter also includes a subsection on climate change and sea level rise.

Chapter 5 – Economic Vulnerability

This chapter builds on the updated wind, flood, and sea level rise hazard risk information presented in Chapter 4. It goes into much greater detail for the wind and flood hazard in key economic areas of the County (e.g., downtown Fort Lauderdale). This chapter focuses on the impact of major flood and wind events on key parts of the Broward County economy, specifically its commercial properties. After a broad overview of the damages, the chapter focuses on the intersection of the areas of highest concentration of commercial facilities with the highest risk from flood and wind. These areas are referred to as 'hot spots' and are the primary drivers of the Broward County economy. Any substantial commercial damage in these areas would cause

significant direct and indirect losses. A significant economic disruption in these areas would ripple throughout the County, the South Florida region, the state and beyond.

The chapter includes detailed projected wind and flood loss estimations and impact scenarios for the 'hot spots' beyond what is in Chapter 4. This chapter also includes potential impacts from sea level rise and estimated property tax and sales tax losses.

Chapter 6 - Mitigation Initiatives

The updated Mitigation Initiatives chapter remains consistent with the 2009 and 2012 plans but has been revised to reflect current goals, objectives, and community actions. It also provides information on the project review and prioritization process as well as the incorporation and/or description of tools developed under the ELMS project (Loss Estimation Tool, Mitigation Assessment Team tool). In addition, the chapter has a section detailing compliance with Element 15 (Identification and Analysis of Mitigation Actions: NFIP Compliance) of the FEMA Planning Guidance.

Chapter 7-Plan Maintenance

The plan maintenance and updating procedures in this Chapter were updated in 2017 to ensure continued compliance with the Emergency Management Accreditation Program (EMAP) standards. This section was revised during the ELMS process to include additional ways to integrate mitigation into other planning mechanisms.

Appendix A – Project Prioritization Matrix

A new Project Prioritization matrix was developed for the County in 2012 and revised as part of the EMAP self-assessment phase for Broward County in 2016. Once approved by the Executive Committee, all current and future projects in Appendix C will be scored and ranked accordingly. This Project Prioritization matrix underwent a reevaluation in 2011/2012 and again in 2016 for clarity and effectiveness.

Appendix B – Proposed Mitigation Project Form

The Plan includes a revised LMS Proposed Project Form used to submit projects that reflects criteria in the Project Prioritization Matrix, key information needed to understand FEMA grant program eligibility, and information needed for CRS Activity 510.

Appendix C – Mitigation Project List

This list was updated on January 1, 2012 and it was recommended to the county to revise it again later in 2012 with subapplicants resubmitting their projects through the new Proposed Mitigation Project Form which was updated in 2016 to include consideration of hazards of most significant concern. The status for each project is included. Projects that have been completed or no longer viable are listed separately at the bottom of the list. This list has been evaluated and the projects that are not eligible for FEMA mitigation grants have been moved to a separate tab in the spreadsheet. As of August 2017, a new WebEOC LMS Dashboard is currently under development for use by the LMS Working Group as a way of submitting proposed projects for review and.

Appendix D – LMS Membership List

Updated with current membership as of January 31, 2017 and reflects the Flood/CRS Subcommittee which also serves as the county's first ever CRS User Group.

Appendix E – Planning Process Support Documents

Changes made in 2017 to reflect the ELMS meetings in 2016-2017.

Appendix F - Resolutions
Includes most current resolutions.

Appendix G – Discontinued ELMS Hazard Profiles (Formerly the CRS/NFIP Supporting Documentation)
Newly revised as part of the 2017 update, this appendix contains previous ELMS version Hazard Profiles that are no longer considered Hazards of Most Significant Concern as a result of the 2017 Risk and Vulnerability Assessment Workshop. Copies of CRS Form AW-214 or 3/5 year Cycle approval documentation for participating CRS communities are now being maintained by CRS Coordinators at the municipal level and are accessible through the LMS CRS Subcommittee/User Group.

Appendix H – Local Enhanced Plan and Mitigation Integration Summary
The Repetitive Loss Property information for the County is tracked by Broward County Emergency Management in accordance with FEMA guidelines. It is protected from release by the Privacy Act of 1974, 5 U.S.C. Section 552(2) and not available to the general public. Therefore, a decision was made to open this appendix to a document available to the general public, the Mitigation Integration Summary. This appendix includes recommendations on how to meet the proposed draft Local Enhanced Plan requirements from Florida. This appendix also includes a summary of plan integration efforts.

Appendix I – Critical Facilities
This appendix shows Table 4.28, At-Risk Critical Facilities (Coastal Flood Events)

Addition of the following appendices in 2012 and updated in 2016-2017:
Appendix J – Housing Vulnerability and Coastal Construction Recommendations
This appendix provides maps and narrative depicting, on a county-wide basis, the vulnerability of the residential housing stock to hurricane winds and flooding. The appendix also includes a map showing the relative age of the building stock in relation to prevalent building codes which gradually increased both wind and flood protection standards for residential buildings. Also updated in 2017 to include recommendations for coastal construction based on the FEMA P-550 document.

Appendix K –Hazards Summary Profile (Changed from EMAP Crosswalk to Hazards Summary Profile in 2016 and updated in 2017)
Describe the consequence analysis on the impacts of the following: public, responders, continuity of operations, property, facilities and infrastructure, the environment, economic condition and public confidence in the Broward County's ability to govern.

Appendix L – Loss Avoidance Studies (LAS)/Loss Estimation Tool (LET)
Includes LAS study conducted in 2011-2012 and LET for flood and wind projects.

Appendix M – Grant Funding Sources Table
In tabular format, a listing of various potential funding sources for mitigation projects is included.

Appendix N – HSEEP Workshop Results
The summary of the June 26, 2017 HSEEP-compliant mitigation workshop is included. This workshop included the following components: 1) Introduction of prioritization criteria and

exercise to determine vulnerabilities to hazards. Feedback from the group was used to revise it; 2) Discussion of Economic Vulnerability, cyber, and Housing Vulnerability sections.

Appendix O – MAT Tool

Includes a pre-mitigation matrix with different mitigation project ideas based on the hazard.

Chapter 1: Introduction

Prior to the creation of the LMS, there was no existing comprehensive, cohesive, or coordinated hazard mitigation program established for Broward County and its 31 municipalities to deal with emergency response and recovery issues, long and short-term planning issues, and economic issues relating to mitigation. The development and implementation of a local mitigation strategy provides a mechanism to address issues that will reduce or eliminate exposure to hazard impacts.

The Disaster Mitigation Act of 2000 (DMA 2000) requires all local governments to have a hazard mitigation plan in place in order to receive mitigation funding from the Federal Emergency Management Agency (FEMA). The DMA 2000 (Public Law 106-390) indicates that as of November 1, 2004 any local government that does not have a FEMA approved hazard mitigation plan in place is not eligible to receive federal pre- or post-disaster hazard mitigation funding. This Plan represents all jurisdictions in Broward County.

FEMA defines hazard mitigation as any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event. Mitigation planning is defined as a process for systematically identifying policies, activities, and tools that can be used to implement those actions.

The LMS has the on-going support of all Broward County municipalities, private sector, and nonprofit organizations. This document will be utilized as a viable working tool to mitigate losses. Mitigation will be institutionalized at the local level through the local mitigation strategy review process. Entities are encouraged to continue to identify and prioritize projects on a frequent basis and not just part of the annual review process.

Broward County's 1.9 plus million residents are the ultimate benefactors of this hazard mitigation project. An immediate short-term benefit of this project is to provide a forum for discussion and implementation of mitigation for Broward County. Minimizing and breaking the repetitive cycle of destruction and rebuilding after a disaster is a long-term goal that may be achieved by the implementation of this strategy.

The Enhanced LMS plan document and planning process continues to evolve to meet and/or exceed federal and state requirements with a goal of increasing its effectiveness including:

- More coordination with the private sector through the Private Sector Committee
- More emphasis on the county and municipalities obtaining more CRS credit points to improve their CRS Class Rating through a more robust CRS Subcommittee and CRS User Group
- Inclusion of a representative from the Broward County Climate Change Action Task Force
- Development of tools that will help determine better candidates for FEMA mitigation grants by looking at the degree of risk as determine by potential future losses
- Development of a process/tool that can help identify year-round mitigation opportunities which include new construction, retrofits, upgrades, and enhancements
- Methodology for integrating with other county and municipal planning mechanisms including comprehensive plans and capital improvements plans

LMS Working Group

The LMS Working group consists of designated representatives from each municipality, county government representatives that address the issues of unincorporated portions of the county and county owned facilities, Hospitals, School District, Universities, Housing Authorities, and Private Sector companies. State and federal agencies are also represented. The makeup of the Working Group is not limited to the aforementioned entities. On the contrary, anyone who desires to participate in the LMS is welcome to do so.

LMS Committees

In order to better structure the working groups' activities, several committees work at addressing a specific area of concern. The Executive Committee serves as the overall governing body of LMS, represented by the chairperson and alternate of each subcommittee, the LMS Working Group chair, and the LMS Coordinator. It also acts as the review committee for the ELMS Plan adoption and the prioritization of LMS projects. Membership on any committee shall be voluntary and subject to the review of the Working Group. A committee member who fails to attend a reasonable number of committee meetings may be dropped from participation in the committee by a majority vote of the other members of that committee. Other Committees that have been formed are the Education and Training Subcommittee, the Planning Subcommittee, The CRS Subcommittee/User Group and Private Sector Subcommittee.

Chapter 2: Broward County Profile

Geography

Broward County comprises 1,323 square miles, located on the South Florida Peninsula, between the Atlantic Ocean and the Everglades. It is bordered by Miami-Dade County to the south, Palm Beach County to the north, Collier County to the west, and Hendry County to the northwest. The County is characterized by flat low-lying topography, mostly less than ten feet (averaging 6 feet) above mean sea level, which must be drained and reclaimed to be developed. Additionally, 4.9 square miles adjacent to U.S. 27, have been designated and acquired for conservation in the East Coast Buffer/Water Preservation Area. The County has 24 miles of coastline and 300 miles of inland waterways. There are 2 state parks in Broward County. Attractive sand beaches and a subtropical climate have led to development of the County's tourism industry. Most beachfront land is built up with high-rise hotels and condominiums. Westward expansion of development continued through the first decade of the 2000's. Though the County is rapidly approaching a build-out state population growth continues with redevelopment of areas within a broad swath of Central Broward extending north and south from county-line to county-line.

Broward County is accessible by road, rail, air, and sea. There are 3 interstate highways and Florida's Turnpike. Interstate 95 and the Turnpike provide the primary north-south connections. There are 2 north-south rail corridors that extend into Miami-Dade and Palm Beach counties: the Florida East Coast Railroad Company railway and the South Florida Rail Corridor (formerly CSX). Port Everglades seaport is the world's third largest cruise-port. About 105 million tourists come through the Port annually. Unlike most U.S. seaports, exports at Port Everglades significantly exceed imports (more than $13.6 billion in exports versus nearly $13.5 billion in imports in calendar year 2014). Cargo growth is climbing to pre-2007 numbers, before the down-turn of the economy. Fort Lauderdale-Hollywood International Airport passenger counts have almost tripled, to 29.2 million in 2016 from 9.9 million in 1995. Air freight has gone up 22% after a significant decrease five years ago.

South Florida's Water Conservation Areas (WCA) 2 and 3 are two sections of northern Everglades. Water Conservation Area 2 (WCA-2) is a sawgrass wetland that encompasses an area of 210 square miles and represents the smallest of the three Everglades Water Conservation Areas. Approximately 58 percent of the inflow water entering WCA-2 originate from the Everglades Agricultural Area (EAA). Water Conservation Area 3 (WCA-3), the largest of the three Everglades WCA's, is located in western Dade and Broward counties. WCA-3 covers an area of 915 square miles. The area is predominately a vast sawgrass marsh dotted with tree islands, wet prairies, and aquatic sloughs. The underdeveloped WCA makes up two-thirds of Broward County square mileage (see Map 4.1) and serve multiple water resource and environmental purposes, including flood control, water supply and habitat for South Florida's plant and animal communities. Ownership of the WCA's is mixed, with State, South Florida Water Management District and private ownership. The State leases portions of its land to the Miccosukee Indian Tribe. The Florida Fish and Wildlife Conservation Commission is responsible for managing the area.

There are 31 municipalities in Broward County. According to the 2010 Census, these communities ranged in size from 24 (Lazy Lake) to 165,521 (Fort Lauderdale). Six cities each have more than 100,000 residents: Fort Lauderdale, Pembroke Pines, Hollywood, Coral Springs, Pompano Beach, and Miramar. Nine municipalities share the Broward County coastal area.

Demographics

Much of the demographic information from this section was primarily taken from the 2016 Population Estimate from the United States Census Bureau, 2010 & 2000 Census Collection, and 2015 American Community Survey (ACS) 1-Year Estimates. Broward County was the second most populous county in the State of Florida, with 1,909,632 people. At the 2010 Census (decadal) conducted on April 1, 2010, the population of Broward County stood at 1,748,066. The percentage population gain from 2010 to 2016 was 9.2% (an increase of 161,486 people).

Broward County is composed of 31 Municipalities as well as Broward Municipal Services District, also referred to as unincorporated areas. This data was not available for 1 of the 31 municipalities, West Park, which was incorporated in 2005. The most significant population increases over this decade were seen in Parkland (73%), Miramar (68%), and Weston (33%). In 2010, Fort Lauderdale (165,521) and Pembroke Pines (154,750) were the 2 largest Municipalities in Broward County, making up 18% of the total Broward County population (see **Table 2.2**).

In 2015, 297,738 people (15.7%) were 65 years of age or older, including 128,832 (7.0%) that were age 75 or older; there were also some 107,865 (5.9%) children under the age of 5 years. The percentages of people over 75 and under 5 years old have both decreased since 2000. Broward County's ethnic and racial diversity continues to increase with the Non-Hispanic Black population 29.7%, closely followed by the Hispanic population who is 1% behind, representing 28.0% of the total population.

Median age in Broward has increased from 37.8 in 2000 to 40 in 2015. This is in part because the population under 15 has increased by 2.3% (7,254 people) to 329,569 in the 2015 Census.

Another special population within Broward County is the Homeless population. The Homeless population (sheltered and unsheltered) in Broward County consists of about 2,766 people according to a count and survey conducted by the U.S. Housing and Urban Development from October 2014. This number represents a 27% decrease of Homeless people in Broward County from January 2011. The survey that was conducted occurred over a single 24-hour period. Due to the nature of the survey and count, and with a challenging economy, it is possible that this number does not accurately reflect the actual number of Homeless people within Broward County.

A third special population is Broward's prison population. This population can be looked at two ways. The number of individuals whose county of commitment is Broward County is 7,374 as of December 31, 2016 per the Florida Department of Corrections. The number of individuals incarcerated within Broward County is an average of 4,423 (January 2012) in County Facilities and 635 in the Florida Department of Corrections facility (January 5, 2012) which was the largest in the state.

The largest unique population to Broward County is the seasonal population. It is estimated that 500,000 people take residence in Broward County during the months of November through March.

The median household income in Broward County in 2015 was $51,968, 5% greater than the median household income for Florida. In 2015, 46,967 (7.0%) households in Broward County reported income of less than $10,000. 15% of all people are currently living below the poverty level in Broward County. Poorer households are least likely to be able to withstand a major disaster since they have limited resources to invest in mitigation measures and insurance.

As of 2015, Broward County had 741,043 total housing units, of which 654,445 were reported as occupied and 86,598 as vacant. There are more than twice as many owner-occupied units (454,750) in Broward as there are rentals (199,695).

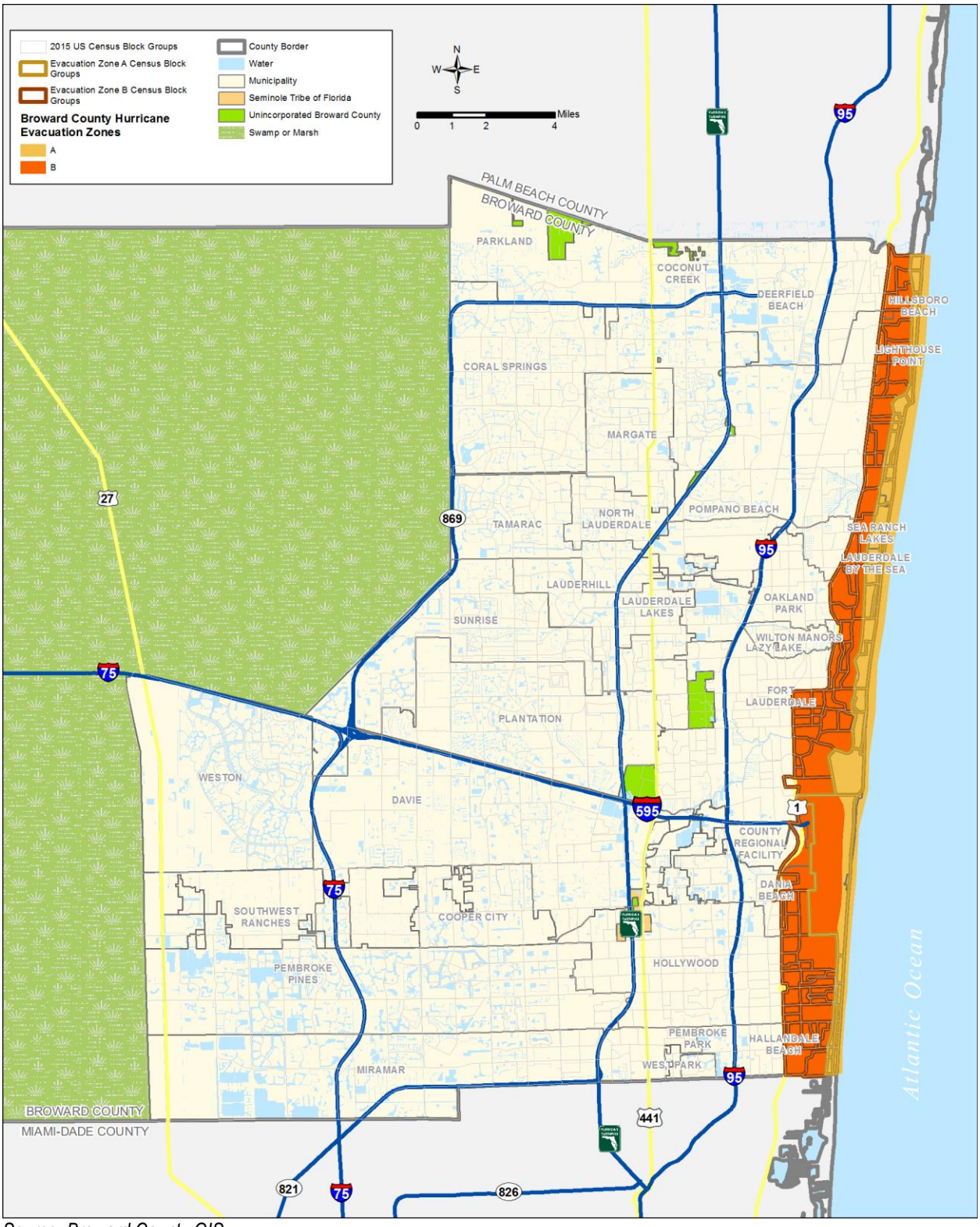
As the result of an elevation study conducted in the year 2000, there has been a significant reduction in the mandatory hurricane evacuation zones in Broward County. For a Category 1 & 2 hurricane, all areas east of the Intracoastal Waterway must be evacuated. For a Category 3 or higher storm, all areas east of Federal Highway (U.S. 1) must be evacuated. In addition, all mobile homes in Broward County must be evacuated for any level of hurricane regardless as to where they are located in the County. The following table gives the pertinent 2015 data for the mandatory evacuation areas from the Broward County Population Forecasting Model:

Table 2.1: Mandatory Evacuation Areas

Hurricane Evacuation Zone	Resident Population	Percentage of Total Population	Total Housing Units	Percentage of Total Housing Units
Categories 1 and 2 (Zone A)	46,551	2.64%	54,896	6.85%
Categories 3, 4 and 5 (Zone B)	100,236	5.54%	65,854	8.20%
Categories 1 – 5 (Zones A and B)	146,787	7.96%	120,750	14.83%

Source: 2015 ACS 5-Year Estimates

Map 2.1: Broward County Hurricane Evacuation Zones



Source: Broward County GIS

In 2000, as a result of the reduction of the mandatory hurricane evacuation zones, there had been a reduction of nearly 112,800 in the resident population that has to be evacuated for a Category 5 storm from around 261,600 based on evacuation zones prior to the year 2000 to around 148,800 for the evacuation zones established immediately following the 2000 Light Detection and Ranging (LiDAR) elevation study. There are currently 146,787 in the evacuation zones.

Senior citizens (retirees) make up a significant portion of those living in hurricane evacuation zones. The 2010 Census shows that some 43,900 residents living in hurricane evacuation zones were age 65 and older, or 29.9% of all persons living in evacuation zones. County-wide, some 14.3% of the population was over 65 at the 2010 Census. In the Category 1 and 2 evacuation zones, the areas that are most likely to be evacuated totals 46,552 residents which accounts for 2.64% of the total population. In Categories 3, 4, and 5 the resident population totals 100,236 persons over the age of 65 and accounts for 44% of population in the area.

According to the 2015 ACS 1-Year Estimates, there were 21,521 mobile homes in Broward County. This is a continuing reduction of units from over 15 years earlier. The number of mobile homes should continue to decline as there are virtually no new mobile home parks being established and several existing parks are being redeveloped for other uses including either permanent resident units or some other use.

Broward County has a diverse population with residents migrating here from all over the globe. Associated with this diversity is a multiplicity of languages. 61.1% of Broward's population speaks only English. Of the 675,026 residents that speak a language other than English, 265,498 do not speak English very well. A majority of those are Spanish speakers (420,598). 205,271 people speak other Indo-European languages and 31,291 people speak Asian and Pacific Islander languages. The ability to effectively communicate to residents is obviously a key element of successful emergency management, thus it is important to be aware of the languages spoken within Broward County to best tailor hazard mitigation planning in an understandable manner.

The following tables are the latest population figures for Broward County and its municipalities from the 2010 Census. The largest change was in Miramar with a population growth of 67.8%. This was due to the great amount of construction activity and the westward growth of new housing in the past decade.

Table 2.2: Current Municipal Populations and Percent Changes from 2000, 2010 and 2015

Jurisdiction	Population Census 2000	Population Estimate 2007	Population Census 2010	Population ACS 2015 5-Year Estimates	Percent Change 2000 - 2010	Percent Change 2007-2010	Percent Change 2010-2015
Coconut Creek	43,566	50,321	52,909	56,816	21.45%	5.14%	7.38%
Cooper City	27,939	29,311	28,548	33,382	2.18%	-2.60%	16.93%
Coral Springs	117,549	126,875	121,096	126,673	3.02%	-4.55%	4.61%
Dania Beach	20,061	28,288	29,639	30,878	47.74%	4.78%	4.18%
Davie	75,720	90,329	91,992	97,372	21.49%	1.84%	5.85%

Deerfield Beach	64,583	74,573	75,018	78,227	16.16%	0.60%	4.28%
Fort Lauderdale	152,397	183,606	165,521	173,570	8.61%	-9.85%	4.86%
Hallandale Beach	34,282	38,634	37,113	38,725	8.26%	-3.94%	4.34%
Hillsboro Beach	2,163	2,276	1,875	1,568	-13.31%	-17.62%	-16.37%
Hollywood	139,357	142,473	140,768	146,791	1.01%	-1.20%	4.28%
Lauderdale by the Sea	5,582	5,867	6,056	6,313	8.49%	3.22%	4.24%
Lauderdale Lakes	31,705	31,295	32,593	34,103	2.80%	4.15%	4.63%
Lauderhill	57,585	67,565	66,887	69,979	16.15%	-1.00%	4.62%
Lazy Lake	38	38	24	33	-36.84%	-36.84%	37.50%
Lighthouse Point	10,767	11,202	10,344	10,842	-3.93%	-7.66%	4.81%
Margate	53,909	54,602	52,284	55,678	-3.01%	-4.25%	6.49%
Miramar	72,739	108,240	122,041	131,384	67.78%	12.75%	7.66%
North Lauderdale	32,264	41,832	41,023	42,853	27.15%	-1.93%	4.46%
Oakland Park	30,966	42,151	41,363	43,347	33.58%	-1.87%	4.80%
Parkland	13,835	24,072	23,962	27,114	73.20%	-0.46%	13.15%
Pembroke Park	6,299	4,824	6,102	6,244	-3.13%	26.49%	2.33%
Pembroke Pines	137,427	146,828	154,750	162,243	12.61%	5.40%	4.84%
Plantation	82,934	84,370	84,955	89,904	2.44%	0.69%	5.83%
Pompano Beach	78,191	102,745	99,845	104,741	27.69%	-2.82%	4.90%
Sea Ranch Lakes	734	741	670	701	-8.72%	-9.58%	4.63%
Southwest Ranches	not available*	7,266	7,345	7,676		1.09%	4.51%
Sunrise	85,779	89,787	84,438	89,942	-1.56%	-5.96%	6.52%
Tamarac	55,588	59,668	60,427	63,227	8.71%	1.27%	4.63%
Broward Municipal Services District	129,437	18,412	17,357	17,491	-86.59%	-5.73%	0.77%
West Park	not available*	14,520	14,156	14,779		-2.51%	4.40%
Weston	49,286	64,157	65,333	68,423	32.56%	1.83%	4.73%
Wilton Manors	12,697	12,723	11,632	12,133	-8.39%	-8.58%	4.31%
TOTAL	**1,625,379**	**1,759,591**	**1,748,066**	**1,843,152**	**9.25%**	**-1.87%**	**5.44%**

Source: 2015 ACS 5-Year Estimates

Table 2.3: Other Key Demographic Data per Municipality

Jurisdiction	Percent of Total Population (2016)	Land Area (sq. miles)	Households 2016	Median Age 2016	Household Income
Coconut Creek	2.79%	12	23,868	40.04	$ 56,660.00
Cooper City	1.72%	8.5	9,645	40.09	$ 92,173.00
Coral Springs	6.69%	24	42,247	36.31	$ 70,632.00
Dania Beach	1.54%	8.5	13,733	40.12	$ 44,042.00
Davie	5.04%	35.6	35,732	37.15	$ 62,219.00
Deerfield Beach	4.00%	16.27	35,291	42.98	$ 40,191.00
Fort Lauderdale	9.28%	35.5	80,551	41.28	$ 52,279.00
Hallandale Beach	2.08%	4.4	19,155	46.99	$ 35,832.00

Jurisdiction	Percent of Total Population (2016)	Land Area (sq. miles)	Households 2016	Median Age 2016	Household Income
Hillsboro Beach	0.10%	0.47	1,190	65.72	$ 76,267.00
Hollywood	8.02%	28.87	61,649	41	$ 48,423.00
Lauderdale by the Sea	0.35%	1.5	3,759	59.09	$ 63,512.00
Lauderdale Lakes	1.87%	4.25	12,605	38.87	$ 35,052.00
Lauderhill	3.88%	8.6	26,138	35.52	$ 38,151.00
Lazy Lake	0.00%	0.07	16	44.0	$ 54,999.00
Lighthouse Point	0.58%	2.49	5,152	48.75	$ 78,869.00
Margate	3.06%	9.17	22,803	41.06	$ 45,332.00
Miramar	6.76%	31.00	41,919	34.14	$ 68,134.00
North Lauderdale	2.33%	5.2	13,563	31.62	$ 44,448.00
Oakland Park	2.36%	8.04	18,291	37.91	$ 45,794.00
Parkland	1.43%	12.769	10,003	38.27	$ 135,781.00
Pembroke Park	0.34%	1.6	2,459	35.08	$ 33,315.00
Pembroke Pines	8.42%	34.25	60,808	39.62	$ 64,504.00
Plantation	4.80%	21.77	37,013	38.94	$ 70,400.00
Pompano Beach	5.83%	25.08	45,201	41.87	$ 42,524.00
Sea Ranch Lakes	0.04%	0.23	387	53.74	$ 68,570.00
Southwest Ranches	0.41%	13	2,230	41.03	$ 111,425.00
Sunrise	4.80%	18.1	35,546	38.98	$ 51,746.00
Tamarac	3.34%	12	29,548	46.72	$ 45,177.00
Broward Municipal Services District	0.99%	not available	not available	not available	$ 45,089.00
West Park	0.79%	2.22	4,587	35.25	$ 41,326.00
Weston	3.52%	25.80	22,368	37.74	$ 98,505.00
Wilton Manors	0.66%	2.04	6,500	46	$ 53,462.00

Source: US Census Bureau 2010 and US Census Information found on the Greater Ft. Lauderdale Alliance website (www.gflalliance.org)

Economy

Broward County is located in the 8th largest Metropolitan Statistical Area (the Miami-Ft. Lauderdale-Pompano Beach MSA) in the country. Since Broward County is a Service and Retail-driven economy, there is no surprise that population growth brings along employment growth. While the population grew by 9.25% from 2000 to 2010, Broward's labor force continues to grow with an average labor force of 1,037,079. The unemployment rate for 2013 was 5.9% (61,292); 2014 was 5.8% (58,071); and 2015 was at 5.0% (49,980). According to the U.S. Department of Labor, the unemployment rate for 2017 has trended favorably with a May 2017 unemployment rate of 3.8%. In comparison, the rate was 10.1% in 2010.

According to the U.S. Bureau of Economic Analysis (BEA), Broward had a per capita personal income (PCPI) of $44,909 in 2015. This PCPI ranked 12th in the state and was 101 percent of the state average, $44,429, and 93 percent of the national average, $48,112. The 2015 PCPI reflected an increase of 4.6 percent from 2014. The 2014-2015 state change was 3.6 percent and the national change was 3.7 percent. In 2005, the PCPI of Broward was $38,294 and ranked 11th in the state. The 2005-2015 compound annual growth rate of PCPI was 1.6 percent. The compound annual growth rate for the state was 2.1 percent and for the nation was 3.0 percent.

In 2015, Broward had a personal income of $85,167,498. This personal income ranked 3rd in the state and accounted for 9.5 percent of the state total. In 2005, the personal income of Broward was $66,895,106 and ranked 3rd in the state.

As mentioned above, Broward's economy is dominated by service and retail industries. Most employees are included as Service employees. According to the Florida Agency for Workforce Innovation, Broward County is trending toward Trade, Transportation, and Utilities being the largest employer. The top 5 employment sectors in Broward County are currently Trade, Transportation, Trade and Utilities (22.7%); Professional and Business Services (16.9%); Government (13.2%); and Educational and Health Services (13%); Retail Trade (11%). Broward continues to lead in job growth with an annual increase of 30,200 jobs added in education and health services (6,400 jobs); professional and business services (11,700 jobs) and government (2,200 jobs); leisure and hospitality (3,400 jobs); construction (3,300 jobs); trade, transportation, and utilities (2,800 jobs) and manufacturing (400 jobs). These employment sectors make up 76.8% of the labor force.

The economy of 2008-2011 is in a period where there have been more employment reductions. Particularly hard hit has been the construction industries. Even at its peak in 2006, the construction industry accounted for only 7.8% (61,000 employees) of Broward's employment. It currently stands at 5.3% in 2015. Manufacturing employment has experienced a continuous decline since 2000 and still accounts for less than 4% of Broward's employment. Broward County's economy, remains a Service and Retail dominated economy.

Currently, the estimated market value of all property in Broward County (according to the Broward County Property Appraiser) is $374.6 million.

The following tables provide a breakdown of key economic areas by municipality. In most municipalities, the number of employees and businesses has increased. In municipalities that the number has grown, the greatest growth has been in businesses under 10 employees. Even in areas where the number of businesses has dropped, a growth is seen in businesses with lower employee counts. On average municipalities are showing greater expenditures than income.

Table 2.4: Key Economic Factors by Community (2016)

Jurisdiction	Total Establish-ments	Total Employees	Businesses with 1-9 Employees	Businesses with 10-99 Employees	Businesses with 100+ Employees
Coconut Creek	1,805	20,010	1,532	239	35
Cooper City	1,455	10,788	1,258	179	18
Coral Springs	5,785	48,183	4,914	787	84
Dania Beach (2009)	2,033	20,632	1,693	303	37
Davie	5,391	45,271	4,547	782	63
Deerfield Beach	4,943	55,151	4,075	788	81
Fort Lauderdale	17,769	190,551	14,777	2,731	261
Hallandale Beach (2009)	2,135	14,553	1,866	251	18
Hillsboro Beach	55	366	49	5	1
Hollywood	9,072	78,359	7,944	1,036	91
Lauderdale by the Sea	420	2,155	379	40	2
Lauderdale Lakes	1,279	10,570	1,089	172	15
Lauderhill	2,257	17,113	1,968	261	26
Lazy Lake (2009)	1	4	1	0	0
Lighthouse Point	680	4,774	580	92	8
Margate	2,417	19,737	2,091	296	31
Miramar	3,694	37,772	3,143	468	83
North Lauderdale	784	6,013	681	95	7
Oakland Park	4,087	27,189	3,587	470	30
Parkland	625	4,081	556	61	6
Pembroke Park	605	4,935	509	88	8
Pembroke Pines	6,318	58,401	5,359	877	82
Plantation	5,245	52,050	4,426	749	70
Pompano Beach	8,032	71,840	6,703	1,211	117
Sea Ranch Lakes	70	352	65	5	0
Southwest Ranches	254	1,420	226	26	2
Sunrise	5,034	46,505	4,229	719	86
Tamarac	2,471	22,316	2,079	352	40
Broward Municipal Services District	not available	8,118	not available	not available	not available
West Park	642	3,410	577	61	4
Weston	2,599	24,569	2,240	316	43
Wilton Manors	1,098	6,346	984	106	9
TOTAL	**99,055**	**913,534**	**84,126**	**13,566**	**1,358**

Source: Florida Prospector website (www.floridaprospector.com)

Table 2.5: Key Economic Factors by Community (2016)

Jurisdiction	Labor Force Size	Job Growth Rate (2000-2010)	Unemploy-ment Rate	Household Income	Household Expenditures
Coconut Creek	32,833	14.1%	3.40%	$56,998.00	$55,799.00
Cooper City	21,071	2.7%	3.11%	$92,103.00	$78,086.00
Coral Springs	74,686	4.9%	3.95%	$70,950.00	$67,574.00
Dania Beach	17,204	12.3%	3.8%	$43,810.00	$48,943.00
Davie	56,528	8.5%	3.20%	$61,647.00	$63,905.00
Deerfield Beach	41,281	11.6%	3.80%	$40,117.00	$47,288.00
Fort Lauderdale	98,929	4.8%	4.00%	$52,307.00	$63,409.00
Hallandale Beach	20,130	10.5%	5.50%	$38,263.00	$45,017.00
Hillsboro Beach	772	20.8%	1.42%	$75,718.00	$78,743.00
Hollywood	81,745	2.8%	4.24%	$48,548.00	$52,841.00
Lauderdale by the Sea	2,945	9.5%	3.23%	$63,487.00	$77,117.00
Lauderdale Lakes	18,473	7.9%	6.65%	$35,066.00	$40,123.00
Lauderhill	37,491	4.2%	5.94%	$38,182.00	$43,384.00
Lazy Lake	18	-27.3%	0.00%	$54,999.00	$66,307.00
Lighthouse Point	6,061	2.3%	2.77%	$79,128.00	$82,875.00
Margate	31,493	6.6%	4.05%	$45,541.00	$48,064.00
Miramar	77,100	49.1%	3.60%	$68,547.00	$62,282.00
North Lauderdale	24,078	1.5%	3.90%	$44,688.00	$45,296.00
Oakland Park	26,912	0.5%	3.50%	$45,840.00	$48,220.00
Parkland	16,812	72.4%	2.80%	$137,203.00	$110,151.00
Pembroke Park	3,107	5.4%	4.22%	$33,432.00	$37,754.00
Pembroke Pines	90,528	17.3%	3.53%	$64,895.00	$60,422.00
Plantation	53,496	3.5%	3.30%	$70,586.00	$67,875.00
Beach	53,177	4.3%	4.60%	$42,491.00	$49,914.00
Sea Ranch Lakes	385	10.1%	5.45%	$68,570.00	$86,764.00
Southwest Ranches	4,325	not available	3.65%	$111,425.00	$100,776.00
Sunrise	52,079	2.1%	3.50%	$51,948.00	$52,842.00
Tamarac	34,116	12.7%	3.60%	$45,360.00	$47,732.00
Broward Municipal Services District	8,118	not available	16.5%	$45,089.00	not available
West Park	7,651		6.17%	41,814.00	43,814.00
Weston	36,234	38.8%	3.04%	$98,997.00	$87,398.00
Wilton Manors	12,470	-0.3%	4.33%	$53,530.00	$58,767.00
TOTAL	**1,042,248**	**10.81% (AVG)**	**4.19 (AVG)**	**$60,039.97 (AVG)**	**$61,918.77 (AVG)**

Source: Florida Prospector website (www.floridaprospector.com)

See Chapter 5, Economic Vulnerability, for greater detail and analysis about Broward County's overall vulnerability to flood and wind hazards and then detailed description and analysis of the vulnerability to major economic areas and sectors.

Chapter 3: Planning Process

Being at the forefront of emergency preparedness, the Broward County Board of County Commissioners appointed a Broward County Emergency Coordinating Council in 1981. This organization has been meeting monthly since its inception to address the emergency preparedness needs of the community. Members are comprised of municipalities, the County, private sector, and nonprofit emergency preparedness agencies.

The Emergency Coordinating Council membership was reviewed and updated and the committees were revised in 2009 and then again in 2011-2012. Realizing the vital importance of having mitigation practiced community wide instead of in piece-meal, the Mitigation Task Force was created to act as a subcommittee to address mitigation issues.

The Mitigation Task Force was created in October 1997 prior to the State's Local Mitigation Strategy Guidelines and the LMS State/County/Municipal contracts. Initial membership included county agencies, a coastal community representative, a non-coastal community representative, nonprofit groups, and the private sector. The Mitigation Task Force was expanded in March 2005 to include 31 municipalities, additional county agencies, and private and nonprofit groups to reach a total membership of 49 members. Monthly meetings were typically held just prior to the Broward Emergency Coordinating Council meetings.

In order to better align with the Mitigation Bureau at the Florida Division of Emergency Management (FDEM), the Mitigation Task Force was renamed as the LMS Working Group. In 2009, the Working Group established an Executive Committee to act as a governing body. As of June 2017, total membership in the Working Group was over 150.

In 2017, the County used a FEMA mitigation grant to update the ELMS plan. The following section will document this process including key meetings:

ELMS Process

The County hired the consulting firm, Elite Business Strategies, LLC., to assist in the update of the ELMS.

The ELMS plan development was coordinated through the LMS Executive and Planning Committees who participated in the LMS meetings and reviewed drafts of the plan at key stages (June 2017 draft, August 2017 draft, and final draft). These two committees were comprised of Broward County department staff, staff from municipalities, and other constituent organizations. The final draft of the ELMS plan was also posted on the Broward County ftp website in August 2017 for review by other committees, plan stakeholders, and the general public. As with any LMS meeting, the general public was welcome to attend in compliance with the Florida Sunshine law.

November 2-3, 2016 - Mitigation for Emergency Managers Course

Purpose: To provide initial training on the mitigation planning process and prepare the LMS Planning Subcommittee and other stakeholders for the upcoming ELMS update. Course taught by Broward and Miami-Dade Counties LMS Coordinators. Attendees: Sign in sheets provided as documentation in appendices.

November 9, 2016 – LMS Planning Subcommittee Meeting

Attendees: Representatives from Broward Emergency Management Division, Miramar, Plantation, Coral Springs, Margate, North Lauderdale, Broward County Public Works Department, Sunrise, Oakland Park, Broward County Planning Council and Hallandale Beach. (see sign in sheets for documentation in appendices.)

The projects in the Vendor scope of work were discussed with the Committee. This included the updates to Chapter 4 HIRA, Chapter 5 Economic Vulnerability, Vulnerability Assessment Workshop and completion of Appendices B, C, and K. Also, overall strategies for the ELMS and Working Group were discussed. The Committee discussed the need to initiate monthly planning meetings that would continue throughout the planning process.

December 15, 2016 – LMS Working Group Quarterly Meeting

Attendees: Representatives from Broward Emergency Management Division, Lighthouse Point, North Lauderdale, Pembroke Pines, Broward County Environmental Protection and Growth Management Department, Sunrise, Coral Springs, Hallandale Beach, Plantation, Miramar, Margate, Cooper City, Broward Health, and Oakland Park.

The Quarterly meeting of the Local Mitigation Strategy Working Group was held at Broward EOC and the agenda included discussion on the Florida Administrative Code 27 P required annual update, the update of the Project List, the continued development of the WebEOC LMS Board, HMGP potential funding and a status update of the Request for Proposal (RFP) for the vendor that will assist with the ELMS update. Miramar representative suggested another workshop to have hands on training and demonstration of the WebEOC LMS Board. Also discussed was the decision made by the Planning Subcommittee to initiate monthly planning meetings starting January 19, 2017 to maintain momentum and oversight of the ELMS update.

January 19, 2017 – LMS Planning Subcommittee Meeting

Attendees: Representatives from Broward Emergency Management Division, Pembroke Pines, Plantation, Margate, Coral Springs, Miramar, Oakland Park, Broward County Public Works Department, Broward County Planning and Development Management Division, Broward County Planning Council, North Lauderdale, Hallandale Beach and Davie

The agenda included topics of discussion on the revision and/or update of the Goals and Objectives section of the ELMS and creation of new strategies. Committee members were asked to weigh in the existing goals and objectives to see if they were still relevant and needed. Also members were asked to identify potential new strategies for achieving the goals that were decided upon. Also discussed were several upcoming trainings that were geared towards the Chapter 4 – HIRA that would examine Cyber as a potential new "Hazard of Most Significant Concern." (**February's meeting was cancelled due to meetings with Purchasing Department involving Evaluation Committee for bringing on the Vendor.**) Appendix E has the following documentation for this meeting: minutes, sign-in sheet, and agenda.

March 22, 2017 – LMS Executive Committee Meeting

Attendees: Miguel Ascarrunz, Lori Vun Kannon, William Johnson, Romeo Lavarias, Mary Francis Jeannot, Herb Parlato, Necole Holton Jacobs.

The meeting was held to present the draft strategies, goals and objectives produced by the Planning Subcommittee. Executive Committee members reviewed and discussed and it was decided to incorporate the recommendations made by the Planning Committee. Appendix E has the following documentation for this meeting: sign-in sheet, agenda.

March 23, 2017 – LMS Working Group and Planning Subcommittee Meeting

Attendees: Representatives from Broward Emergency Management Division, Margate, Miramar, Broward County Planning and Development Management Division, Broward County Public Works Department, Coral Springs, Lauderdale-by-the-Sea, Plantation, Broward Office of Economic & Small Business Development, Davie, Hallandale Beach, Fort Lauderdale, Oakland Park, North Lauderdale, Coconut Creek, and Plantation.

This combined quarterly Working Group/Planning Subcommittee meeting topics of discussion included information on the State Hazard Mitigation Program Advisory Team and Plan Update due to the State's plan update timeframe coinciding with Broward's. The state completed the draft of the Broward Hazard Profile and would like to have the information vetted and verified by the county. The group decided to pursue verification along with the conduct of our internal HIRA and Vulnerability Assessment. Other topics included a brief dialogue on the HMGP process for Hurricane Matthew and Broward County's allocation. Also reviewed and discussed was the LMS Plan Crosswalk and it was Alex Falcone from Coral Springs identified and discussed each element with the group from his perspective as a former FDEM Mitigation Planner. The elements (S2, S9-S11) which are required to be completed by the municipalities will be disseminated through a Survey Monkey. The current progress was outlined for the group as follows: Chapter 1 – Introduction (in progress); Chapter 2 – County Profile (in progress); Chapter 3 – Planning Process (in progress); Chapter 4 – HIRA and Vulnerability Assessment (awaiting vendor support); Chapter 5 – Economic Vulnerability (awaiting vendor support); Chapter 6 – Mitigation Initiatives (not started); Chapter 7 – Plan Maintenance (not started). The final Evaluation Committee meeting for the Vendor selection is scheduled for April 3rd.

April 12, 2017 – LMS CRS Subcommittee/User Group Meeting

Attendees: Representatives from Broward County Planning and Development Management Division, Lighthouse Point, CRS Max Consultants, Pembroke Pines, Broward Emergency Management Division, Davie, Miramar, Margate, Southwest Ranches, Sunrise, Broward County Public Works, North Lauderdale, Hallandale Beach and guest speaker Josh Overmyer from the Florida Division of Emergency Management.

This was a meeting to discuss changes to the CRS manual and to identify any requirements or initiatives involving CRS communities needing to be included in the ELMS update. It was already decided that using the CRS program as a way of maintaining good floodplain management practices would remain a goal listed in the ELMS.

April 20, 2017 – LMS Planning Subcommittee Meeting

Attendees: Representatives from Broward Emergency Management Division, Pembroke Pines, North Lauderdale, Miramar, Coral Springs, Margate, Lauderhill, Broward County Planning Council, Broward County Public Works, Hallandale Beach, Oakland Park, Broward Planning and Development Management Division, Davie, Sunrise, Broward County Aviation Department, Plantation, Fort Lauderdale, and Hollywood.

The meeting centered on discussion involving the update of Chapter 6 – Mitigation Initiatives. Specifically, existing initiatives, building permitting activities, capability assessments, count programs, planning policies and laws, building codes, floodplain management (CRS, NFIP), flood insurance and drainage, collaborative partnerships, post disaster initiatives, federal standards, community and regional specific initiatives like the SE Florida Regional Climate Change Compact, and future initiatives. The group also discussed including land use planning and a possible formal initiative for the Working Group to undertake and talked about updating one of the objectives to reflect this. Assignments were made for members to bring jurisdiction specific initiatives as well as updating NFIP Section of the plan for municipalities as well as the Broward Municipal Services District (Unincorporated Broward County). Additionally, the Survey Monkey to capture municipality required answers for the LMS Crosswalk was disseminated and due date is June 30th. At this meeting it was clear that many of these initiatives would take time, but that the people involved were dedicated to the task.

May 25, 2017 – LMS Planning Subcommittee Meeting

Attendees: Representatives from Broward Emergency Management Division, Margate, Elite Business Strategies, LLC., Miramar, Broward County Planning and Development Management Division, Coral Springs, Lauderdale-by-the-Sea, Plantation, Broward Office of Economic & Small Business Development, Davie, Hallandale Beach, Fort Lauderdale, Oakland Park, North Lauderdale, Coconut Creek, Plantation and the Florida Division of Emergency Management.

The Committee met and was introduced to the staff from Elite Business Strategies, LLC., the Vendor that was selected to assist with the update. After briefing the group on the company's background and previous projects worked on, Mrs. Ousley who served as the Team Leader for the selected Vendor discussed how they would go about working with us to update Chapters 4, 5 and complete the LMS Crosswalk as well as other deliverables outlined in the scope of work. Also, Melissa Schloss with the Florida Division of Emergency Management participated meeting via webinar to cover the LMS Update Manual and further discuss the LMS Crosswalk and answer questions related to the update, approval and adoption of the final plan. It was decided that our official "Kick-off Meeting" would be June 12th although work was already being performed and progress made. The public would be invited through Sunshine notices and the meeting would be announced through the county website, all social media platforms and through all the municipalities. The progress to date was relayed as follows: Chapter 1 – Introduction (in progress); Chapter 2 – County Profile (in progress); Chapter 3 – Planning Process (in progress); Chapter 4 – HIRA and Vulnerability Assessment (formal workshop date TBD); Chapter 5 – Economic Vulnerability (in progress); Chapter 6 – Mitigation Initiatives (in progress); Chapter 7 – Plan Maintenance (not started).

June 12, 2017 – LMS Working Group Quarterly/ELMS Plan Update Kick-off Meeting

Attendees: Representatives from Broward Emergency Management Division, Elite Business

Strategies, LLC., Pembroke Pines, Fort Lauderdale, Lighthouse Point, Broward County Aviation Department, Margate, Coral Springs, Oakland Park, Broward County Sheriff's Office, Broward Public Works Department, North Lauderdale, Miramar, Pembroke Park, Hallandale Beach, Pompano Beach, Lauderhill, Davie, Oakland Park, and Sunrise.

The meeting attendees were provided with a read ahead packet prepared by Elite Business Strategies, LLC., that outlined the deliverables and timeline for project completion. The Working Group members were given an opportunity to discuss any foreseeable issues with meeting the deadlines and timetable. The group recognized the possibility of project interruption due to hurricane season starting but decided to continue being aggressive in planning efforts as mitigation effort. The date for the HIRA and Vulnerability Assessment Workshop was discussed and decided for June 26th. Members were asked to identify 3 representatives (including themselves) to attend the workshop. Director Ascarrunz stated that he would take care of disseminating the invites to county staff and ECC members. The LMS Coordinator and Elite stated that they would work together on the format and the structure and develop a scenario that could be used to determine vulnerabilities to our hazards of most significant concern. It was also suggested to invite a forecaster from the National Weather Service to participate in the workshop. Additionally, the best way to collect jurisdiction specific Repetitive Loss (RL) and Severe Repetitive Loss (SRL) information without violating the privacy laws. It was decided that each Floodplain Manager or CRS Coordinator would provide the data in a GIS shapefile for the Vendor to compile and incorporate in the update. An update was given on the ELMS including information of the Economic Vulnerability Assessment. Volunteers were requested for a review of the upcoming draft.

June 26, 2017 – Threat Hazard Identification Risk Assessment (THIRA) and Vulnerability Assessment Workshop

Attendees: Representatives from the Broward County Public Works Department (Facilities Management, Construction Management, Water and Wastewater Services and Traffic Engineering Divisions), Broward County Risk Management Division, Broward Emergency Management Division, Broward County Aviation Department, Broward County Environmental Protection and Growth Management Department, Broward County Planning Council, Port Everglades, Pembroke Pines, Margate, Coral Springs, Seminole Tribe of Florida, North Lauderdale, Wilton Manors, Tamarac, Greater Fort Lauderdale Conventions and Visitors Bureau, Hallandale Beach, Oakland Park, National Weather Service, Broward County Enterprise Technology Services, Miramar, Broward County Planning Development Management Division, Parkland, Davie, Deerfield Beach, Broward Sheriff's Office, Broward County Transportation Department, Broward County Office of Economic and Small Business Development, North Lauderdale, Florida Department of Health, Fort Lauderdale, Pembroke Park, and the South Florida Water Management District.

This purpose of the workshop was to gather information from participant's perspectives of threats and hazards facing their jurisdiction, agency or organization based on their areas of expertise. The objective of the workshop were to validate the progress of the updated 2017 Broward County THIRA for inclusion into the Enhanced Local Mitigation Strategy (ELMS), Chapter 4; enhance situational awareness of risks associated within the jurisdiction; and identify gaps of information for threats, hazards and risks within the jurisdiction from the perspective of response personnel, emergency managers and public and private stakeholders. Speakers included Miguel Ascarrunz, Director of Emergency Management for Broward County, National Weather Service Forecaster Anthony Reynes, Benjamin Sanchez from Broward County Enterprise Technology Services who

provided information on Cyber as emerging threat, and LMS and Project Overview from Broward County Emergency Management Mitigation Program Manager Necole Holton Jacobs. Princess Ousley and Michael Johns representing Elite Business Strategies, LLC., along with Necole Holton Jacobs and Anthony Reynes facilitated the HIRA and scenario based discussion involving all the current hazards of most significant concern for the county. The workshop was designed to adhere to Homeland Security Exercise Evaluation Program (HSEEP) guidelines and as such, the core capabilities of Community Resilience, Risk and Disaster Resilience Assessment and Threat and Hazard Identification were chosen. An After Action Report/Corrective Actions document was compiled following the workshop that incorporates the workshop findings and identifies potential future mitigation initiatives.

July 19, 2017 – LMS CRS Subcommittee/User Group Meeting

Attendees: Representatives from Broward Emergency Management Division, Wilton Manors, Lauderhill, Miramar, Hallandale Beach, Davie, CRS Max Consultants, Fort Lauderdale, Cooper City, Coconut Creek, Lauderdale-by-the-Sea, Davie, Weston, and Sunrise.

Committee Member Earl King, CEO of CRS Max Consultants provided a presentation on the services provided by his company to communities all over the state of Florida. Also discussed were issues related to the updated CRS Manual and Elevation Certificates. Mr. King answered a variety of questions from committee members and the group also discussed progress being made to collect RL and SRL data for inclusion in the ELMS update. The new committee Chair Jeanine Athias gave an update on the progress being made by the municipalities to update the NFIP section of the ELMS.

July 20, 2017 – LMS Planning Subcommittee Meeting

Attendees: Representatives from Broward Emergency Management Division, Plantation, Pompano Beach, Tamarac, Margate, Coral Springs, North Lauderdale, Miramar, Fort Lauderdale, and Davie.

The group discussed the Workshop Corrective Action document and the workshop THIRA results. Flooding and tropical cyclones remain the top hazards of most significant concern for the county. Although cyber did not score high enough to be ranked a hazard of most significant concern, the group felt that the information from the workshop should be included and identified as a hazard for further analysis and should also be included on Appendix K (Hazard Summary Profile). The group discussed the update progress as follows: Chapter 1 – Introduction (complete); Chapter 2 – County Profile (complete); Chapter 3 – Planning Process (in progress); Chapter 4 – HIRA and Vulnerability Assessment (in progress); Chapter 5 – Economic Vulnerability (in progress); Chapter 6 – Mitigation Initiatives (almost complete); Chapter 7 – Plan Maintenance (in progress).

August 17, 2017 – LMS Planning Subcommittee Meeting

Attendees: Representatives from Margate, Broward Emergency Management Division, Pembroke Pines, Broward County Public Works, Tamarac, Lighthouse Point, Fort Lauderdale, North Lauderdale, and Plantation.

The group discussed the first draft of the ELMS that had been disseminated and comments received. Also discussed was any outstanding information that still needed to be collected, particularly the RL and SRL data and the NFIP section for municipalities. The LMS Crosswalk

Survey results were discussed and the group appreciated how easy the Survey Monkey made it to capture the required information. A discussion on the review and approval as well as plan adoption by the county and municipalities was discussed again. To date, all RL and SRL data has been received and forwarded to the contractor for inclusion. NFIP updates have been received from Fort Lauderdale, Sunrise, Hallandale Beach, Lauderhill, Coral Springs, Margate, Miramar, Plantation, Pompano Beach, Weston, Broward Municipal Services District, Pembroke Pines and Tamarac. The ELMS update progress is as follows: Chapter 1 – Introduction (complete); Chapter 2 – County Profile (complete); Chapter 3 – Planning Process (completion upon final draft review and comment); Chapter 4 – HIRA and Vulnerability Assessment (complete); Chapter 5 – Economic Vulnerability (complete); Chapter 6 – Mitigation Initiatives (almost complete); Chapter 7 – Plan Maintenance (almost complete upon revision based on 2016 EMAP Standards). Final draft to be disseminated for review and comment this week.

Committees

Executive Committee

The Executive Committee was formed in 2009 to act as the overall governing body of the LMS. Its responsibilities are as follows:

- Support plan development
- Attend all scheduled meetings
- Approve overall LMS Goals and Objectives
- Provide subject matter expertise
- Assist in evaluating and prioritizing mitigation actions

Planning Subcommittee

The Planning Subcommittee was originally formed in March 1998 to serve as the working group for the Broward County Mitigation Task Force.

The Planning Committee remains responsible for research and on-going development for the Local Mitigation Strategy, evaluation and enhancement procedures, a conflict resolution mechanism, municipal building permit data tracking procedures, critical facility vulnerability analysis, and mitigation initiative identification and prioritization procedures.

The Planning Subcommittee has also assisted in the development of “Procedures for Coordination of Public and Private Sector Mitigation”, “A Public Officials Guide to Emergency Preparedness” and a public officials briefing breakfast, identification of potential flood mitigation projects and a flood mitigation workshop and published a Homeowner’s Retrofit Guide.

Education Committee

The original Education and Training Committee was created in March 1998 to address mitigation education and training issues for the Mitigation Task Force.

American Red Cross, Broward County Emergency Management, Broward County Office of Economic Development, Florida Department of Financial Services (formerly Department of Insurance), Area Agency on Aging, Florida Department of Children & Families, South Florida

Regional Planning Council, VISTA/AmeriCorps, Home Depot, the City of Deerfield Beach, and the City of Pembroke Pines were all members of the subcommittee.

A mission was developed by the committee to promote mitigation education and training in order to strengthen Broward County's readiness for disasters and its capacity to minimize disaster-induced loss of life and property. Public education and awareness activities include: articles, radio spots, flyers, fairs, conferences, workshops, and notices of public meetings to solicit public involvement. The primary goal of the subcommittee was to promote an awareness and understanding of disaster mitigation theory and practice, particularly of structural retrofitting and advocate preparedness, through education and training. Objectives determined to meet this goal included:

- To identify which segments of the community are most at risk and therefore, most in need of education and training about disaster mitigation
- To develop strategies for teaching the community about disaster mitigation in a timely and effective manner
- To coordinate with existing entities teaching about disaster preparedness and to encourage the dissemination of correct and up to date information on the subject of mitigation
- To serve as a clearinghouse for the delivery of disaster mitigation educational instruction

The original Education and Training Committee's goals and objectives were provided to the planning committee for incorporation into the overall local mitigation goals and objectives. The renamed Committee now meets as needed to address the tasks associated with accomplishing the objectives.

Accomplishments beyond the development of goals and objectives include identification of potential mitigation projects and the creation of a mitigation speaker's bureau. Available Mitigation training includes existing courses offered by FEMA and the Florida Division of Emergency Management. Local requests for training courses will be processed on a case by case basis through the EOC training section. A list of mitigation oriented training courses are distributed to all LMS Working Group members. The local mitigation coordinator routinely distributes related training notices as received from federal, state, regional agencies, and professional associations.

The LMS Coordinator, in coordination with the Education Committee, works with the Office of Public Communications year round to disseminate hazard mitigation information to the general public. For post-disaster operations, Emergency Support Function (ESF) # 14 – Information and Planning will assume this role.

Private Sector Subcommittee

The Private Sector Committee was created to strengthen the ties between the public and private sector as it relates to mitigation activities. The Committee is a valuable resource of information to the business community. In turn, the input from the private sector is utilized in the planning process for enhancement in the ELMS Plan. Members of the committee include Broward County Office of Economic and Small Business Development, the Broward Alliance (600 major corporations, 17 chambers of commerce, and 31 municipalities), and Broward County Emergency Management Division.

The ESF#18 - Business and Industry, for the County's Comprehensive Emergency Management Plan, was developed to address business and tourism needs during an emergency activation and recovery. Procedures for Public/Private Sector Mitigation Planning Procedures were also created.

CRS Subcommittee/CRS User Group

These two subcommittees were updated in 2017 to include the CRS User Group as the core committee membership. The CRS subcommittee will be a resource to the County in exploring ways to expand the CRS programs for all jurisdictions. The subcommittee will also interact with other important county flood mitigation groups including the Broward Surface Water Coordinating Council comprised of SFWMD and the various local drainage districts.

General Body

The General Body of the LMS is composed of representatives from all 31 municipalities, Seminole Tribe of Florida, essential governmental and non-governmental stakeholders, and other public and interested parties who provide information on existing and/or potential projects that mitigate the effects of hazards within Broward County.

The LMS membership meets quarterly and members are required to participate in at least 2 meetings per year. During meetings in 2017, the Planning Subcommittee used these meetings to request a list of mitigation actions from each participant, discuss hazard mitigation funding and eligible projects, and finalize a schedule for the plan development. The General Body plays an integral role identifying existing and potential mitigation activities and actions that will make Broward County more resilient to natural disasters. In the 2017 LMS meetings, the general body was presented the various components of the ELMS, including the Economic Vulnerability and the Loss Estimation Tool, as well as hearing guest speakers on CRS and mitigation in disaster recovery (see the 2016-2017 meetings described earlier in this chapter).

Method and Schedule for Evaluation, Maintenance & Revision

The LMS Working Group has identified procedures for the periodic review of the local mitigation strategy. This process provides a coordinated approach for municipal, county, regional, and state review and is detailed in Chapter 7 of this Plan.

Municipal

The LMS should be reviewed at the municipal level on an annual basis. An updated project list from each municipality shall be composed and submitted to Broward County Emergency Management by mid-January of each year as part of the revisions to the Local Mitigation Strategy. Revisions to the applicable municipal Comprehensive Emergency Management Plan should occur simultaneously with the LMS review due to the County.

County

Components of the LMS shall be reviewed and updated including a revised project list. Consolidation of municipal proposed revisions to the project list should be completed by January 1st of each year. An internal review shall be conducted by the Broward County Emergency Management Division as part of the annual self-assessment process. All county/municipal

revisions shall be reviewed by the LMS Working Group and the changes will be submitted to the Emergency Management Director for approval, if deemed necessary.

All applicable components of the ELMS may be incorporated into the Broward County Comprehensive Emergency Management Plan as part of the annual review process. The Broward County Comprehensive Emergency Management Plan is reviewed and approved by the State every 4 years. Any proposed revisions from the State review of the CEMP will be part of the revisions submitted to the Board of County Commissioners.

All necessary changes to Broward County and municipal comprehensive plans should be added into the established review schedule for the applicable elements and amendments.

Regional

A revised Enhanced Local Mitigation Strategy may be submitted to the South Florida Regional Planning Council (SFRPC) for review as a member of the LMS Working Group. Copies of the Local Mitigation Strategy may be available for adjacent counties and other applicable jurisdictions for comments.

State

The revised ELMS shall be submitted to the State of Florida, Division of Emergency Management for review and comment as required by the 5-year FEMA review cycle or as directed by the division. The 2017 ELMS is being submitted as a full update to the State and FEMA and will be adopted by the Broward County Board of County Commissioners and the municipalities. The next update will be due to the State no later than 2022. For details on plan update process, go to the "Update/Enhancement" subsection of Chapter 7.

Procedures have been identified to ensure that a broad group of local government representatives, citizens, adjacent community representatives, and county liaisons participate in the review and revision of the local mitigation strategy.

Local Mitigation Strategy Working Group

The LMS Working Group shall meet as necessary to perform its mission. Prior to hurricane season each year, the guiding principles, hazard identification and vulnerability assessment, and the mitigation initiatives shall be incorporated into county and state exercises. The local exercise shall involve the activation of the Emergency Operations Center with municipal representation and all 18 Emergency Support Functions.

The LMS Working Group identifies conflict resolution procedures. Any disputes arising from the local mitigation strategy shall be mediated utilizing the South Florida Regional Planning Council Dispute Resolution Process. The SFRPC has established a Regional Dispute Resolution Process (RDRP), as specified by Florida Statutes, 186.509.

*Participation in the RDRP does not waive any party's right to judicial or administrative action, nor does it convey or limit intervener status or standing in any judicial or administrative proceeding.

Municipal Level

All participating municipalities shall have membership in the LMS Working Group and the Emergency Coordinating Council. Each municipality should form a municipal working group to review the local mitigation strategy and identify potential mitigation programs/projects in their communities. Residents and adjacent or impacted communities need to be included in the review process at the local level.

County and Public/Private Sector

Pertinent county agencies and other public and private sector partners shall have membership on the Broward County LMS Working Group and the Emergency Coordinating Council. Members of the Working Group shall review the strategy and assist in the identification of potential mitigation projects.

All LMS Working Group meetings are open to the public and are advertised in accordance with Florida Sunshine laws. Public participation is encouraged in the planning process and any comments shall be taken into consideration. In the future, a new, dedicated interactive mitigation website will be developed and utilized in the planning process.

Chapter 4: Risk Assessment

Introduction

This chapter of the LMS includes the assessment of hazard risks facing Broward County and its participating municipal jurisdictions. The purpose of the risk assessment is to use best available data and technology to identify and evaluate potential hazard risks facing Broward County, as well as provide the factual basis for mitigation activities proposed in Broward County's LMS that aim to reduce those risks. The chapter has been broken down into the following key sections:

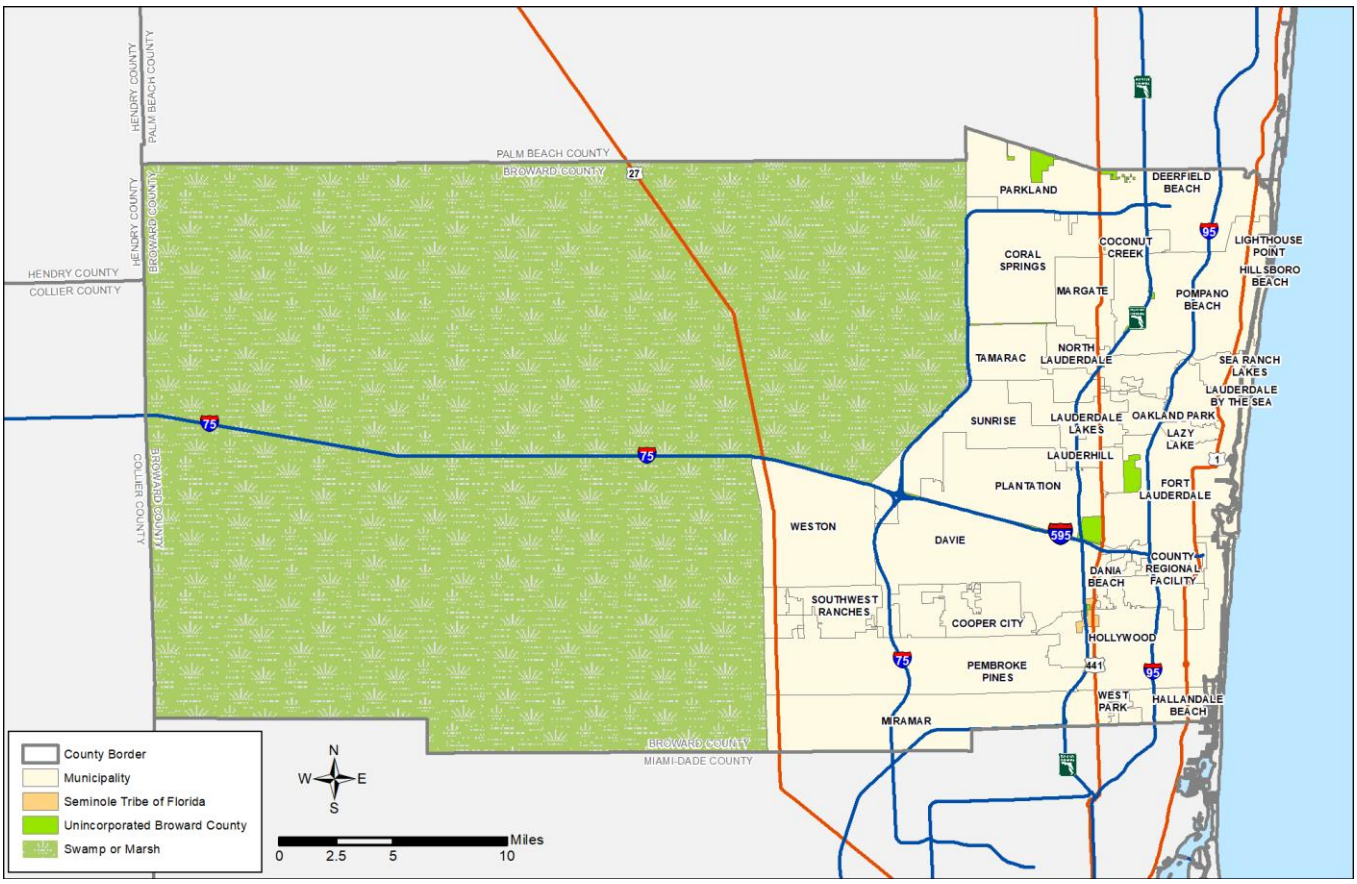
- Introduction
- Risk Assessment Methods
- Asset Inventory
- Initial Hazard Identification
- Natural Hazards
- Human Caused Hazards
- Conclusions on Hazard Risk

The risk assessment completed for Broward County provides for the identification and analysis of known hazards that may threaten life and property across the entire planning area. It also includes the results of a multi-jurisdictional vulnerability assessment conducted for each of Broward County's municipal jurisdictions[1] (shown in **Maps 4.1** and **4.2**) to determine where locally specific risks vary from those facing the rest of the county. The vulnerability assessment helps to describe each jurisdiction's vulnerability to identified hazards in terms of the types and numbers of buildings, infrastructure, and critical facilities located in hazard areas as well as potential loss estimates for vulnerable structures.

The Threat Hazard Identification and Risk Assessment (THIRA), Economic Vulnerability, and Mitigation Initiatives for Broward County have been prepared in compliance with the Federal Emergency Management Agency's Local Multi-Hazard Mitigation Planning Guidance, dated March 2013.and meets the requirements of 44 CFR § 201.

1 Although this risk assessment does not officially or comprehensively analyze risks faced by the Seminole Tribe of Florida, it is of significance to note that the Seminole Reservation Headquarters is located in Hollywood and there are 2 Seminole run Casinos located in Hollywood and Coconut Creek. The Hollywood Reservation is a 497 acre urban reservation that is home to more than 500 Seminoles.

Map 4.2: 2017 Broward County Base Map (Entire County)



Source: Broward County GIS 2017

Map 4.3: 2017 Broward County Base Map (Developed Areas Only)

Source: Broward County GIS 2017

Risk Assessment Methods

As described above, the risk assessment completed for Broward County includes two primary studies including: (1) the hazard identification and analysis; and (2) a multi-jurisdictional vulnerability assessment.

The hazard identification and analysis provides the following information for each hazard:

- A general background description of each potential natural, technological, and/or human caused hazard that could impact Broward County
- The known locations and/or spatial extent of each hazard (if applicable)
- A locally-specific history of past hazard occurrences based on best available data
- A statement addressing the probability of future hazard occurrences that could affect Broward County

All of the information presented as part of the hazard identification and analysis is based on existing local, state, and federal sources as cited throughout. Sources include historical records on hazard events (such as the storm events database maintained by the National Climatic Data Center) as well as input from the Broward County Mitigation Task Force and other relevant information provided through existing local plans, studies, and reports.[2]

The multi-jurisdictional vulnerability assessment was conducted with two distinct methodologies: first, utilizing Hazards United States-Multi-Hazards (Hazus-MH), FEMA's loss estimation software, and second, a statistical risk assessment methodology. Each approach provides estimates for the potential impact by using a common, systematic framework for evaluation. The results of the multi-jurisdictional vulnerability assessment are provided for each hazard immediately following the summary of information provided through the hazard identification and analysis, as listed above.

The Hazus-MH risk assessment methodology is parametric, in that distinct hazard and inventory parameters (wind speed and building types) were modeled using the Hazus-MH software to determine the impact (damages and losses) on the built environment.

The statistical risk assessment methodology was applied to analyze hazards of concern that were outside the scope of the Hazus-MH software. The Hazus-MH driven methodology uses a statistical approach and mathematical modeling of risk to predict a hazard's frequency of occurrence and estimated impacts based on recorded or historic damage information. Below is a brief description of both approaches.

2 Other existing plans, studies and reports include the 2000 version of the Broward County Local Mitigation Strategy, the Broward County Economic & Socioeconomic Vulnerability Study, Port Everglades Vulnerability & Economic Study, the Broward County profile from Florida Department of Community Affairs report entitled *Integrating Hazard Mitigation Planning into Comprehensive Planning,* the State of Florida Hazard Mitigation Plan and the CSX Transportation Hazardous Materials Density Study for Broward County, Florida (2006).

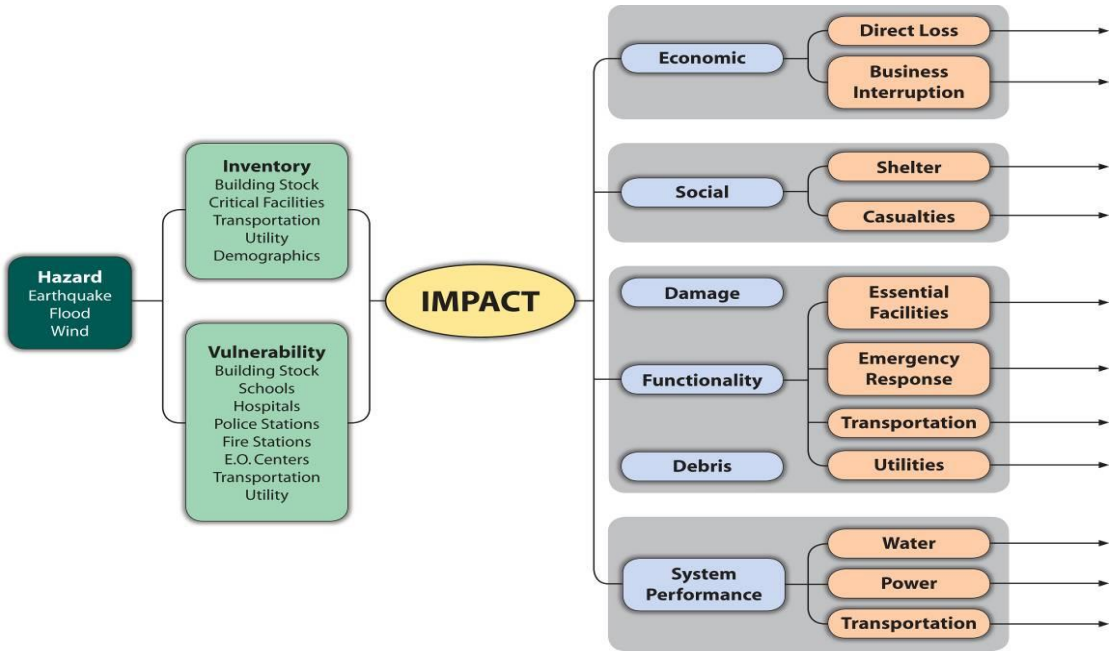
Hazus-MH

Hazus-MH is FEMA's standardized loss estimation software program built upon an integrated geographic information system (GIS) platform (Figure 4.1) in March 2011. After the initial release of the program, FEMA released Hazus 2.0 in May/June 2011. The main update to Hazus in the 2.0 version was to enhance the capability of integrating storm surge results into the flood module. Subsequent versions of Hazus, including versions 3.0 (released November 2015) and 4.0 (March 2017) were released following Hazus 2.0. These updates provided optimizations to the Hazus program and added the ability to run an analysis using a tsunami scenario.

For this updated enhanced LMS document, Hazus 4.0 was used for calculating flood losses (updating work using Hazus-MH MR-5 and Hazus-MH 2.0). The new Hazus results are found in Table 4.20 (wind), Table 4.22 (flood), and the hot spot profiles in Chapter 5 for the hazards presenting the greatest risk to Broward County (flood and wind).

The original LMS risk assessment applied Hazus-MH MR-5 to produce regional profiles and estimate losses for 2 hazards. At the time this analysis was completed, Hazus-MH MR-5 was used to estimate potential losses from hurricane wind and riverine ("non-coastal") flood hazards using Hazus-MH default building stock inventory data. The results of the Hazus-MH model analysis includes annualized loss estimates for each municipal jurisdiction in Broward County so that potential loss values may be compared to one another throughout Broward County.
Additional local databases made available through Broward County, including local tax assessor records and critical facilities data were used in addition to Hazus-MH inventory data in order to conduct a GIS-based vulnerability assessment for the flood and storm surge hazards (further described under the vulnerability assessment section of these hazards). For the updated enhanced LMS documents, the local tax assessor records were aggregated (by building use type and value) and imported into Hazus to improve the default inventory data.

Figure 4.1: Conceptual Model of Hazus-MH Methodology



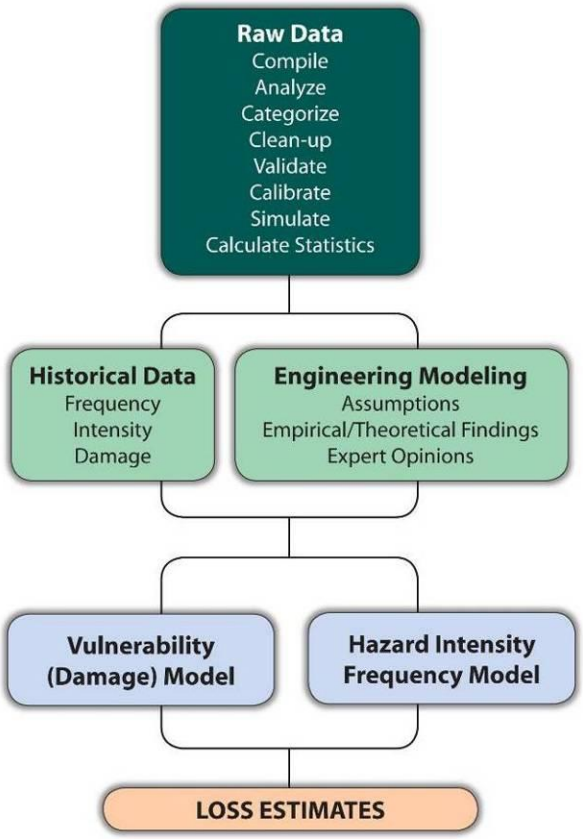
Statistical Risk Assessment Methodology

Risks associated with other natural and anthropogenic hazards (beyond wind and flood) were analyzed using a statistical assessment methodology developed and used specifically for this effort. Historical data for each hazard were used and statistical evaluations are performed using manual calculations. The general steps used in the statistical risk assessment methodology are summarized below:

1. Compile data from the following sources:
    a. Local
    b. National
    c. Literature
2. Clean up data:
    a. Remove duplicates
    b. Update losses (For inflation)
    c. Modify losses (For population growth and distribution)
3. Identify patterns in:
    a. Frequency
    b. Intensity
    c. Vulnerability
    d. Loss
4. Statistically and probabilistically extrapolate the patterns
5. Produce meaningful results:
    a. Development of annualized loss estimates

Figure 4.2 illustrates a conceptual model of the statistical risk assessment methodology as applied to Broward County.

Figure 4.2: Conceptual Model of the Statistical Risk Assessment Methodology



The economic loss results are presented here using two interrelated risk indicators:

1. The Annualized Loss (AL), which is the estimated long-term weighted average value of losses to property in any single year in a specified geographic area (i.e., county).

2. The Annualized Loss Ratio (ALR), which expresses estimated annualized loss normalized by property replacement value.

The estimated Annualized Loss (AL) addresses the key idea of risk: the probability of the loss occurring in the study area (largely a function of building construction type and quality). By annualizing estimated losses, the AL factors in historic patterns of frequent smaller events with infrequent but larger events to provide a balanced presentation of the risk. The Annualized Loss Ratio (ALR) represents the AL as a fraction of the replacement value of the local inventory. This ratio is calculated using the following formula:

ALR = Annualized Losses / Total Exposure

The annualized loss ratio gauges the relationship between average annualized loss and replacement value. This ratio can be used as a measure of vulnerability in the areas and, since it is normalized by replacement value, it can be directly compared across different geographic units such as metropolitan areas or counties.
Loss estimates provided herein used best available data, and the methodologies applied resulted in an approximation of risk. These estimates should be used to understand relative risk from hazards and potential losses. Uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from approximations and simplifications that are necessary for a comprehensive analysis (e.g., incomplete inventories, demographics, or economic parameters).

National Climatic Data Center Storm Event Database

Much of the historical event data presented in the tables in this section were taken directly from the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC) database. NCDC receives storm data from the National Weather Service (NWS) which, in turn, receives their information from a variety of sources, including, but not limited to: county, state and federal emergency management officials, local law enforcement officials, SKYWARN spotters, NWS damage surveys, newspaper clipping services, the insurance industry, and the general public. For many hazards, NCDC data is most accurate beginning from the early to mid-1990's which limits its usefulness for conducting a detailed risk assessment. However, as it is the source of the best available data that can be easily obtained (and is recommended for use by FEMA), it has been heavily relied on in order to profile and analyze the hazards further discussed in this section.

Asset Inventory

A variety of data exists on buildings, infrastructure, and critical facilities for Broward County. For purposes of the multi-jurisdictional vulnerability assessment, much of this data was based on the inventory databases made readily available through Hazus-MH, FEMA's loss estimation software as described earlier in this section under "Risk Assessment Methods." This includes the number, type, and value of buildings located in each municipality in Broward County. **Table 4.1** summarizes the total building value for each jurisdiction as extracted from the Broward County Property Appraiser (and as utilized for estimating losses to hurricane wind, flood, and storm surge). **Table 4.2** summarizes the total number of buildings for each jurisdiction by type for Broward County.

Table 4.1: Total Building Values for Broward County, By Type (As of June 2017)

Jurisdiction	Residential	Commercial	Industrial	Other*	Total
Coconut Creek	$4,253,559,510	$462,876,750	$132,429,210	$346,266,130	$4,581,327,140
Cooper City	$3,135,076,760	$159,097,910	$31,613,960	$189,925,800	$3,515,714,430
Coral Springs	$10,593,818,770	$1,215,515,370	$236,570,660	$646,372,260	$10,593,818,770

Jurisdiction	Residential	Commercial	Industrial	Other*	Total
Dania Beach	$1,674,944,910	$697,616,550	$333,816,320	$111,291,960	$2,817,669,740
Davie	$7,501,037,660	$823,979,830	$415,905,950	$907,563,500	$9,648,486,940
Deerfield Beach	$4,797,155,850	$975,783,900	$707,131,250	$377,522,780	$6,857,593,780
Fort Lauderdale	$23,609,397,420	$6,738,007,070	$1,169,206,010	$2,164,840,100	$33,681,450,600
Hallandale Beach	$4,825,110,460	$502,505,800	$77,428,770	$122,769,400	$5,527,814,430
Hillsboro Beach	$1,011,670,020	$8,929,340	$0	$1,422,820	$1,022,022,180
Hollywood	$12,349,996,010	$2,231,138,920	$628,978,780	$975,595,020	$16,185,708,730
Lauderdale-By-The-Sea	$2,230,917,100	$147,795,270	$0	$7,519,630	$2,386,232,000
Lauderdale Lakes	$983,060,260	$171,107,800	$35,046,680	$173,921,430	$1,363,136,170
Lauderhill	$2,598,979,520	$254,001,020	$72,385,010	$319,990,570	$3,245,356,120
Lazy Lake	$4,893,910	$0	$0	$0	$4,893,910
Lighthouse Point	$1,930,434,190	$82,673,450	$0	$12,147,330	$2,025,254,970
Margate	$2,834,576,290	$365,985,690	$95,979,340	$176,015,760	$3,472,557,080
Miramar	$8,749,489,400	$877,121,560	$608,922,070	$713,016,840	$10,948,549,870
North Lauderdale	$1,478,605,500	$142,745,100	$34,133,900	$138,489,730	$1,793,974,230
Oakland Park	$2,481,636,470	$523,025,000	$349,674,140	$170,701,730	$3,525,037,340
Parkland	$4,142,329,980	$58,178,940	$509,790	$214,453,120	$4,415,471,830
Pembroke Park	$144,115,510	$61,884,220	$237,440,230	$40,085,130	$483,525,090
Pembroke Pines	$12,129,339,750	$1,420,827,530	$130,216,860	$914,400,710	$14,594,784,850
Plantation	$7,362,183,860	$1,574,711,570	$86,239,010	$545,623,390	$9,568,757,830
Pompano Beach	$8,096,946,470	$1,073,264,850	$1,631,764,840	$815,001,190	$11,616,977,350
Sea Ranch Lakes	$179,739,850	$8,465,750	$0	$0	$188,205,600
Southwest Ranches	$1,009,052,620	$30,885,740	$7,504,300	$176,169,930	$1,223,612,590
Sunrise	$5,014,296,390	$1,730,167,550	$384,573,600	$772,545,620	$7,901,583,160
Tamarac	$3,829,992,130	$374,490,660	$174,188,250	$168,260,530	$4,546,931,570
Broward Municipal Services District	$462,821,490	$54,010,270	$36,554,520	$1,041,575,160	$1,594,952,440
West Park	$461,800,930	$47,919,710	$65,634,590	$30,048,040	$605,403,270
Weston	$8,015,924,270	$650,263,320	$219,381,870	$345,824,880	$9,231,394,340
Wilton Manors	$1,377,589,080	$142,485,550	$10,738,030	$67,073,540	$1,597,886,200
TOTAL	**$149,270,492,340**	**$23,607,461,990**	**$7,913,967,940**	**$12,686,434,030**	**$190,766,084,550**

** "Other" building occupancy category includes agriculture, religious/nonprofit, government, and education occupancies.*

Source: Broward County Property Appraiser June 2017 Tax Roll Data.

Table 4.2: Total # of Buildings for Broward County, By Type (Through June 2017)

Jurisdiction	Residential	Commercial	Industrial	Other*	Total
Coconut Creek	20,416	222	34	107	20,779
Cooper City	10,941	161	5	83	11,190
Coral Springs	38,006	1,012	308	190	39,516
Dania Beach	11,246	503	454	118	12,321
Davie	28,425	725	350	433	29,933
Deerfield Beach	32,873	697	651	168	34,389
Fort Lauderdale	71,738	5,367	1,522	643	79,270
Hallandale Beach	23,592	474	180	92	24,338
Hillsboro Beach	2,215	3	0	7	2,225
Hollywood	54,819	2,580	720	430	58,549
Lauderdale-By-The-Sea	5,991	163	0	14	6,168
Lauderdale Lakes	11,975	136	26	51	12,188
Lauderhill	23,268	319	87	114	23,788
Lazy Lake	15	0	0	0	15
Lighthouse Point	5,342	100	0	17	5,459
Margate	21,889	314	167	88	22,458
Miramar	37,336	1,390	197	195	39,118
North Lauderdale	10,858	102	16	62	11,038
Oakland Park	15,897	787	812	132	17,628
Parkland	9,156	23	2	113	9,294
Pembroke Park	1,421	85	119	21	1,646
Pembroke Pines	55,742	735	108	159	56,744
Plantation	29,760	994	111	169	31,034
Pompano Beach	44,608	1,349	1,879	380	48,216
Sea Ranch Lakes	208	1	0	0	209
Southwest Ranches	2,212	15	3	340	2,570
Sunrise	34,730	565	393	145	35,833
Tamarac	30,600	318	68	78	31,064
Broward Municipal Services District	3,696	190	72	140	4,098
West Park	4,291	192	223	68	4,774
Weston	21,714	625	78	62	22,479
Wilton Manors	4,998	313	22	45	5,378
TOTAL	**669,978**	**20,460**	**8,607**	**4,664**	**703,709**

** "Other" building occupancy category includes agriculture, religious/nonprofit, government, and education occupancies.*
Source: Broward County Property Appraiser June 2017 Data

In addition to the data made readily available through Hazus-MH, some local inventory data has been integrated into the multi-jurisdictional vulnerability assessment. This also includes local tax assessor records for developed parcels in each of the municipal jurisdictions, which were utilized in order to estimate potential losses due to flooding events as further described under the vulnerability assessment section of the "Flood" hazard.

Critical Facilities

Critical Facilities are defined as those structures from which essential services and functions for survival, continuation of public safety actions, and disaster recovery are performed or provided.

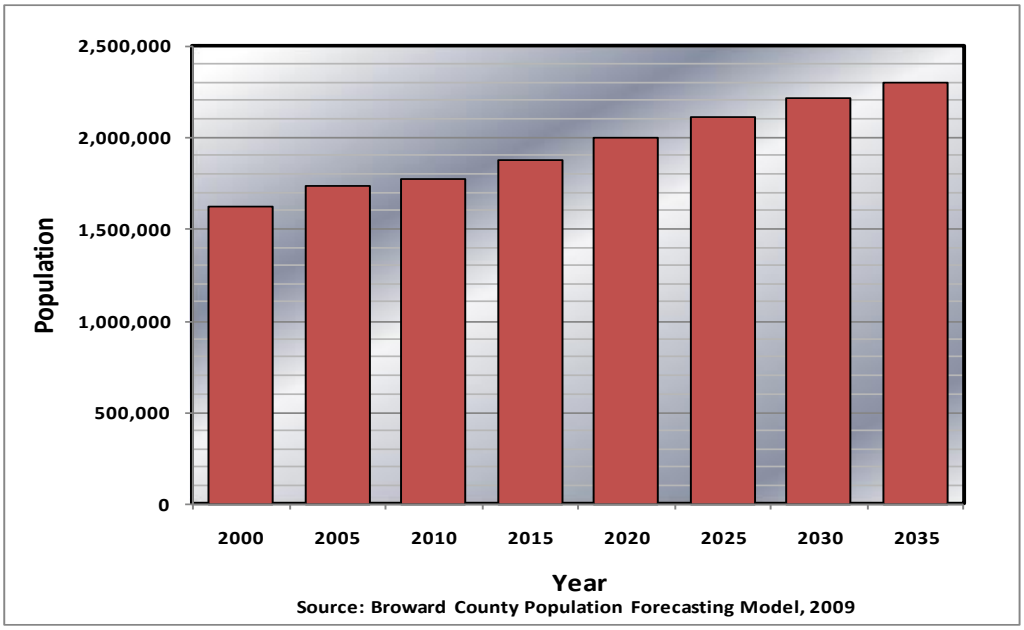
For the purposes of this document, Broward County has identified those critical facilities that have the potential for being affected by natural and human caused disasters. The identification and location of critical facilities throughout Broward County are shown in **Map 4.3**.

Population and Development Trends

According to U.S. Census Bureau estimates for 2010, Broward County has a population of 1,909,632 residents and 741,043 housing units in the county. Population density across the county is shown in Map 4.4. The median age of the population is 40 years of age, and approximately 15.7% of the county's population is age 65 or older. The percentage population gain from 2000 to 2016 was nearly 18% (an increase of 286,614 people). Population estimates and the percent change in population that occurred during 2000 to 2016 for all jurisdictions within Broward County were presented in **Figure 2.1.**

The Broward County Planning and Redevelopment Division expects the population to grow during the next 25 years, reaching 2,298,008 people by the year 2035. **Figure 4.3** illustrates that population growth in 5-year intervals which was developed in 2000.

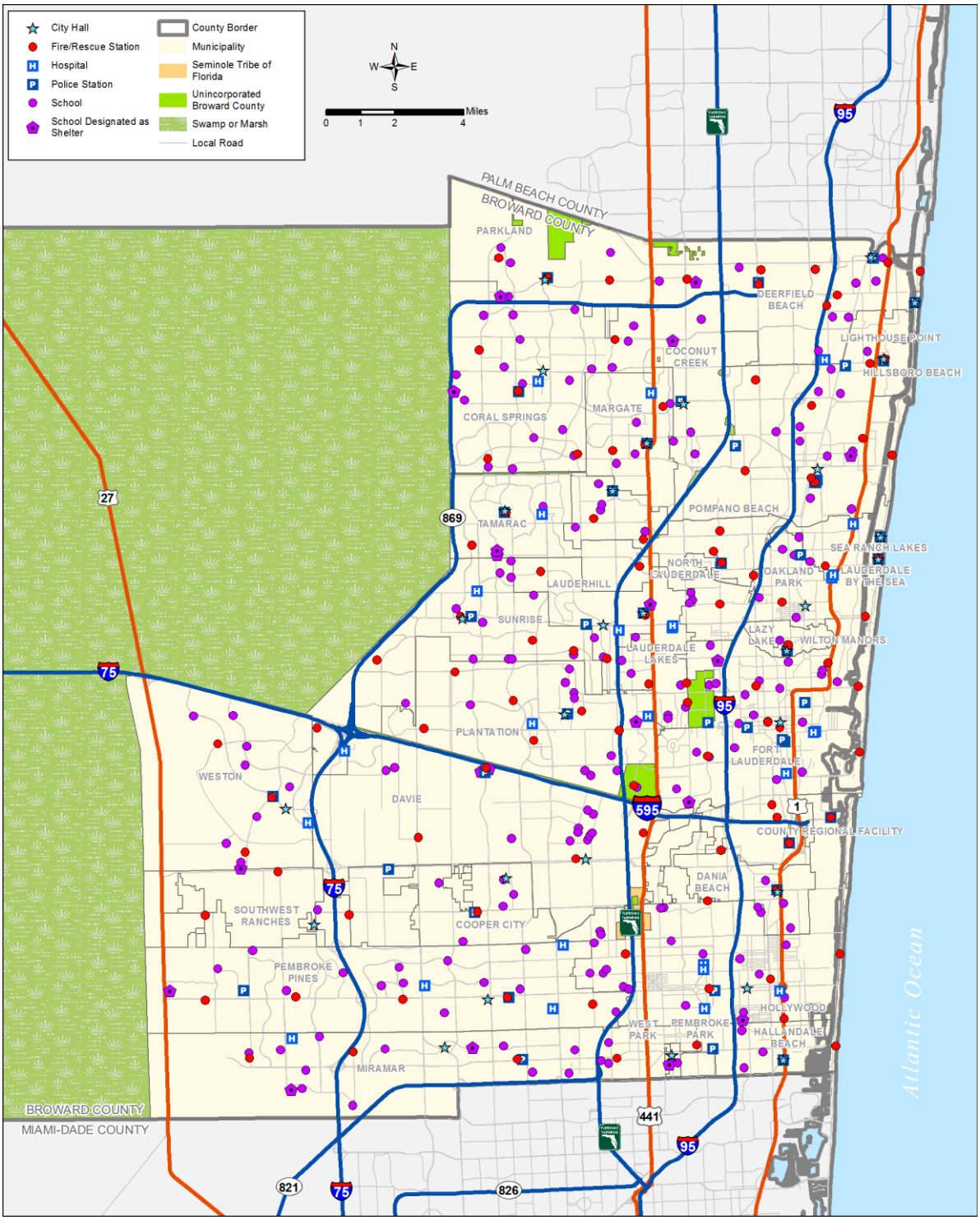
Figure 4.3: Population Projections for Broward County 2000-2035



According to 2010 U.S. Census, Broward County has 741,043 housing units, of which approximately 88.3% are occupied. The population density in the county (exclusive of the Conservation Area) is nearly 3,740 persons per square mile, and nearly all of the 1.9 million residents live in municipal jurisdictions. Average household size is 2.73 persons. Based on the population forecasts for Broward County, it is expected that approximately 934,932 housing units will be needed by 2035 to accommodate the population. It is also worth noting that the population numbers listed herein refer to Broward County's permanent, year-round residents; but, there are significant increases in people when considering seasonal influxes from other areas and tourists.

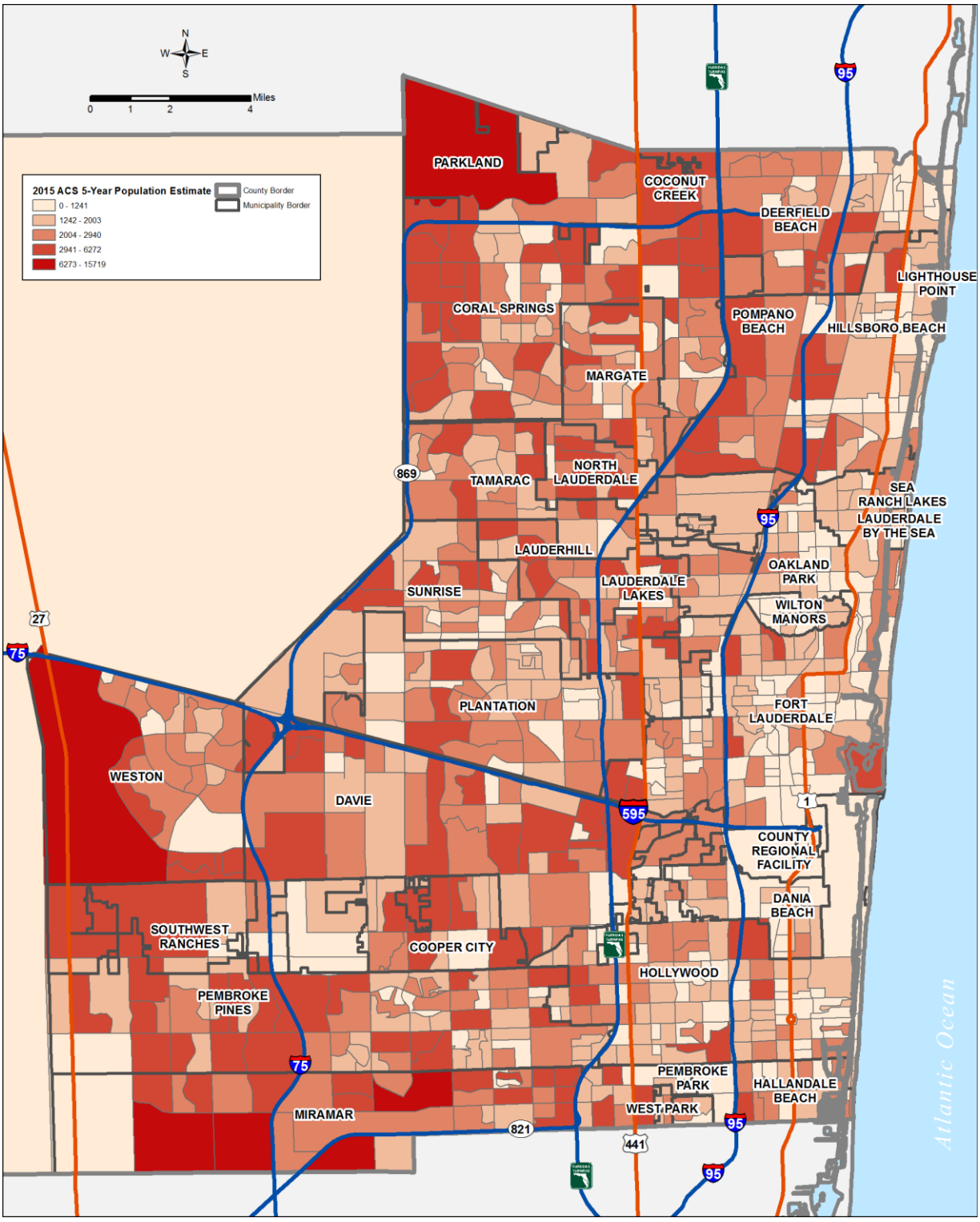
As the permanent population grows, more development and infrastructure is needed to accommodate the increasing number of residents. According to the 2017 Broward County Land Use Plan, “Broward County's “developable” area, consisting of approximately 431 square miles of the eastern portion of the County, can be characterized as essentially built-out. This built-out character physically constrains the ability to accommodate the new residents expected by the year 2040, and also the desire to enhance the County’s economic base. To accommodate new population and economic activity, Broward County endorses a strategic approach to direct growth to areas which maximize the efficient use of land and create places to shop, work and play. Broward County supports a development strategy which promotes the principles of “Smart Growth,” which seeks to maintain and create desirable communities and neighborhoods for Broward County residents, visitors and economic interests, including quality housing for all, integrated with excellent public facilities, recreational opportunities and open space areas, and which preserves and conserves natural resources. Future mitigation planning should include the potential of using repetitive neighborhoods as both open-space/recreational spaces and “ponding” areas during flood periods.” See **Chapter 6** for mitigation initiatives.

Map 4.4: Critical Facilities



Source: Broward County GIS 2017

Map 4.5: Population Distribution by Census Block Group, 2015 ACS 5-Year Estimates



Source: Broward County GIS 2017, US Census Bureau

Hazard Vulnerability Profile for Existing and Future Land Use

This section provides information on Broward County's existing and future land use vulnerabilities to 3 spatially defined hazards to be addressed further in this risk assessment including storm surge from tropical cyclones, flood, and wildfire. It borrows heavily from a study performed by the Florida Department of Community Affairs (FDCA), an agency now defunct. Beginning in 2004, land use tabulations in relation to known hazard areas were developed by FDCA's Division of Community Planning as part of an analysis entitled, *Integrating Hazard Mitigation Planning into Comprehensive Planning: Broward County Profile.* The following data were used for the tabulations: online Mapping for Emergency Management, Parallel Hazard Information System (MEMPHIS)[3], 2017 Broward County Property Appraiser / Florida Department of Revenue data, and the current Florida Department of Environmental Protection and South Florida Water Management District GIS databases and shapefiles.

For the purposes of this profile, the identified hazard areas include the coastal hazards zone in relation to storm surge, hurricane vulnerability zones in relation to evacuation clearance times, flood zones in relation to the 100-year flood, and wildfire susceptible areas. More details about the hazard zones used for the tabulation are as follows:

- The Coastal Hazards Zone (CHZ) illustrates areas at risk to surge, which is comprised of the category 1 storm surge zone from NOAA Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model and the category 1 evacuation zone.
- The Hurricane Vulnerability Zone (HVZ) shows hurricane risk, which includes Category 1 to 3 Hurricane Evacuation Zones.
- FEMA's designated 100-year flood zones (i.e., A, AE, V, VE, AO, 100 IC, IN, AH) are used for flood.
- All medium-to-high risk zones from MEMPHIS for wildfire (Level 5 through Level 9).

Existing land use data was acquired from County Property Appraisers and the Florida Department of Revenue for tabulation of the total amount of acres and percentage of land in identified hazard areas, sorted by existing land use category for the Broward Municipal Services District areas. The total amount of acres and percentage of land in the identified hazards areas was tabulated and sorted by future land use category according to the local future land use map, as well as the amount of these lands listed as vacant according to existing land use. Broward County future land use data was acquired from Broward County and might not reflect changes per recent future land use amendments.

County acreage was tabulated by existing (**Table 4.3**) and future (**Table 4.4**) land uses within the hazard areas.[4] The results of these land use tabulations are summarized below along with some

3 MEMPHIS was designed to provide a variety of hazard related data in support of the Florida Local Mitigation Strategy DMA2K revision project. It was created by Kinetic Analysis Corporation under contract with the FDCA. For more details on a particular hazard or an explanation of the MEMPHIS methodology, consult the MEMPHIS Web site (http://lmsmaps.methaz.org/lmsmaps/index.html).

4 Note: The Everglades Conservation Area is not included in the following land use tabulations.

recommendations included with the FDCA study. This information was confirmed for accuracy and relevance with the Division of Forestry in July 2017.

Storm Surge from Tropical Cyclones

Table 4.3 presents the existing land uses within the surge zone. There are 14,665 acres of land within the coastal hazard zone (CHZ) and an additional 237 acres in the hurricane vulnerability zone (HVZ). These zones are primarily located on the barrier islands and inland up to a couple miles. Incorporated coastal communities occupy a majority of the land in these zones. Currently, 43.1% of the CHZ and 42.6% of the HVZ have single-family homes. Another major existing land use of these zones is commendably parks and conservation, with 13.0% of the CHZ and 13.9% of the HVZ used for these purposes. In addition, approximately 19% of both zones are still undeveloped. **Table 4.4** shows that of the currently vacant land in the CHZ and HVZ, 33.4% and 28.7%, respectively, are designated for future transportation uses. While future investment in transportation in these zones may increase evacuation capacities, it also will increase the taxpayer's investment in a hazardous area and subsidize future growth where the intention is to limit densities. **Table 4.4** also shows that currently vacant land is allocated for future residential use. According to the tabulations, 10.8% of the vacant property in both zones is designated for 5 dwelling units per acre and another 8.6% of the CHZ and 10.1% of the HVZ vacant acres are designated for 25 dwelling units per acre. If development occurs accordingly, it will further increase the population in the Category 1 evacuation zone and likely put more people at risk from storm surge.

Flood

Table 4.3 presents the existing land uses within the 100-year floodplain. Much of Broward County is within a flood zone. Currently, 193,965 acres are at risk from flooding, but this does not include the Everglades Conservation Area which naturally floods. Of the 193,965 acres, 64.8%, or 125,750 acres are in residential use. Also, 33,981 flood-prone acres, or 17.5%, of the floodplain, is currently undeveloped. An additional 9,934 acres besides those in the Everglades Conservation Area are designated as parks, conservation areas, and golf courses. Using flood-prone areas for parks and conservation purposes is a strong flood mitigation strategy since development can be limited in these areas and the natural hydrology left in place. Existing vacant land allows the County and municipalities an opportunity to regulate or limit development before it occurs. Of the 33,981 acres currently undeveloped in the zone, 50.2% are designated for future residential uses, as shown in Table 4.4. Another 3,177 acres are designated for commercial use while an additional 1,260 vacant acres are designated for community facilities. Transportation and right-of-way future land uses are designated towards 14.2% of existing undeveloped land. This is a lot of development that is currently allowable within the 100-year floodplain. With proper mitigation designed into these structures and roads, much of the development can occur without increasing the vulnerability of the County to flood losses. However, alterations to the natural hydrology often have unforeseen impacts if mitigation occurs in a piece-meal fashion rather than looking at system-wide drainage impacts.

Wildfire

Table 4.3 presents the land uses associated with high-risk wildfire zones. Small wildfire-prone areas are found throughout the County, although there is a concentration along Route 27. Single-family homes are found in 46.9% of the wildfire susceptible acres, generally scattered in isolated

areas south of Highway 75 and east of Route 27. These homes are most likely very vulnerable to a wildfire since single-family residential neighborhoods on the outskirts of urban areas typically have a lot of vegetation that can allow a fire to spread between homes. Another 24% of the wildfire risk areas, or 1,628 acres, are currently conserved and special attention should be paid to maintaining wildfire fuel levels through prescribed burning or mechanical means in these areas. Another 875 acres are currently undeveloped. Vacant lands often can add to wildfire risk since wildfire fuel levels are not typically maintained. Of the undeveloped land, Table 4.4 shows that 19.1% is designated for future residential estates and 12.6% is designated for rural ranches. When development does occur on these lands, wildfire mitigation techniques for neighborhood design should be encouraged as well as education of homeowners about maintaining defensible space.

Table 4.3: Total County Acres in Hazard Areas by Existing Land Use Category

Existing Land Use Category		Coastal Hazard Zone	Hurricane Vulnerability Zone	Flood Zones	Wildfire Susceptible Areas
Agriculture	Acres	85.8	150.1	5,446.3	832.0
	%	0.49%	0.68%	2.88%	3.54%
Attractions, Stadiums, Lodging	Acres	144.8	295.6	509.1	2.9
	%	0.82%	1.33%	0.27%	0.01%
Places of Worship	Acres	45.3	117.2	1,678.6	187.1
	%	0.26%	0.53%	0.89%	0.80%
Commercial	Acres	615.2	1,224.4	9,445.8	370.4
	%	3.49%	5.51%	5.00%	1.58%
Government, Institutional, Hospitals, Education	Acres	2,170.2	1,116.4	14,097.4	1,900.2
	%	12.32%	5.02%	7.47%	8.10%
Industrial	Acres	249.0	302.8	5,803.5	271.2
	%	1.41%	1.36%	3.07%	1.16%
Parks, Conservation Areas, Golf Courses	Acres	2,643.1	2,633.0	9,676.3	743.7
	%	15.00%	11.85%	5.12%	3.17%
Residential Group Quarters, Nursing Homes	Acres	5.9	7.1	337.0	0.2
	%	0.03%	0.03%	0.18%	0.00%
Residential Multi-Family	Acres	174.5	853.8	5,673.1	183.0
	%	0.99%	3.84%	3.00%	0.78%
Residential Mobile Home, or Commercial Parking Lot	Acres	182.7	279.0	2,701.5	61.0
	%	1.04%	1.25%	1.43%	0.26%
Residential Single-Family	Acres	1,577.1	5,264.2	32,778.4	2,635.8
	%	8.95%	23.68%	17.36%	11.23%
Submerged Lands (Water Bodies)	Acres	3,181.1	1,966.1	16,171.3	2,345.7
	%	18.05%	8.84%	8.56%	9.99%
Transportation, Communication, Rights-of-Way	Acres	2,157.8	1,972.1	24,255.1	1,997.5
	%	12.25%	8.87%	12.85%	8.51%
Utility Plants and Lines, Solid Waste Disposal	Acres	232.4	15.9	8,732.3	6,836.9
	%	1.32%	0.07%	4.62%	29.13%

Existing Land Use Category		Coastal Hazard Zone	Hurricane Vulnerability Zone	Flood Zones	Wildfire Susceptible Areas
Vacant	Acres	221.8	122.9	4,994.7	178.5
	%	1.26%	0.55%	2.65%	0.76%
All Others	Acres	701.2	907.5	18,827.5	2,795.3
	%	3.98%	4.08%	9.97%	11.91%
No Data	Acres	3,233.6	5,000.9	27,688.5	2,130.6
	%	18.35%	22.50%	14.66%	9.08%
TOTAL	**Acres**	**17,621.5**	**22,229.0**	**188,816.4**	**23,472.2**
	%	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Source: Broward County Property Appraiser GIS July 2017 Data, Broward County Property Appraiser GIS, Florida Regional Planning Councils and Florida Division of Emergency Management, Broward County GIS, FEMA National Flood Hazard Layer, Southern Wildfire Risk Assessment

Table 4.4: Total and Undeveloped Acres in Hazard Areas by Future Land Use Category

Future Land Use Category		Coastal Hazard Zone		Hurricane Vulnerability Zone		Flood Zones		Wildfire Susceptible Areas	
		Total	Undev.	Total	Undev.	Total	Undev.	Total	Undev.
Activity Center	Acres	949.2	340.0	1415.8	794.4	11498.5	6718.0	884.9	390.3
	% of Total	5.4%	4.9%	6.4%	7.1%	6.1%	7.3%	3.8%	5.3%
Agricultural	Acres	77.9	0.0	0.0	0.0	9686.1	959.8	7989.9	518.0
	% of Total	0.4%	0.0%	0.0%	0.0%	5.1%	1.0%	34.0%	7.0%
Commerce	Acres	1386.3	889.0	1681.4	1086.8	24230.8	16386.7	1338.6	862.2
	% of Total	7.9%	12.9%	7.6%	9.7%	12.8%	17.9%	5.7%	11.6%
Commercial Recreation	Acres	312.8	281.6	357.1	307.0	4169.6	2235.6	0.0	0.0
	% of Total	1.8%	4.1%	1.6%	2.7%	2.2%	2.4%	0.0%	0.0%
Community	Acres	314.0	190.3	499.3	385.1	7055.3	5911.2	937.5	890.8
	% of Total	1.8%	2.8%	2.2%	3.4%	3.7%	6.4%	4.0%	12.0%
Conservation - Natural Reservations	Acres	1681.5	214.0	1518.8	223.2	4218.1	674.6	1172.5	156.6
	% of Total	9.5%	3.1%	6.8%	2.0%	2.2%	0.7%	5.0%	2.1%
Conservation - Reserve Water Supply Area	Acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	% of Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Electrical Generation Facility	Acres	501.5	255.3	59.4	53.7	561.7	313.5	0.0	0.0
	% of Total	2.8%	3.7%	0.3%	0.5%	0.3%	0.3%	0.0%	0.0%
Estate (1) Residential	Acres	30.6	2.8	0.0	0.0	13515.7	8919.2	554.0	255.1
	% of Total	0.2%	0.0%	0.0%	0.0%	7.2%	9.7%	2.4%	3.4%
	Acres	184.0	61.4	794.0	199.4	1070.5	318.9	0.0	0.0

Future Land Use Category		Coastal Hazard Zone		Hurricane Vulnerability Zone		Flood Zones		Wildfire Susceptible Areas	
		Total	Undev.	Total	Undev.	Total	Undev.	Total	Undev.
High (50) Residential	% of Total	1.0%	0.9%	3.6%	1.8%	0.6%	0.3%	0.0%	0.0%
Irregular Residential	Acres	160.5	4.7	30.3	2.2	20689.9	6677.7	2731.2	711.3
	% of Total	0.9%	0.1%	0.1%	0.0%	11.0%	7.3%	11.6%	9.6%
Low (2) Residential	Acres	53.3	29.2	93.3	66.0	3366.3	1099.0	1053.3	218.2
	% of Total	0.3%	0.4%	0.4%	0.6%	1.8%	1.2%	4.5%	2.9%
Low (3) Residential	Acres	1778.1	413.7	2699.4	1282.6	12859.2	5083.9	1155.8	319.0
	% of Total	10.1%	6.0%	12.1%	11.5%	6.8%	5.5%	4.9%	4.3%
Low (5) Residential	Acres	3188.8	1214.9	5257.2	3326.6	26515.3	12498.9	182.7	38.7
	% of Total	18.1%	17.6%	23.6%	29.7%	14.0%	13.6%	0.8%	0.5%
Low-Medium (10) Residential	Acres	283.0	81.6	356.2	234.8	7476.2	3197.6	200.5	39.3
	% of Total	1.6%	1.2%	1.6%	2.1%	4.0%	3.5%	0.9%	0.5%
Medium (16) Residential	Acres	374.8	81.8	1068.9	519.8	6972.1	3015.5	6.4	0.0
	% of Total	2.1%	1.2%	4.8%	4.6%	3.7%	3.3%	0.0%	0.0%
Medium-High (25) Residential	Acres	806.0	110.7	2029.3	597.3	3742.8	1150.9	0.0	0.0
	% of Total	4.6%	1.6%	9.1%	5.3%	2.0%	1.3%	0.0%	0.0%
Mining	Acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	% of Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Palm Beach County Rural Residential-10	Acres	0.0	0.0	0.0	0.0	112.7	37.0	0.0	0.0
	% of Total	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
Recreation and Open Space	Acres	1590.4	984.1	1409.6	852.5	10026.6	7235.7	1174.1	997.7
	% of Total	9.0%	14.3%	6.3%	7.6%	5.3%	7.9%	5.0%	13.4%
Rural Estates	Acres	0.0	0.0	0.0	0.0	1348.1	910.0	637.6	391.4
	% of Total	0.0%	0.0%	0.0%	0.0%	0.7%	1.0%	2.7%	5.3%
Rural Ranches	Acres	0.0	0.0	0.0	0.0	5318.6	3988.3	2296.1	1639.0
	% of Total	0.0%	0.0%	0.0%	0.0%	2.8%	4.3%	9.8%	22.1%
Transportation	Acres	2122.8	1624.5	1702.8	1136.4	11334.4	4243.0	928.5	0.0
	% of Total	12.0%	23.6%	7.7%	10.2%	6.0%	4.6%	4.0%	0.0%
Water	Acres	1825.9	109.0	1256.1	114.7	3022.1	115.1	228.6	0.0
	% of Total	10.4%	1.6%	5.7%	1.0%	1.6%	0.1%	1.0%	0.0%
TOTAL	**Acres**	**17621.5**	**6888.5**	**22229.0**	**11182.7**	**188790.5**	**91690.1**	**23472.2**	**7427.4**
	% of Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Source: Broward County Property Appraiser GIS July 2017 Data, Broward County Property Appraiser GIS, Florida Regional Planning Councils and Florida Division of Emergency Management, Broward County GIS, FEMA National Flood Hazard Layer, Southern Wildfire Risk Assessment

Hazard Identification

Broward County is vulnerable to a wide range of natural and human caused hazards that threaten life and property. FEMA's current regulations and guidance under the Disaster Mitigation Act of 2000 (DMA 2000) require, at a minimum, an evaluation of a full range of natural hazards. An evaluation of human-caused hazards (i.e., technological hazards, terrorism) is encouraged, though not required for plan approval. The initial identification of hazards for inclusion in the risk assessment was based on earlier versions of the Broward County LMS, as well as a review of the State of Florida Hazard Mitigation Plan and FEMA mitigation planning guidelines. **Table 4.5** lists the full range of hazards initially identified for inclusion in this risk assessment.

Table 4.5: Initially Identified Hazards for Broward County

Natural Hazards	Human Caused Hazards
Atmospheric ☐ Extreme Heat ☐ Freeze ☐ Lightning ☐ Severe Thunderstorm (hail and wind) ☐ Tornado ☐ Tropical Cyclone (wind and storm surge) ☐ Winter Storm **Hydrologic** ☐ Coastal Erosion ☐ Drought ☐ Flood ☐ Rip Current ☐ Sea Level Rise/Climate Change **Geologic** ☐ Earthquake ☐ Expansive Soils ☐ Sinkhole / Land Subsidence ☐ Tsunami ☐ Volcano **Other** ☐ Wildfire	**Biological** ☐ Agricultural Disease ☐ Pandemic/Infectious Disease **Societal** ☐ Civil Disturbance ☐ Mass Migration ☐ Terrorism **Technological** ☐ Cyber ☐ Dam / Levee Failure ☐ Hazardous Material Incident ☐ Nuclear Power Plant Accident ☐ Structural Fire

Major Disaster Declarations

Prior to determining the potential hazards of most significant concern for Broward County, it is also helpful to review past major disaster declarations that have impacted the area. Major disasters are declared by the President of the United States when the magnitude of a disaster event is of such severity and magnitude that effective response is beyond the capabilities of the State and the local governments. In these cases, eligible applicants may apply for a wide range

of federal disaster assistance that include funds for public assistance, individual assistance, and hazard mitigation assistance.[5]

Since 1965, Broward County has received 17 presidential disaster declarations for hurricane, flood, wildfire, tornado, and freeze events as listed in **Table 4.6**. Please note that this listing does not include all federal, state, or local emergency declarations issued for smaller, less damaging disaster events that did not warrant a presidential declaration.

Table 4.6: Presidential Disaster Declarations for Broward County (1965 – June 15, 2017)

Event	Declaration Date	Declaration Number
Hurricane Betsy	09/14/1965	FEMA-209-DR
Freeze	03/15/1971	FEMA-304-DR
Hurricane Andrew	08/24/1992	FEMA-955-DR
Tornadoes, Flooding, High Winds & Tides, Freezing	03/22/1993	FEMA-982-DR
Severe Storms, High Winds, Tornadoes, and Flooding	02/20/1998	FEMA-1204-DR
Severe Storms, High Winds, Tornadoes, and Flooding	03/09/1998	FEMA-1195-DR
Extreme Fire Hazard	06/18/1998	FEMA-1223-DR
Hurricane Irene	10/20/1999	FEMA-1306-DR
Heavy Rains and Flooding	10/04/2000	FEMA-1345-DR
Severe Freeze	02/06/2001	FEMA-1359-DR
Hurricane Charley and Tropical Storm Bonnie	08/13/2004	FEMA-1539-DR
Hurricane Frances	09/04/2004	FEMA-1545-DR
Hurricane Jeanne	09/26/2004	FEMA-1561-DR
Hurricane Katrina	08/28/2005	FEMA-1602-DR
Hurricane Wilma	10/24/2005	FEMA-1609-DR
Tropical Storm Fay	8/21/2008	FEMA-3288-DR
Hurricane Matthew	11/04/2016	FEMA-4283-DR

Source: Federal Emergency Management Agency

Hazards of Most Significant Concern for Broward County

Each of the initially identified hazards was studied for their potential impact on Broward County as well as in terms of the availability of hazard mitigation strategies to reduce that impact. Best available data on historical occurrences, the geographic location and extent as well as the probability of future occurrences were collected and reviewed as part of the hazard identification process.

Additionally, an Enhanced Local Mitigation Strategy (ELMS) Risk and Vulnerability Assessment Workshop was conducted on June 26, 2017. All 31 Municipalities of Broward County were represented at the three and a half (3.5)-hour workshop to discuss hazard mitigation and jointly

5 For more information on the disaster declaration process and federal disaster assistance, see www.fema.gov/rrr/dec_guid.shtm.

performing a comprehensive Threat Hazard Identification and Risk Analysis (THIRA), to help identify the main hazards of significant concern among local government officials.

The workshop scenario included a powerful Tropical Storm, recently downgraded from a Category-1 Hurricane, making landfall directly upon Ft. Lauderdale causing wide-spread damage from sustained 70-mile per hour winds and massive flooding across Broward County with a storm surge of 3.5 feet. As Broward County works to support evacuated or otherwise displaced populations, a non-related ransomware cyber-attack occurs world-wide but especially impacts Broward County's governmental, heath and private sector entities who are working to recover from the storm.

The results of this workshop indicated that tropical cyclone, flood, severe storms/tornadoes, sea level rise/climate change, pandemic or infectious disease, hazardous materials incidents, wildfire, extreme heat, drought, coastal erosion, mass migration and terrorism were considered the hazards of most significant concern for mitigation planning purposes. Cyber-threats were also evaluated and it was determined that additional coordination with Broward County Enterprise Technology Services (ETS) and the Florida Agency for State Technology (AST) is needed to further accurately assess the impact of this hazard. Hazards of moderate concern included nuclear power plant accident, civil disturbance, and lightning. All of the remaining hazards were considered as having low concern among local officials. Additional information of these findings and full tabulation of workshop participant assessment of hazard Priority Risk Index (PRI) scores can be found in the 2017 Enhanced Local Mitigation Strategy Risk and Vulnerability Assessment Workshop After-Action Report (AAR).

Upon further consideration of these initial study findings and subsequent data collection efforts, the hazards marked with a "✓" in **Table 4.7** were identified as the most significant hazards of concern for Broward County and are further evaluated and described more fully in this section. Those hazards excluded from further analysis are listed in **Table 4.8** along with brief documentation on why they have been excluded, however these hazards will continue to be revisited during future updates to the risk assessment for Broward County.

The LMS working group reviewed the initial draft findings in July 2017 and again in August 2017. The results from the draft findings were weighted and then incorporated into the final hazards identified as most significant concern.

Table 4.7: Most Significant Hazards of Concern for Broward County

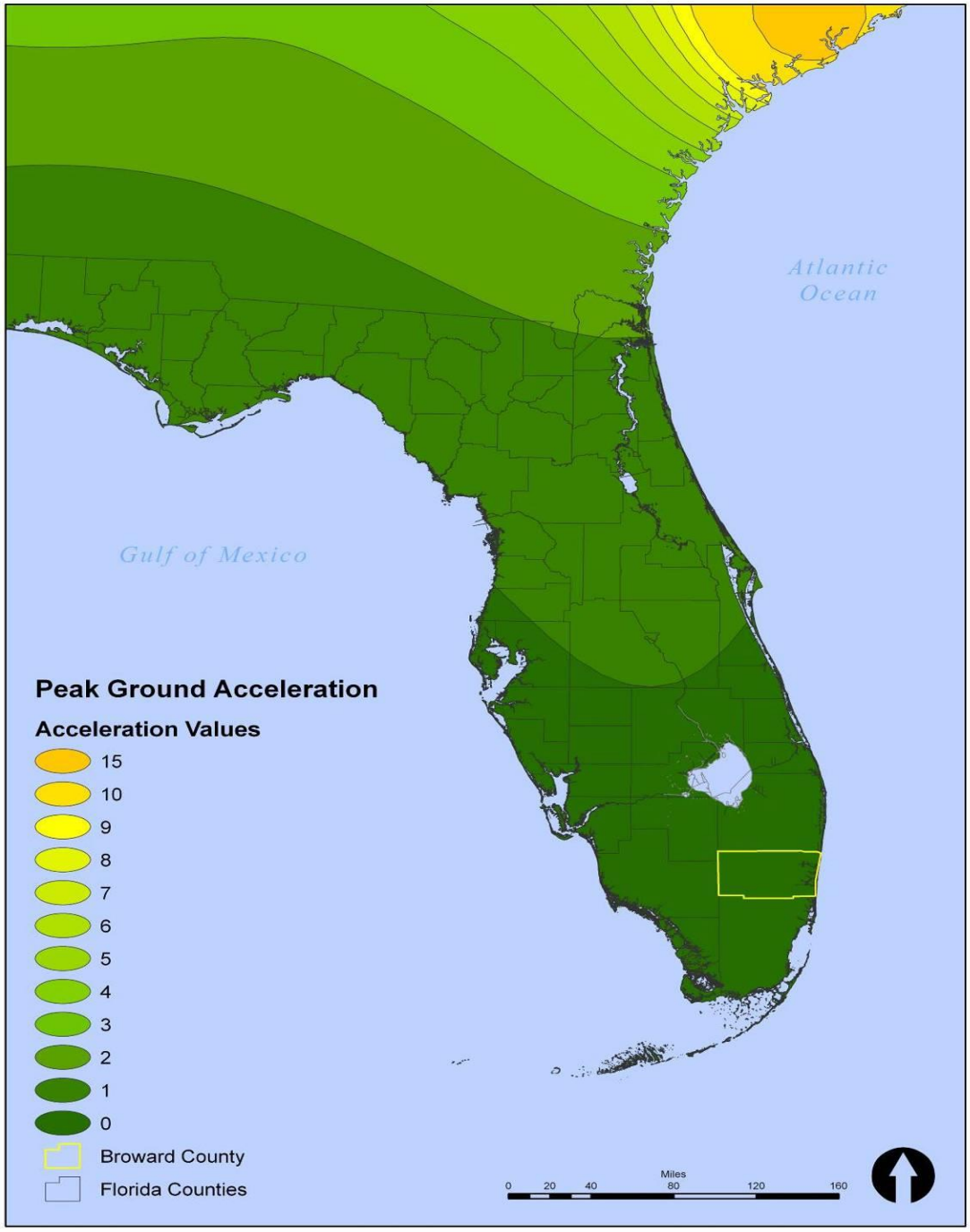
Natural Hazards	Human Caused Hazards
Atmospheric ☑ Extreme Heat ☐ Freeze ☐ Lightning ☑ Severe Thunderstorm ☑ Tornado ☑ Tropical Cyclone (Storms and Hurricanes) ☐ Winter Storm **Hydrologic** ☑ Coastal Erosion ☑ Drought	**Biological** ☐ Agricultural Disease ☑ Pandemic/Infectious Disease **Societal** ☐ Civil Disturbance ☑ Mass Migration ☑ Terrorism **Technological** ☐ Cyber ☐ Dam / Levee Failure

☑ Flood ☐ Rip Current ☑ Sea Level Rise/Climate Change **Geologic** ☐ Earthquake ☐ Expansive Soils ☐ Sinkhole / Land Subsidence ☐ Tsunami ☐ Volcano **Other** ☑ Wildfire	☑ Hazardous Material Incident ☐ Nuclear Power Plant Accident ☐ Structural Fire

Table 4.8: Hazards Excluded from Further Analysis

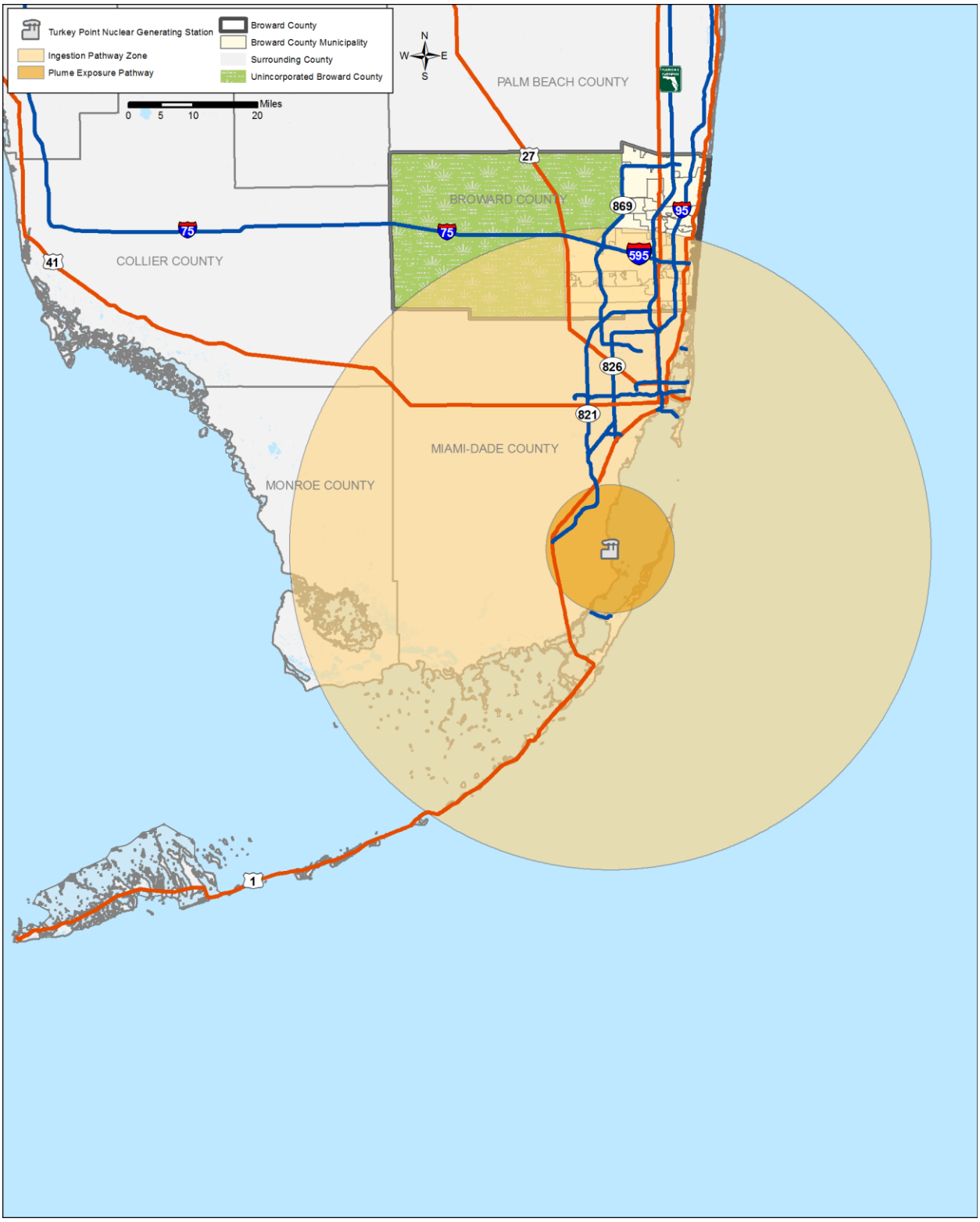
Hazard	Reasons for Exclusion
Freeze	Deep freezes do occasionally occur in South Florida; however, these events cause minimal impact outside of agricultural losses and related economic industries (including commercial nurseries). Due to widespread urban development and minimal agricultural land uses in Broward County, historical crop damages due to freezes are minimal in comparison to other areas in Florida.
Winter Storm	South Florida is not at risk to winter storms (including snow, ice, sleet, and blizzard conditions).
Earthquake	Broward County is located well outside of any areas identified by the United States Geological Survey as having seismic risk (see **Map 4.5**). The peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for Broward County is 0% gravity (g) (lowest potential for seismic ground shaking events). FEMA recommends that earthquakes only be further evaluated for mitigation purposes in areas with a PGA of 3% g or more.
Expansive Soils/Land Subsidence	South Florida is not at risk to expansive soils. Based on its soil type, there is no potential for ground swelling and associated property damages in Broward County.
Tsunami	Extremely rare, small events are possible along the eastern shoreline of Broward County but the impact would likely be minimal. Further, the vulnerability of coastal assets to tsunami inundation is lessened through ongoing hurricane storm surge mitigation practices.
Volcano	Volcanoes are not located anywhere remotely near Broward County.
Agricultural Disease	Due to widespread urban development and minimal agricultural land uses in Broward County, agricultural disease is not a significant hazard of concern for Broward County. Although some residents do have citrus trees on their property that are susceptible to citrus canker, the Florida Department of Agriculture has an aggressive program in place for the cutting down and removal of infected trees.
Civil Disturbance	There have been no recorded instances of large, unlawful civil disturbances in Broward County that have exceeded the ability of existing law enforcement resources and partnering agencies to suppress and control. Aside from existing operations planning and ongoing security preparedness efforts, there is little that may be done in terms of hazard mitigation.
Dam / Levee Failure	According to the U.S. Army Corps of Engineers and the FEMA National Dam Safety Program, there are no identified dams or levees which pose a high or intermediate hazard to Broward County. The Broward County portion of the East Coast Protective Levee was accredited in September 2013. Although not included as a significant hazard of concern, future analysis should be done on the impact of dam / levee failure.
Nuclear Power Plant Accident	Broward County is located outside of the Plume Exposure Pathway (10 mile radius) of the Turkey Point Nuclear Power Generating Station (located in Miami-Dade County) in which shelter and/or evacuation would likely be the principal immediate protective actions against accidental releases of radiological plumes (see **Map 4.6**). Portions of Broward County are located in the Ingestion Pathway Zone (50 mile radius) but in the event of an accident, impacts are likely to be limited to serving as a host to evacuees from Miami-Dade County.
Structural Fire	The structural fire hazard is more appropriately and adequately addressed through statewide and local fire safety standards and codes, in addition to the continuous planning, training, and routine operation of local firefighting services.
*** Lightning	Lightning is a weather hazard of importance and extensive cautionary messaging is produced from the National Weather Services and local television venues during storms and rain events. Although not included as significant hazard of concern, more in-depth analysis was done on lighting in hazards assessment.
*** Rip Currents	Rip currents are a risk of importance and cautionary messaging is produced from the National Weather Services and local television venues. Although not included as significant hazard of concern, more in-depth analysis was done on rip currents in hazards assessment.

Map 4.6: Peak Ground Acceleration for Earthquake Risk



Source: 2012 Broward County ELMS, verified 2017

Map 4.7: Turkey Point Nuclear Power Plant Emergency Planning Zones



Source: 2017 Broward County GIS, Florida Department of Emergency Management

Natural Hazards

Natural hazards have the potential to threaten lives and cause costly damages to the built environment. Natural hazards are the largest single contributor to catastrophic or repetitive damage to communities in Broward County. This section includes the natural hazards that pose the greatest risk in Broward County. Natural hazards are categorized as atmospheric, hydrologic, geologic, and other (i.e., wildfire). Hazards are listed alphabetically by category. An addition to the enhanced LMS plan is the inclusion of sea level rise/climate change as a natural hazard. While this warrants its own subsection under "Hydrologic Hazards", it has far ranging impacts that are discussed in the "Probability of Future Events" sections of other hazards that will be impacted such as drought, hurricane wind, flood, and wildfire. Broward County's list of projects to mitigate hazards may be found in Appendix C. In the project list, tropical cyclones (hurricanes and tropical storms), thunderstorms, and tornadoes are all listed as "Wind" events.

Atmospheric Hazards

For the purposes of this vulnerability assessment atmospheric hazards are events or incidents that are associated with weather generated phenomenon. Atmospheric hazards included in this section are extreme heat, lightning, severe thunderstorm (hail and wind), tornado, and tropical cyclone.

Extreme Heat

Background

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and that last for an extended period of time. Humid conditions may also add to the discomfort of high temperatures. Health risks from extreme heat include heat cramps, heat fainting, heat exhaustion, and heat stroke. According to the National Weather Service, heat is the leading weather-related killer in the United States and during the ten-year period between 1993 and 2002 killed more people than lightning, tornadoes, floods, and hurricanes combined. However, most deaths are attributed to prolonged heat waves in large cities that rarely experience hot weather. The elderly and the ill are most at-risk, along with those who exercise outdoors in hot, humid weather.

Location and Spatial Extent

Extreme temperatures typically impact a large area that cannot be confined to any geographic boundaries. Therefore, it is assumed that all of Broward County is uniformly exposed to this hazard and that the spatial extent of impact is large. It is important to note however that while extreme temperatures threaten human health they typically do not cause significant damage to the built environment.

Historical Occurrences

According to the State of Florida Hazard Mitigation Plan, Florida averages 12 heat related fatalities per year. Major historical events in the state include 241 deaths in a 1993 heat wave, and another 68 during a 1999 heat wave. Recent events in Broward County, as recorded by the National Climatic Data Center, include the following (no significant extreme heat events have occurred since 2012):

Winter 2003 – Extreme Heat

During February 27 through March 23, 18 daily heat records were set in southeast Florida. There were more heat records during this 25-day period in southeast Florida than at any time of year and at any time in history. The warmest temperature ever in March in Fort Lauderdale was recorded at 93 degrees on the 22nd. The entire month of March was the warmest on record in Fort Lauderdale.

June 2006 – Extreme Heat

On June 16, 2006, a 20 year old male died of apparent heat exposure in the Everglades in extreme northern Broward County. High temperatures that day were in the lower 90s and lowest relative humidity values were around 55%, producing maximum heat index values of near 105 degrees.

June 21-22, 2009– Extreme Heat

On Sunday June 21 and Monday June 22, unusually high temperatures affected interior and eastern sections of South Florida. High temperatures reached the upper 90s in a few locations on June 21. The hottest day was June 22, in which an all-time record high was tied at Fort Lauderdale at 100 degrees.

June 15, 2012- Extreme Heat

On June 15, 2012, in Metro Broward County, there were six injuries that were caused extreme heat (NOAA, 2017). Six teenagers suffered heat exhaustion at a Jr. R.O.T.C. summer camp in Davie.

Probability and Extent of Future Events

The probability of future extreme heat waves in Broward County is considered "likely". In the future Broward County could be expected to be impacted by periodic extreme heat events with temperatures up to the all-time record high of 100 degrees.

Vulnerability Assessment

Broward County's existing buildings, infrastructure, and critical facilities are not considered vulnerable to damage caused by extreme heat events and therefore any estimated property losses are anticipated to be minimal across the area. Extreme heat does however present a significant life and safety threat to Broward County's population. Heat casualties are usually caused by lack of adequate air conditioning or heat exhaustion. The most vulnerable population to heat casualties are the elderly or infirmed, who frequently live on low fixed incomes, and cannot afford to run air-conditioning on a regular basis, may experience power outages, and may be isolated, with no immediate family or friends to look out for their well-being.

Broward County has a large elderly population (around 297,738 people over the age of 65) that is particularly susceptible to the effects of extreme heat. The greatest impact to this and other segments of the population will likely occur during extreme heat conditions that follow large-scale power outages (e.g., after a damaging hurricane event) which eliminate the availability of air conditioning. In such cases, it is anticipated that many casualties will be avoided as many people will utilize air-conditioned shelter space made available throughout Broward County.

Severe Storm

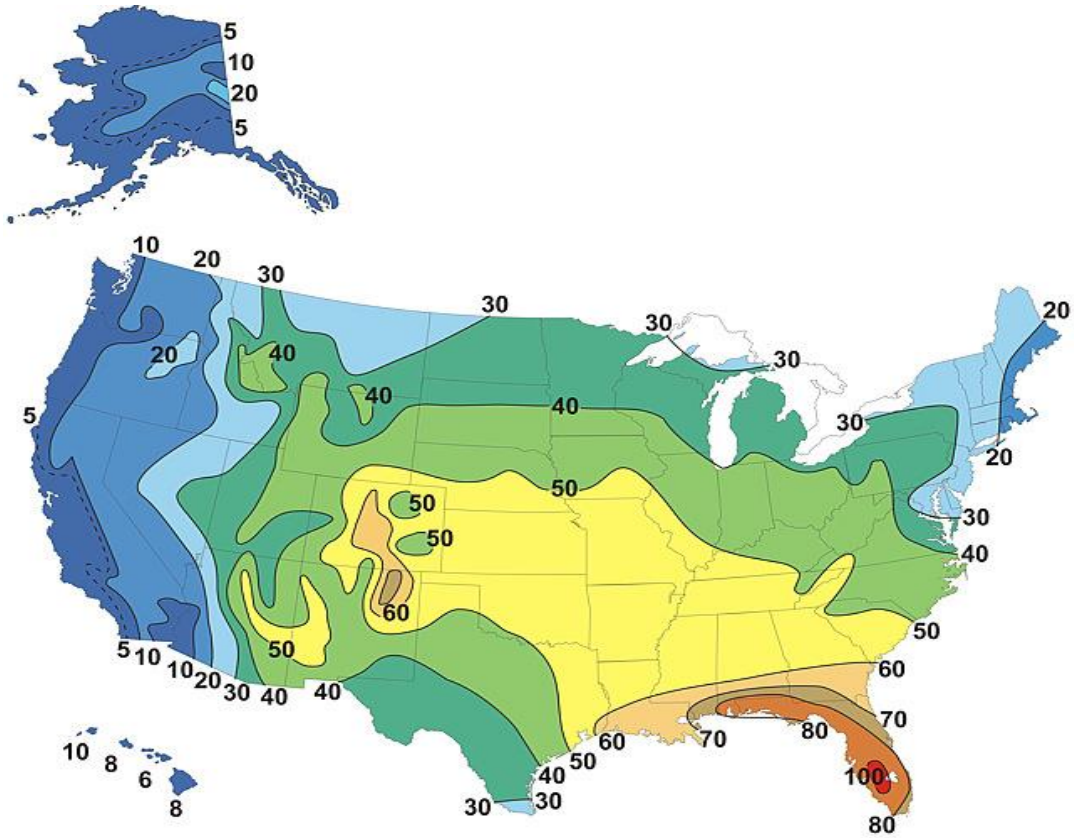
Background

According to the National Severe Storms Laboratory, more than 100,000 thunderstorms occur each year, though only about 10% of these storms are classified as "severe" (wind speeds greater than 58 miles per hour). Although thunderstorms generally affect a small area when they occur, they are very dangerous because of their ability to generate strong winds, tornadoes, hailstorms, flash flooding, and damaging lightning. While thunderstorms can occur in all regions of the United States, they are most common in the central and southern states because atmospheric conditions in those regions are most ideal for generating these powerful storms.

Thunderstorms are caused when air masses of varying temperatures meet. Rapidly rising warm moist air serves as the "engine" for thunderstorms. These storms can occur singularly, in lines or in clusters. They can move through an area very quickly or linger for several hours.

The National Weather Service estimates that as many as 40,000 thunderstorm occurrences each day world-wide. On annual basis, this means an incredible 14.6 million occurrences annually world-wide. **Figure 4.5** illustrates the average annual number of thunderstorm days in the United States. Florida leads the nation with the highest incidence per year (80 to 100 plus annual thunderstorm days).

Figure 4.4: Average Annual Number of Thunderstorm Days Throughout the U.S, 2017



Source: National Weather Service, 2017

Straight-line Wind

Straight-line winds, which in extreme cases have the potential to cause wind gusts that exceed 100 miles per hour, are responsible for most thunderstorm wind damage. One type of straight-line wind, the downburst, can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation.

Hail

Hailstorms are another potential damaging outgrowth of severe thunderstorms. Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until having developed sufficient weight they fall as precipitation—as balls or irregularly shaped masses of ice greater than 0.75 inches in diameter. The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth's surface. Higher temperature gradients relative to elevation above the surface result in increased suspension time and hailstone size.

Location and Spatial Extent

As seen in Figure 4.5, Florida remains one of the most vulnerable states in the U.S. to thunderstorm events. According to the State of Florida Hazard Mitigation Plan, it is a rare occasion when thunderstorms are not observed somewhere in the state on a daily basis during the summer rainy season (generally the end of May through the beginning of October). Thunderstorms vary tremendously in terms of size, location, intensity, and duration but are considered extremely frequent occurrences throughout South Florida and Broward County. It is assumed that all of Broward County is uniformly exposed to severe thunderstorms.

Historical Occurrences

According to the National Climatic Data Center, there have been 418 recorded severe thunderstorm events (including hail and high wind) in Broward County since the early 1950's. These included:

- **277 high wind events** since 1955 that resulted in 3 fatalities, 12 injuries, and $2.37 million in property damages. The costliest event occurred on August 1, 1993 when a downburst flipped over an airplane at the Fort Lauderdale Executive airport causing approximately $500,000 in damages.

- **141 hail events** since 1955 that resulted in no reported fatalities, 1 injury, $12,000 in property damages, and no reported crop damages (listed by jurisdiction in **Table 4.11**). The locations of historically recorded hail events are shown in **Map 4.7**.

Table 4.11: Historical Hail Impacts by Jurisdiction

Jurisdiction	Number of Events (1955-2016)	Maximum Hail Size (Inches)
Coconut Creek	2	0.88
Cooper City	2	1
Coral Springs	8	1.25
Dania Beach	6	2.75

Jurisdiction	Number of Events (1955-2016)	Maximum Hail Size (Inches)
Davie	22	1
Deerfield Beach	1	0.75
Fort Lauderdale	18	3
Hallandale Beach	1	0.75
Hillsboro Beach	1	1.25
Hillsboro Lighthouse	0	not applicable
Hollywood	13	1.25
Lauderdale-By-The-Sea	0	not applicable
Lauderdale Lakes	9	1.75
Lauderhill	4	0.88
Lazy Lake	0	not applicable
Lighthouse Point	2	0.88
Margate	5	1.25
Miramar	29	1.75
North Lauderdale	2	1
Oakland Park	2	1
Parkland	2	1
Pembroke Park	0	not applicable
Pembroke Pines	5	0.88
Plantation	5	1
Pompano Beach	4	0.88
Sea Ranch Lakes	0	not applicable
Southwest Ranches	0	not applicable
Sunrise	2	1
Tamarac	2	1.75
Broward Municipal Services Districts	9	1.75
West Park	0	not applicable
Weston	0	not applicable
Wilton Manors	0	not applicable
TOTAL	157	3

Source: NOAA National Centers for Environmental Information

Probability and Extent of Future Events

The probability of future severe thunderstorm events in Broward County is considered “highly likely”. In the future Broward County could be expected to receive severe thunderstorm events with straight-line winds that exceed 58 mph winds and hail size up to 3 inches in diameter.

Vulnerability Assessment

Historical evidence shows that all of Broward County is vulnerable to impacts from severe thunderstorms. Because it cannot be predicted where severe thunderstorms may strike, all buildings and facilities are considered to be uniformly exposed to this hazard and could potentially be impacted. It is important to note that only high wind and hail events attributed to severe thunderstorms that have been reported through NOAA data have been factored into this risk assessment. However, in the past 61 years it is likely that a higher number of thunderstorm occurrences have not been reported.

To estimate potential losses due to hail, NOAA historical hail loss data was used to develop a hail stochastic model. In this model:

- Losses were scaled for inflation
- Average historic hail damageability was used to generate losses for historical hail events where losses were not reported
- Expected annualized losses were calculated through a non-linear regression of historical data
- Probabilistic losses were scaled to account for would-be losses where no exposure/instrument was present at the time of the event

Table 4.12, after **Map 4.7**, shows potential annualized losses for hail by jurisdiction.

Map 4.8: Historic Hail Events

Source: NOAA National Centers for Environmental Information

Table 4.12: Potential Annualized Losses by Jurisdiction (Hail)

Jurisdiction	Total Exposure	Annualized Expected Property Losses ($)	Annualized Percent Loss Ratio
Coconut Creek	$3,061,603,270	Negligible	0.00%
Cooper City	$1,943,657,150	Negligible	0.00%
Coral Springs	$8,134,798,700	Negligible	0.00%
Dania Beach	$1,878,435,580	Negligible	0.00%
Davie	$6,711,031,880	Negligible	0.00%
Deerfield Beach	$5,161,599,440	Negligible	0.00%
Fort Lauderdale	$22,130,694,710	Negligible	0.00%
Hallandale Beach	$3,836,691,130	Negligible	0.00%
Hillsboro Beach	$810,574,300	Negligible	0.00%
Hollywood	$10,029,588,340	Negligible	0.00%
Lauderdale-By-The-Sea	$1,739,928,950	Negligible	0.00%
Lauderdale Lakes	$1,152,461,750	Negligible	0.00%
Lauderhill	$2,492,601,430	Negligible	0.00%
Lazy Lake	$4,107,550	Negligible	0.00%
Lighthouse Point	$1,261,700,120	Negligible	0.00%
Margate	$2,296,212,030	Negligible	0.00%
Miramar	$7,475,638,380	Negligible	0.00%
North Lauderdale	$1,260,435,790	Negligible	0.00%
Oakland Park	$2,473,754,560	Negligible	0.00%
Parkland	$2,682,321,260	Negligible	0.00%
Pembroke Park	$404,154,300	Negligible	0.00%
Pembroke Pines	$10,247,846,250	Negligible	0.00%
Plantation	$6,803,128,100	Negligible	0.00%
Pompano Beach	$8,981,181,420	Negligible	0.00%
Sea Ranch Lakes	$110,763,020	Negligible	0.00%
Southwest Ranches	$890,133,450	Negligible	0.00%
Sunrise	$5,308,400,300	Negligible	0.00%
Tamarac	$3,283,696,510	Negligible	0.00%
Broward Municipal Services Districts	$1,106,396,610	Negligible	0.00%
West Park	$331,537,990	Negligible	0.00%
Weston	$6,490,572,820	Negligible	0.00%
Wilton Manors	$941,493,080	Negligible	0.00%
TOTAL	**$131,437,140,170**	**Negligible**	**0.00%**

** Negligible is less than $5,000*
Source: 2012 Broward County LMS, verified in 2017

To estimate potential losses due to severe storms, NOAA historical hail loss data was used to develop a severe thunderstorm stochastic model. In this model:

- Losses were scaled for inflation
- Average historic severe storms damageability was used to generate losses for historical severe thunderstorm events where losses were not reported
- Expected annualized losses were calculated through a non-linear regression of historical data

- Probabilistic losses were scaled to account for would-be losses where no exposure/instrument was present at the time of the event

Table 4.13 shows potential annualized property losses for thunderstorm wind for each jurisdiction in Broward County.

Table 4.13: Potential Annualized Losses by Jurisdiction (Thunderstorm Wind)

Jurisdiction	Total Exposure	Annualized Expected Property Losses ($)	Annualized Percent Loss Ratio
Coconut Creek	$3,061,603,270	Negligible	0.00%
Cooper City	$1,943,657,150	Negligible	0.00%
Coral Springs	$8,134,798,700	Negligible	0.00%
Dania Beach	$1,878,435,580	Negligible	0.00%
Davie	$6,711,031,880	Negligible	0.00%
Deerfield Beach	$5,161,599,440	Negligible	0.00%
Fort Lauderdale	$22,130,694,710	$27,290	0.00%
Hallandale Beach	$3,355,758,950	Negligible	0.00%
Hillsboro Beach	$810,574,300	Negligible	0.00%
Hollywood	$10,029,588,340	Negligible	0.00%
Lauderdale-By-The-Sea	$1,739,928,950	Negligible	0.00%
Lauderdale Lakes	$1,152,461,750	Negligible	0.00%
Lauderhill	$2,492,601,430	Negligible	0.00%
Lazy Lake	$4,107,550	Negligible	0.00%
Lighthouse Point	$1,261,700,120	Negligible	0.00%
Margate	$2,296,212,030	Negligible	0.00%
Miramar	$7,475,638,380	Negligible	0.00%
North Lauderdale	$1,260,435,790	Negligible	0.00%
Oakland Park	$2,473,754,560	Negligible	0.00%
Parkland	$2,682,321,260	Negligible	0.00%
Pembroke Park	$404,154,300	Negligible	0.00%
Pembroke Pines	$10,247,846,250	Negligible	0.00%
Plantation	$6,803,128,100	Negligible	0.00%
Pompano Beach	$8,981,181,420	Negligible	0.00%
Sea Ranch Lakes	$110,763,020	Negligible	0.00%
Southwest Ranches	$890,133,450	Negligible	0.00%
Sunrise	$5,308,400,300	Negligible	0.00%
Tamarac	$3,283,696,510	Negligible	0.00%
Broward Municipal Services Districts	$1,106,396,610	Negligible	0.00%
West Park	$331,537,990	Negligible	0.00%
Weston	$6,490,572,820	Negligible	0.00%
Wilton Manors	$941,493,080	Negligible	0.00%
TOTAL	**$131,437,140,170**	**$27,290**	**0.00%**

** Negligible is less than $5,000*
Source: 2012 Broward County LMS, verified 2017

Tornado

Background

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. Tornadoes are most often generated by thunderstorm activity (but sometimes result from hurricanes and other tropical storms) when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The damage caused by a tornado is a result of the high wind velocity and wind-blown debris, also accompanied by lightning or large hail. According to the National Weather Service, tornado wind speeds normally range from 40 to more than 300 miles per hour. The most violent tornadoes have rotating winds of 250 miles per hour or more and are capable of causing extreme destruction and turning normally harmless objects into deadly missiles.

Each year, an average of over 1,000 tornadoes are reported nationwide, resulting in an average of 70 deaths and 1,500 injuries over the last thirty years (NOAA, 2016). They are more likely to occur during the months of March through May and can occur at any time of day, but are likely to form in the late afternoon and early evening. Most tornadoes are a few dozen yards wide and touch down briefly, but even small short-lived tornadoes can inflict tremendous damage. Highly destructive tornadoes may carve out a path over a mile wide and several miles long.

The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction such as residential homes (particularly mobile homes). The Enhanced Fujita Scale for Tornadoes was developed to measure tornado strength and associated damages (**Table 4.14**).

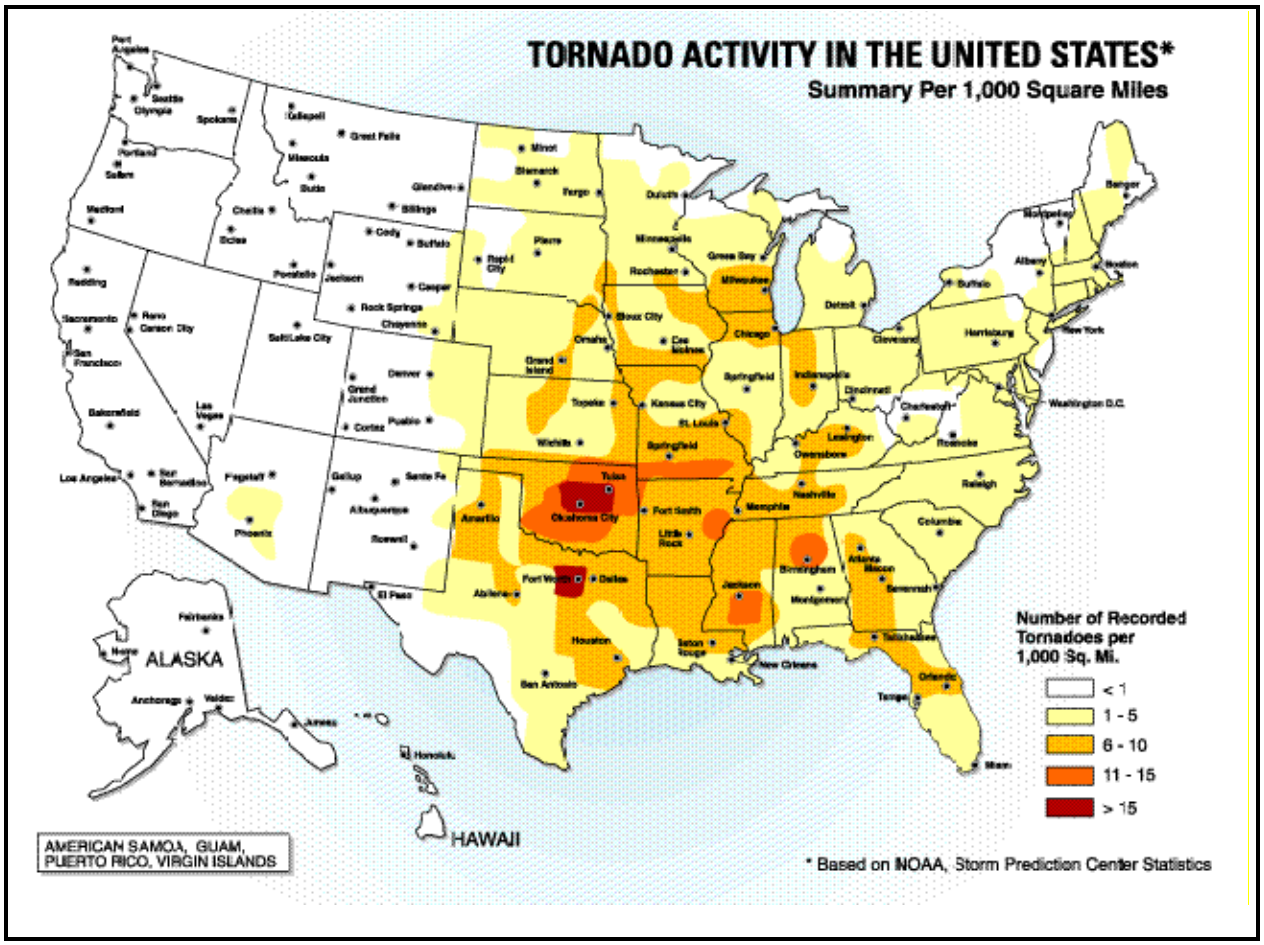
Table 4.14: Enhanced Fujita Scale for Tornadoes

EF-Scale Number	Intensity Phrase	3 Second Gust (MPH)	Type of Damage Done
EF0	GALE	65–85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
EF1	MODERATE	86–110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
EF2	SIGNIFICANT	111–135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	SEVERE	136–165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF4	DEVASTATING	166–200	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
EF5	INCREDIBLE	Over 200	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.

According to the NOAA Storm Prediction Center (SPC), the highest concentration of tornadoes in the United States has been in Oklahoma, Texas, Kansas, and Florida respectively. Although the Great Plains region of the Central United States does favor the development of the largest and most dangerous tornadoes (earning the designation of “tornado alley”), Florida experiences the greatest number of tornadoes per square mile of all U.S. states and are generally EF0 or EF1 in intensity (SPC, 2016). **Figure 4.6** shows tornado activity in the United States based on the number of recorded tornadoes per 1,000 square miles.

The tornadoes associated with tropical cyclones are most frequent in September and October when the incidence of tropical storm systems is greatest. This type of tornado usually occurs around the perimeter of the storm, and most often to the right and ahead of the storm path or the storm center as it comes ashore. These tornadoes commonly occur as part of large outbreaks and generally move in an easterly direction.

Figure 4.5: Average Annual Number of Thunderstorm Days Throughout the U.S, 2010



Source: Federal Emergency Management Agency

Waterspouts

Waterspouts are weak tornadoes that form over warm water and are most common along the Gulf Coast and southeastern states. Waterspouts occasionally move inland, becoming tornadoes that can cause damage and injury. However, most waterspouts dissipate over the open water threatening only marine and boating interests. Typically a waterspout is weak and short-lived, and because they are so common, most go unreported unless they cause damage.

Location and Spatial Extent

Tornadoes occur throughout the State of Florida, and based on historical data more confirmed tornado touchdowns have been confirmed in South Florida than other regions in the state. Florida tornadoes typically impact a relatively small area; however, events are completely random and it is not possible to predict specific areas that are more susceptible to tornado strikes over time. Therefore, it is assumed that all of Broward County is uniformly exposed to this hazard. According to the Florida Division of Emergency Management, Florida has 2 distinct tornado seasons: (1) summer (most frequent, less intense events); and (2) late winter/early spring (less frequent, more intense events).

Historical Occurrences

Florida averages 66 tornado events per year, though most are smaller, less intense, and shorter in duration than those in other states. According to the State of Florida Hazard Mitigation Plan, when compared with other states Florida ranks #4 in the number of tornado events; #19 in tornado deaths; #11 in tornado injuries; and #18 in damages.

According to the National Climatic Data Center, there have been 115 recorded tornado events in Broward County since 1950.[6] These events resulted in 1 death, 96 injuries, and an estimated $173.7 million in property damages. Most of these events (74) were determined to be of minimal tornado intensity (F0), as shown in **Table 4.15**. The specific location of the reported touchdown occurrence for each of these historical tornado events in Broward County (where known) is shown in **Map 4.8** (some touchdown points do overlap). The strongest and most deadly tornado in Broward County history occurred on March 1, 1980 when an F3 tornado killed 1 person, injured 33, and caused approximately $25 million in property damages.

Table 4.15: Overall Historical Tornado Impact in Broward County by Jurisdiction

Jurisdiction	Number of Events (1950-2016)	Magnitude (Fujita Scale*)						Maximum F Scale
		F0	F1	F2	F3	F4	F5	
Coconut Creek	1	0	1	0	0	0	0	EF1**
Cooper City	0	0	0	0	0	0	0	not applicable
Coral Springs	4	4	0	0	0	0	0	F0
Dania Beach	0	0	0	0	0	0	0	not applicable
Davie	3	2	0	1	0	0	0	EF2**
Deerfield Beach	2	1	1	0	0	0	0	F1
Fort Lauderdale	4	2	2	0	0	0	0	F1

6 These events do not include reported funnel clouds or waterspouts.

Jurisdiction	Number of Events (1950-2016)	Magnitude (Fujita Scale*)						Maximum F Scale
		F0	F1	F2	F3	F4	F5	
Hallandale Beach	6	4	2	0	0	0	0	F1
Hillsboro Beach	1	1	0	0	0	0	0	F0
Hillsboro Lighthouse	0	0	0	0	0	0	0	not applicable
Hollywood	3	2	1	0	0	0	0	F1
Lauderdale-By-The-Sea	0	0	0	0	0	0	0	not applicable
Lauderdale Lakes	1	0	1	0	0	0	0	EF1**
Lauderhill	1	1	0	0	0	0	0	F0
Lazy Lake	0	0	0	0	0	0	0	not applicable
Lighthouse Point	0	0	0	0	0	0	0	not applicable
Margate	0	0	0	0	0	0	0	not applicable
Miramar	3	1	2	0	0	0	0	F1
North Lauderdale	0	0	0	0	0	0	0	not applicable
Oakland Park	1	1	0	0	0	0	0	F0
Parkland	0	0	0	0	0	0	0	not applicable
Pembroke Park	0	0	0	0	0	0	0	not applicable
Pembroke Pines	3	2	1	0	0	0	0	F1
Plantation	3	3	0	0	0	0	0	EF0**
Pompano Beach	4	4	0	0	0	0	0	F0
Sea Ranch Lakes	0	0	0	0	0	0	0	not applicable
Southwest Ranches	0	0	0	0	0	0	0	not applicable
Sunrise	2	0	1	1	0	0	0	EF1 and EF2**
Tamarac	2	1	1	0	0	0	0	F1
Broward Municipal Services Districts	71	45	16	7	3	0	0	F3
West Park	0	0	0	0	0	0	0	not applicable
Weston	0	0	0	0	0	0	0	not applicable
Wilton Manors	0	0	0	0	0	0	0	not applicable
TOTAL	**115**	**74**	**29**	**9**	**3**	**0**	**0**	**F3**

Source: National Climatic Data Center - as of 12/31/2016

** - For historical purposes, the Fujita Scale was used in this table*

*** - The tornados occurred when the Enhanced Fujita scale had been adopted.*

To exemplify the potential impact of a major tornado event, the following notable recent events are described and considered as part of Broward County's risk assessment and mitigation planning purposes.

June 16, 1997
An F1 tornado touched down in Sunrise at the intersection of Commercial Boulevard and Nob Hill, flipping 1 car. The tornado moved southwest to near NW 103 Street/NW 45 Avenue. Several roofs were damaged, numerous windows were broken, small trees were uprooted, and power lines knocked down. Several cars were damaged by flying debris, and 1 injury was reported. Total damages exceeded $1 million.

February 2, 1998
In the evening, several F1 tornadoes crossed the Dade/Broward County line and damaged a strip shopping center in Miramar. The multiple tornadoes moved across North Perry

airport, where 40 aircraft were destroyed and 40 aircraft were damaged. The tornadoes weakened as they continued north-northeast damaging a shopping center in Davie near Orange Road/Hiatus Road. Total damages exceeded $30 million.

October 18, 2011
A strong tornado rated as an EF-2 with maximum estimated winds of 125 mph moved across western portions of Plantation and Sunrise on the evening of October 18th. A total of 136 structures suffered damage, with about 20-25 of these sustaining significant to severe damage. A few mobile homes in the Plantation section of the tornado were destroyed with roof and wall collapse. The tornado intensified as it moved into Sunrise, damaging homes in the New Orleans Homes subdivision. Two concrete block homes sustained significant to total roof loss, and several other homes had significant roof, garage and window damage. Cars were damaged by winds and debris as well as uprooted and sheared trees. Most of the damage was in the EF-1 range, except for a two-block area of EF-2 damage in Sunrise at the New Orleans Homes subdivision where the highest winds were noted. Despite the magnitude and extent of the damage, no major injuries were reported with only a few scrapes and cuts. Federal assistance was approved for residents in the affected area due to the severity and magnitude of the damage.

January 27, 2016
A line of severe storms moved onto the Gulf coast at 5am that morning, prompting the issuance of several special weather statements, severe thunderstorm warnings, and tornado warnings as it crossed the south-Central peninsula. A strong cyclic mesocyclone that moved onshore during the early morning hours tracked across the peninsula, where it re-intensified over north Central Broward county and produced an EF-1 tornado that moved across Coconut Creek and Pompano Beach. The tornado touched down near the intersection of NW 2nd court and NW 43rd Ave and traveled northeast leading to several snapped and uprooted hardwood trees and damage to fences across NW 42nd, Palmetto Drive, and Coconut Creek Boulevard. The tornado damaged trees, power lines and tossed several cars across the impacted area.

Probability and Extent of Future Events
The probability of future tornado occurrences affecting Broward County is “highly likely”. According to historical records, Broward County experiences an average of nearly 2 confirmed tornado touchdowns per year. While the majority of these events are small in terms of size, intensity, and duration, they do pose a significant threat should Broward County experience a direct tornado strike. In the future Broward County could be expected to be hit by tornadoes reaching up to EF3 in strength.

Vulnerability Analysis
To estimate potential losses due to tornadoes, NOAA historical tornado loss data was used to develop a tornado stochastic model. In this model:

- Losses were scaled for inflation
- Average historic tornado damageability was used to generate losses for historical tornadic events where losses were not reported

- Expected annualized losses were calculated through a non-linear regression of historical data
- Probabilistic losses were scaled to account for would-be losses where no exposure/instrument was present at the time of the event

Table 4.16 shows potential annualized property losses for each jurisdiction in Broward County.

Table 4.16: Potential Annualized Losses by Jurisdiction (Tornado)

Jurisdiction	Total Exposure	Annualized Expected Property Losses ($)	Annualized Percent Loss Ratio
Coconut Creek	$3,061,603,270	*Negligible*	0.00%
Cooper City	$1,943,657,150	*Negligible*	0.00%
Coral Springs	$8,134,798,700	*Negligible*	0.00%
Dania Beach	$1,878,435,580	*Negligible*	0.00%
Davie	$6,711,031,880	*Negligible*	0.00%
Deerfield Beach	$5,161,599,440	$8,756	0.00%
Fort Lauderdale	$22,130,694,710	$40,834	0.00%
Hallandale Beach	$3,836,691,130	$21,247	0.00%
Hillsboro Beach	$810,574,300	*Negligible*	0.00%
Hollywood	$10,029,588,340	*Negligible*	0.00%
Lauderdale-By-The-Sea	$1,739,928,950	*Negligible*	0.00%
Lauderdale Lakes	$1,152,461,750	*Negligible*	0.00%
Lauderhill	$2,492,601,430	*Negligible*	0.00%
Lazy Lake	$4,107,550	*Negligible*	0.00%
Lighthouse Point	$1,261,700,120	*Negligible*	0.00%
Margate	$2,296,212,030	*Negligible*	0.00%
Miramar	$7,475,638,380	$1,046,334	0.01%
North Lauderdale	$1,260,435,790	*Negligible*	0.00%
Oakland Park	$2,473,754,560	*Negligible*	0.00%
Parkland	$2,682,321,260	*Negligible*	0.00%
Pembroke Park	$404,154,300	*Negligible*	0.00%
Pembroke Pines	$10,247,846,250	$7,872	0.00%
Plantation	$6,803,128,100	*Negligible*	0.00%
Pompano Beach	$8,981,181,420	*Negligible*	0.00%
Sea Ranch Lakes	$110,763,020	*Negligible*	0.00%
Southwest Ranches	$890,133,450	*Negligible*	0.00%
Sunrise	$5,308,400,300	$22,890	0.00%
Tamarac	$3,283,696,510	*Negligible*	0.00%
Broward Municipal Services Districts	$1,106,396,610	$553,674	0.05%
West Park	$331,537,990	*Negligible*	0.00%
Weston	$6,490,572,820	*Negligible*	0.00%
Wilton Manors	$941,493,080	*Negligible*	0.00%
TOTAL	**$131,437,140,170**	**$1,701,607**	**0.00%**

Jurisdiction	Total Exposure	Annualized Expected Property Losses ($)	Annualized Percent Loss Ratio

** Negligible is less than $5,000*
Source: 2012 Broward County LMS, verified 2017

Map 4.8 provides the locations of historical tornado occurrences in Broward County. For historical purposes, the Fujita scale was used in this map except for the recent Sunrise tornado (October 18, 2011) when the Enhanced Fujita scale was used.

Map 4.9: Historic Tornado Occurrences through March 2017

Source: NOAA National Centers for Environmental Information

Tropical Cyclones (Storms and Hurricanes)

Background

Hurricanes and tropical storms are classified as cyclones and defined as any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and whose diameter averages 10 to 30 miles across. A tropical cyclone refers to any such circulation that develops over tropical waters. Tropical cyclones act as a "safety-valve," limiting the continued build-up of heat and energy in tropical regions by maintaining the atmospheric heat and moisture balance between the tropics and the pole-ward latitudes. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation, and tornadoes. Coastal areas are also vulnerable to the additional forces of storm surge, wind-driven waves, and tidal flooding which can be more destructive than cyclone wind.

The key energy source for a tropical cyclone is the release of latent heat from the condensation of warm water. Their formation requires a low-pressure disturbance, warm sea surface temperature, rotational force from the spinning of the earth, and the absence of wind shear in the lowest 50,000 feet of the atmosphere. The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico during the official Atlantic hurricane season, which encompasses the months of June through November. The peak of the Atlantic hurricane season is in early to mid-September and the average number of storms that reach hurricane intensity per year in this basin is about 6.

As an incipient hurricane develops, barometric pressure (measured in millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. Hurricane intensity is further classified by the Saffir-Simpson Scale (**Table 4.17**), which rates hurricane intensity on a scale of 1 to 5, with 5 being the most intense. Storm surge is no longer included in the scale due to fluctuations in wind speed in the span of a hurricane that may not alter the storm surge level.

Table 4.17: Saffir-Simpson Hurricane Wind Scale

Category	Maximum Sustained Wind Speed (MPH)	Minimum Surface Pressure (Millibars)
1	74 - 95	Greater than 980
2	96 - 110	979-965
3	111 - 130	964-945
4	131 – 155	944-920
5	155 plus	Less than 920

The Saffir-Simpson Scale categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure and, which are combined to estimate potential damage. Categories 3, 4, and 5 are classified as "major" hurricanes, and while hurricanes within this range comprise only 20% of total tropical cyclone landfalls, they account for over 70% of the damage in the United States. **Table 4.18** describes the damage that could be expected for each category of hurricane. Damage during hurricanes may also result from spawned tornadoes, storm surge, and inland flooding associated with heavy rainfall that usually accompanies these storms.

Table 4.18: Hurricane Damage Classifications

Storm Category	Damage Level	Description of Damages	Photo Example
1	MINIMAL	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage.	
2	MODERATE	Some roofing material, door, and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings may break their moorings.	
3	EXTENSIVE	Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures, with larger structures damaged by floating debris. Terrain may be flooded well inland.	
4	EXTREME	More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland.	
5	CATASTROPHIC	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required.	

Sources: National Hurricane Center; Federal Emergency Management Agency

Location and Spatial Extent

Florida remains one of the most vulnerable states in the U.S. to hurricanes and tropical storms. According to the State of Florida Hazard Mitigation Plan, there were 60 land falling hurricanes between 1900 and 2002 with significantly more frequent tropical storms. Between 2002 and 2012, the State of Florida received 15 presidential declarations for hurricanes and tropical storms totaling over $1.6billion in federal funds. Hurricane activity increased from 2004-2005 with 4 presidential declarations in 2004 and another 3 presidential declarations for hurricanes in 2005.

However, from 2006-2016 hurricane activity decreased with 1 presidential declaration in 2008, 1 presidential declaration in 2012 and 2 in 2016. There has only been 1 hurricane/tropical storm presidential declaration in Broward County from 2006 to 2016.

By virtue of its geographic location in South Florida, all areas of Broward County are highly susceptible to hurricanes and tropical storm-force winds. Further, the immediate coastal zone and areas along the canals of Broward County are extremely susceptible to potential storm surge inundation resulting from hurricanes and tropical storms. The South Florida Water Management District (SFWMD) manages water levels in the canals in order to reduce salt water intrusion into the fresh ground water that is tapped for public water supply. SFWMD monitors water levels in the canals carefully and operates a series of water control structures in each canal that have gates which shut when the tailwater near the structure is too high to allow positive drainage from the west to the east. Examples of the water control structures are the S33 on Canal C-12 (the North Fork of the New River) and S36 on Canal C-13. These structures are generally west of I-95 about halfway between the I-95 and the Florida Turnpike (one exception is the G54 on the G-15 Canal (the North New River Canal) which is just west of the Florida Turnpike).

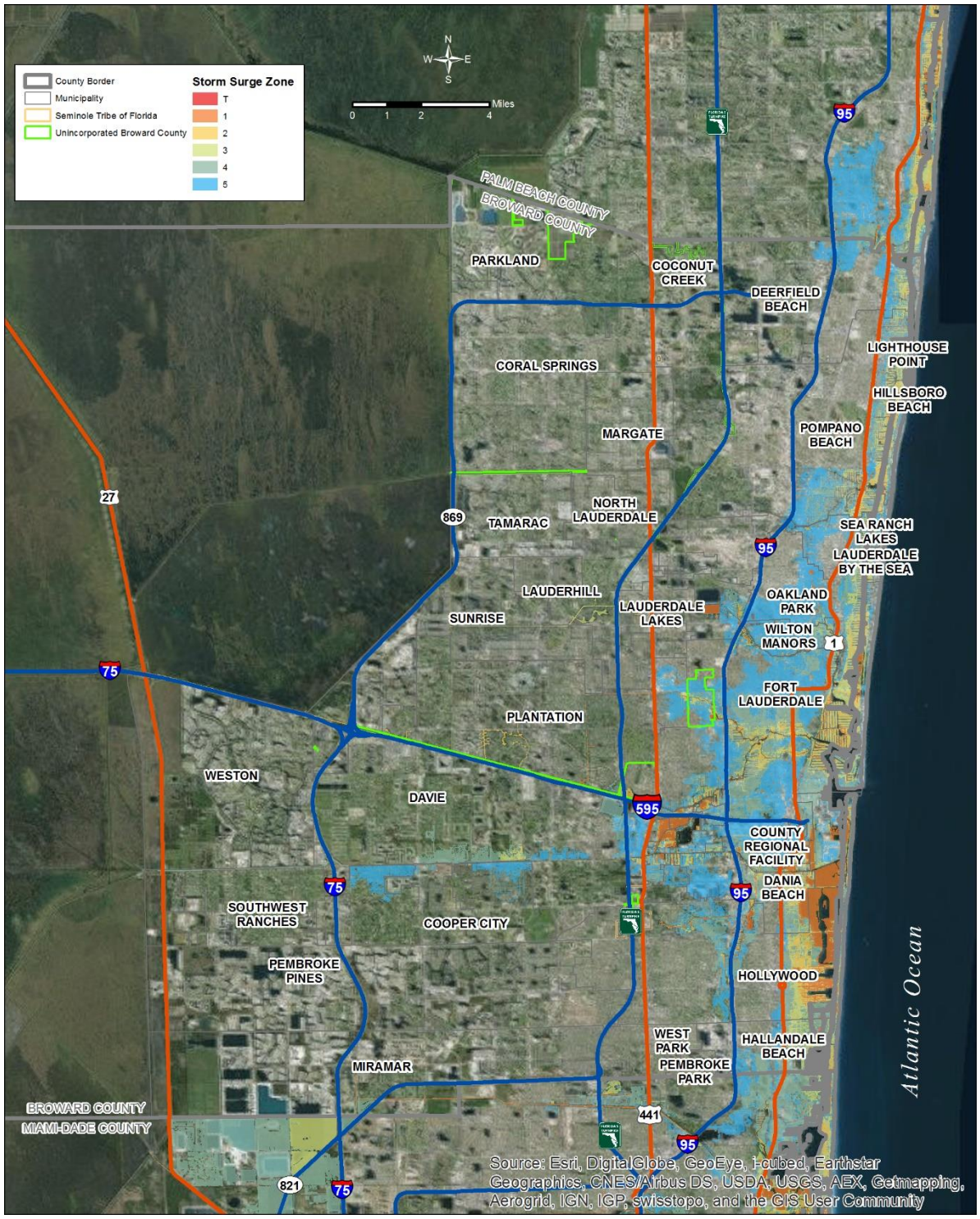
High tailwater generally occurs during high tide conditions and the effect is to block saltwater from travelling farther to the west of the water control structures. As these structures would be closed during high tide, they are also closed during storm surge events which generally mean that the gates would also block the storm surge from travelling west of the water control structures. It is conceivable that an extreme event may damage the gates to be inoperable and thus not block the storm surge but this is not within the reasonable range of potential events. Thus the storm surges do not show any inundation west of the water control structures. It is expected that increases in sea level combined with high tides may future overtopping of some of the water control structures

Maps 4.9 and 4.10 illustrate storm surge inundation zones for Broward County derived from Florida Division of Emergency Management's effort to update Regional Evacuation Studies). As part of the statewide study, the DEM managed a separate contract for the production of updated LIDAR elevation data, which was completed for about 28,000 square miles across the State of Florida. New Sea, Lake, and Overland Surge from Hurricanes (SLOSH) modeling was then completed for 2 SLOSH basins involved in the update for South Florida: Biscayne Bay for Miami-Dade and Broward Counties, and Florida Bay for Monroe County. SLOSH is a modeling tool used to estimate storm surge for coastal areas resulting from historical, hypothetical, or predicted hurricanes taking into account maximum expected levels for pressure, size, forward speed, track, and winds. Therefore, the SLOSH data is best used for defining the potential maximum surge for any particular location.

Map 4.10: 2017 Storm Surge Inundation Zones

Source: FDOT, UFL GeoPlan, Broward County GIS, FDEM

Map 4.11: Aerial of Storm Surge Inundation (2017)



Source: FDOT, UFL GeoPlan, Broward County GIS, FDEM

Historical Occurrences

According to NOAA historical storm track records, 102 hurricane or tropical storm tracks have passed within 75 miles of Broward County since 1850.[7] This includes: three Category 5 hurricanes, 8 Category 4 hurricanes, 13 Category 3 hurricanes, 15 Category 2 hurricanes, 18 Category 1 hurricanes, and 49 tropical storms. Of the 106 recorded storm events, 22 had tracks that traversed directly through Broward County. **Table 4.19** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 75 miles of Broward County), and Category of the storm based on the Saffir-Simpson Scale. **Map 4.11** shows the track of each recorded storm in relation to Broward County and South Florida.

Table 4.19: Historical Storm Tracks within 75 Miles of Broward County (1850–June 2017)

Date of Occurrence	Storm Name	Maximum Wind Speed (MPH)	Storm Category
10/17/1859	Unnamed	70	Tropical Storm
11/1/1861	Unnamed	70	Tropical Storm
9/17/1863	Unnamed	70	Tropical Storm
10/23/1865	Unnamed	105	Category 2 Hurricane *
10/11/1870	Unnamed	105	Category 2 Hurricane
10/20/1870	Unnamed	90	Category 1 Hurricane
8/17/1871	Unnamed	115	Category 3 Hurricane
8/25/1871	Unnamed	105	Category 2 Hurricane
10/7/1873	Unnamed	115	Category 3 Hurricane
9/16/1876	Unnamed	70	Tropical Storm
10/20/1876	Unnamed	105	Category 2 Hurricane
7/3/1878	Unnamed	45	Tropical Storm
9/8/1878	Unnamed	70	Tropical Storm
10/22/1878	Unnamed	80	Category 1 Hurricane
8/17/1881	Unnamed	45	Tropical Storm
8/24/1885	Unnamed	80	Category 1 Hurricane
8/24/1886	Unnamed	80	Category 1 Hurricane
8/16/1888	Unnamed	125	Category 3 Hurricane *
9/8/1888	Unnamed	50	Tropical Storm
9/24/1888	Unnamed	45	Tropical Storm
10/6/1889	Unnamed	45	Tropical Storm *
8/24/1891	Unnamed	85	Category 1 Hurricane
10/7/1891	Unnamed	50	Tropical Storm*
6/10/1892	Unnamed	45	Tropical Storm *
9/25/1894	Unnamed	105	Category 2 Hurricane
10/2/1895	Unnamed	60	Tropical Storm
10/16/1895	Unnamed	40	Tropical Storm*
10/9/1896	Unnamed	60	Tropical Storm
8/2/1898	Unnamed	40	Tropical Storm
9/27/1898	Unnamed	40	Tropical Storm
10/11/1898	Unnamed	70	Tropical Storm
7/30/1899	Unnamed	45	Tropical Storm
8/10/1901	Unnamed	45	Tropical Storm*

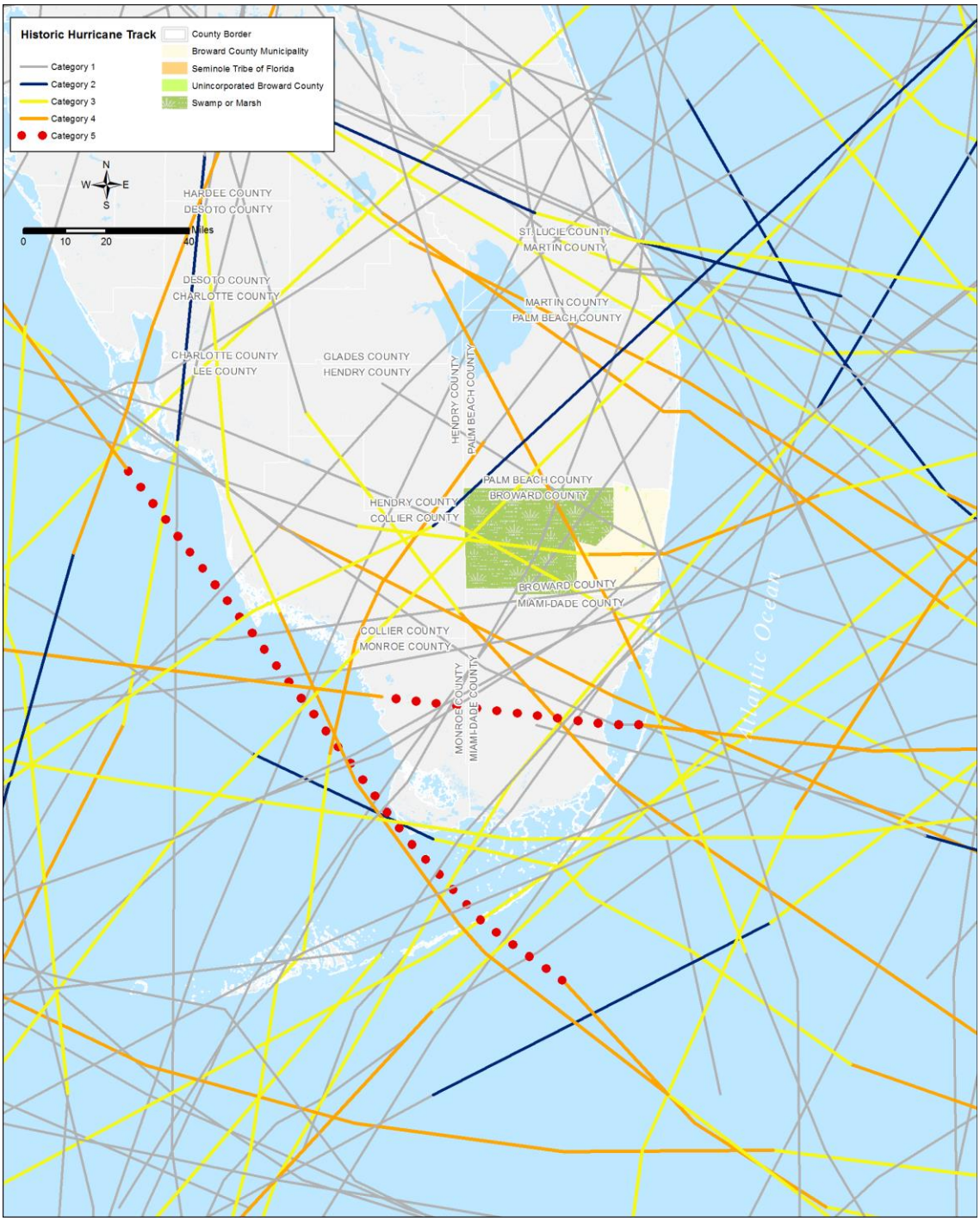
7 These storm track statistics do not include tropical depressions or extratropical storms. Though these related hazard events are less severe in intensity, they may indeed cause significant local impact in terms of rainfall and high winds.

Date of Occurrence	Storm Name	Maximum Wind Speed (MPH)	Storm Category
9/11/1903	Unnamed	85	Category 1 Hurricane*
10/17/1904	Unnamed	80	Category 1 Hurricane
6/17/1906	Unnamed	85	Category 1 Hurricane
10/18/1906	Unnamed	120	Category 3 Hurricane
6/28/1909	Unnamed	50	Tropical Storm*
8/29/1909	Unnamed	50	Tropical Storm
10/11/1909	Unnamed	115	Category 3 Hurricane
10/18/1910	Unnamed	120	Category 3 Hurricane
11/15/1916	Unnamed	80	Category 1 Hurricane
10/20/1924	Unnamed	105	Category 2 Hurricane*
7/27/1926	Unnamed	110	Category 2 Hurricane
9/16/1926	Unnamed	40	Tropical Storm
9/18/1926	Unnamed	140	Category 4 Hurricane
10/21/1926	Unnamed	110	Category 2 Hurricane
8/8/1928	Unnamed	100	Category 2 Hurricane
8/13/1928	Unnamed	60	Tropical Storm
9/16/1928	Unnamed	150	Category 4 Hurricane
9/28/1929	Unnamed	110	Category 2 Hurricane
8/30/1932	Unnamed	65	Tropical Storm
7/30/1933	Unnamed	85	Category 1 Hurricane
9/4/1933	Unnamed	130	Category 4 Hurricane
10/5/1933	Unnamed	130	Category 4 Hurricane
5/27/1934	Unnamed	45	Tropical Storm
9/3/1935	Unnamed	160	Category 5 Hurricane
9/29/1935	Unnamed	115	Category 3 Hurricane
11/4/1935	Unnamed	75	Category 1 Hurricane
6/15/1936	Unnamed	45	Tropical Storm
7/29/1936	Unnamed	65	Tropical Storm
8/11/1939	Unnamed	80	Category 1 Hurricane
10/6/1941	Unnamed	120	Category 3 Hurricane
9/15/1945	Unnamed	140	Category 4 Hurricane*
11/1/1946	Unnamed	45	Tropical Storm
9/17/1947	Unnamed	160	Category 5 Hurricane*
10/12/1947	Unnamed	85	Category 1 Hurricane*
9/22/1948	Unnamed	120	Category 3 Hurricane*
10/5/1948	Unnamed	125	Category 3 Hurricane
8/27/1949	Unnamed	150	Category 4 Hurricane
10/18/1950	King	110	Category 2 Hurricane*
10/2/1951	How	70	Tropical Storm
2/3/1952	Unnamed	50	Tropical Storm*
8/29/1953	Unnamed	50	Tropical Storm*
10/5/1953	Unnamed	40	Tropical Storm
10/9/1953	Hazel	70	Tropical Storm
10/18/1959	Judith	50	Tropical Storm
9/10/1960	Donna	140	Category 4 Hurricane
8/27/1964	Cleo	105	Category 2 Hurricane*
10/14/1964	Isbell	125	Category 3 Hurricane*
9/8/1965	Betsy	125	Category 3 Hurricane
10/4/1966	Inez	85	Category 1 Hurricane
10/2/1969	Jenny	45	Tropical Storm
8/19/1976	Dottie	40	Tropical Storm*

Date of Occurrence	Storm Name	Maximum Wind Speed (MPH)	Storm Category
9/3/1979	David	100	Category 2 Hurricane
8/18/1981	Dennis	40	Tropical Storm
9/27/1984	Isidore	60	Tropical Storm
7/24/1985	Bob	45	Tropical Storm
10/12/1987	Floyd	75	Category 1 Hurricane
10/16/1991	Fabian	45	Tropical Storm
8/24/1992	Andrew	160	Category 5 Hurricane
11/16/1994	Gordon	50	Tropical Storm
8/2/1995	Erin	85	Category 1 Hurricane
8/24/1995	Jerry	40	Tropical Storm
11/5/1998	Mitch	65	Tropical Storm
9/21/1999	Harvey	60	Tropical Storm*
10/15/1999	Irene	75	Category 1 Hurricane*
8/13/2004	Charley	145	Category 4 Hurricane
9/5/2004	Frances	110	Category 2 Hurricane
9/26/2004	Jeanne	120	Category 3 Hurricane
8/25/2005	Katrina	80	Category 1 Hurricane
10/24/2005	Wilma	105	Category 2 Hurricane
8/30/2006	Ernesto	70	Tropical Storm
8/20/2008	Fay	80	Tropical Storm
7/24/2008	Bonnie	45	Tropical Storm
8/2/2013	Dorian	39	Tropical Storm

** Storm track traversed through Broward County.*
Source: National Hurricane Center

Map 4.12: Historical Storm Tracks



Source: International Best Track Archive for Climate Stewardship (IBTrACS) accessed via NOAA National Centers for Environmental Information
Additional Research Citation: Knapp, K. R., M. C. Kruk, D. H. Levinson, H. J. Diamond, and C. J. Neumann, 2010: The International Best Track Archive for Climate Stewardship (IBTrACS): Unifying tropical cyclone best track data. Bulletin of the American Meteorological Society, 91, 363-376. non-government domain doi:10.1175/2009BAMS2755.1

Some of the more notable historical tropical cyclone events for Broward County are described below:

October 18, 1906 Hurricane
A hurricane moved across the Florida Keys and passed over Miami on October 18 as a Category 3 storm resulting in the loss of 134 lives.

September 18, 1926 Hurricane
The eye of the hurricane moved directly over Miami on the morning of September 18, leaving approximately 100 dead. The storm continued northwestward across South Florida and entered the Gulf of Mexico at Fort Myers. Northeast winds from the storm raised Lake Okeechobee water levels above the low dike on the south end of the lake near Moore Haven. Approximately 3 miles of dike failed, sending 10 to 12 foot floodwaters into Moore Haven and at least 5-foot deep floodwaters into Clewiston, 16 miles to the southeast.

September 16, 1928 Hurricane [Okeechobee Hurricane]
A Category 4 hurricane made landfall near Palm Beach on September 16 with a central pressure of 929 millibars. The center passed near Lake Okeechobee, causing the lake to overflow its banks and inundate the surrounding area to a depth of 6 to 9 feet. An estimated 1,836 people died in Florida, primarily due to the lake surge. Damage to property was estimated at $25 million in Florida.

September 3, 1935 [Labor Day Hurricane]
This hurricane is considered to be one of the most severe hurricanes ever recorded in Florida. With winds in excess of 200 miles per hour, the storm passed over the Florida Keys on September 2 with a minimum barometric pressure of 26.35 inches. Three relief-work camps, inhabited by veterans of World War I, were destroyed. The American Red Cross estimates that 408 lives were lost.

September 3, 1979 Hurricane David
Hurricane David, a category 2 storm, made landfall north of Palm Beach and caused an estimated $476 million in damages.

August 24, 1992 Hurricane Andrew
Hurricane Andrew made a memorable landfall in South Miami-Dade County, causing estimated damages in excess of $26 billion in damages. Andrew produced approximately 7 inches of rain, sustained winds of 165 miles per hour, a maximum storm tide of 16 feet, and a total of 96 deaths (including Louisiana). In all, Andrew destroyed 25,000 homes and significantly damaged more than 100,000 others in South Florida. Two weeks after the hurricane, the U.S. military deployed nearly 22,000 troops to aid in the recovery efforts, the largest military rescue operation in U.S. history. When Hurricane Andrew hit southeast Miami-Dade County, flying debris in the storm's winds knocked out most ground-based wind measuring instruments, and widespread power outages caused electric-based measuring equipment to fail. The winds were so strong many wind-measuring tools were incapable of registering the maximum winds. Surviving wind observations and measurements from aircraft reconnaissance, surface pressure, satellite analysis, radar, and distribution of debris and structural failures were used to estimate the surface winds. Although originally classified as a Category 4 storm, extensive post-impact research led to the reclassification of Andrew as a Category 5 hurricane in 2002.

Augusts 2, 1995 Hurricane Erin
Erin, a tropical storm in the central Bahamas, strengthened to minimal hurricane intensity, before moving ashore near Vero Beach. Erin moved across central Florida as a tropical storm then moved into the northeast Gulf of Mexico where it reintensified to hurricane strength before moving ashore a final time near Pensacola. In southeast Florida maximum winds gusts were 37 knots at Miami Beach with the lowest pressure of 1000.9 millibars at West Palm Beach International Airport. An unscientific study estimated that lost productivity in Dade, Broward, and Palm Beach counties, caused by the approach of Erin, amounted to $200 million.

November 5, 1998 Tropical Storm Mitch
Tropical Storm Mitch, once a powerful Category 5 storm, crossed South Florida at Monroe and Palm Beach counties at tropical storm strength. The storm caused gusty winds, severe thunderstorms, tornadoes, and beach erosion. Property damage was estimated at $30 million.

September 13–22, 1999 Hurricane Floyd
Hurricane Floyd was an enormous Category 4 storm that skirted the southeast Florida coast with minimal effects, mostly to marine interests. Most areas reported maximum sustained winds of 25 to 30 miles per hour, which caused very minor damage, mainly to trees and some utility lines. Rainfall amounts were unusually light with less than 1/2 inch reported at all official stations in South Florida. The storm surge ranged from 3.3 feet above normal in Palm Beach County to 1.5 feet above normal in Miami-Dade County, causing mostly minor beach erosion. Other marine damage occurred to sea walls and small boats. Floyd's unpredictable path led to the largest peacetime evacuation in U.S. history as over a million people sought refuge. Floyd did not make landfall in Florida, but created flooding, beach erosion, and resulted in nearly $68 million in property damages.

October 15, 1999 Hurricane Irene
Hurricane Irene was a Category 1 storm as it made landfall in Monroe and Miami-Dade counties, moving southwest to northeast. It moved northeast across central Miami-Dade and Broward counties before exiting into the Atlantic on October 16 near Jupiter in northeast Palm Beach County. The storm caused major flooding due to 9-18 inches of rainfall, beach erosion, and minor wind damages. Heavy rains and sustained winds of tropical storm force caused widespread flooding and power outages in the metropolitan areas of Broward County. 4 tornadoes touched down in Broward and Palm Beach counties, injuring 3 persons. Damage in southeast Florida, mainly from flooding is estimated near $600 million which includes $335 million in agricultural losses. An estimated 700,000 customers lost electricity. Flooding in a few residential areas lasted for a week displacing several hundred persons and isolating thousands more. Other long-term ecological repercussions may be experienced from the flooding rains such as the effects of high water on Everglade's hammocks, and the effects of excessive fresh-water runoff on estuaries.

September 5, 2004 Hurricane Frances
Hurricane Frances made landfall at Seawalls Point in Martin County as a Category 2 hurricane. Frances moved farther inland just north of Lake Okeechobee and weakened to a tropical storm before crossing the entire Florida Peninsula and exiting into the Gulf of Mexico just north of Tampa. The highest measured sustained wind at Fort Lauderdale-

Hollywood International Airport was 41 miles per hour with a peak gust of 55 miles per hour. The estimated storm surge ranged from 1-2 feet along the northeast Broward Coast. 2 vehicle-related deaths were reported in Broward County. Florida Power and Light (FPL) reported power outages occurred to 423,000 customers in Broward. An estimated 7,000 persons sought refuge in public shelters in Broward County. Wind damage to house roofs, mobile homes, trees, power lines, signs, screened enclosures, and outbuildings occurred over much of southeast Florida, but was greatest in Palm Beach County. Preliminary property damage in South Florida is estimated at $620 million, including $80 million in Broward County.

September 26, 2004 Hurricane Jeanne

Hurricane Jeanne made landfall as a Category 3 hurricane near the south end of Hutchinson Island, nearly coincident with the landfall point of Hurricane Frances only 3 week before. After landfall Jeanne initially moved along a track similar to Frances, just north of Lake Okeechobee as it weakened to a tropical storm then it turned to the northwest and moved over the northwest Florida. Although slightly smaller and stronger than Hurricane Frances, winds and pressures over southeast Florida were remarkably similar to Frances. The estimated storm surge ranged from 1-2 feet along the northeast Broward Coast. 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. Preliminary property damage in southeast Florida is estimated at $330 million, including $50 million in Broward. Florida Power and Light reported outages occurred to 165,900 customers in Broward County.

August 25, 2005 Hurricane Katrina

Hurricane Katrina made landfall as a Category 1 hurricane along the southeast Florida coast. The center of the 25-mile-wide eye of Katrina made landfall near the Broward/Miami-Dade County border then moved toward the southwest across central and southwest Miami-Dade County, passing directly over the National Weather Service (NWS) Office in Sweetwater. Katrina weakened to a tropical storm before exiting the Florida peninsula into the Gulf of Mexico then quickly regained hurricane strength (and would later strike the Mississippi and Louisiana coast). Maximum sustained winds measured at the NWS Automated Surface Observing System (ASOS) sites included 60 miles per hour at Fort Lauderdale-Hollywood International Airport. The maximum ASOS-measured peak wind gusts included 82 miles per hour at Fort Lauderdale-Hollywood International Airport, and other unofficial peak wind gust measurements included 92 miles per hour at Port Everglades. Mostly minor beach erosion and isolated incidence of coastal flooding were observed. Total damage in South Florida was estimated at around $100 million. Wind damage was mainly to vegetation, signs, and watercraft. Winds and flooding combined caused an estimated $423 million in losses to agriculture and nurseries.

Hurricane Wilma caused extensive damage throughout Broward County.

October 24, 2005 Hurricane Wilma

Hurricane Wilma made landfall as a Category 3 storm on the southwest Florida coast between Everglades City and Cape Romano in Collier County. Wilma exhibited a very large 55 to 65 mile-wide eye while crossing the state, and the eye covered

large portions of South Florida, including most of Broward County with maximum sustained winds of 125 miles per hour and an estimated minimum central pressure of 950 millibars. The highest recorded gusts were in the 100-120 miles per hour range.

An interesting and revealing aspect of Wilma was the wind field in the eye wall. The winds on the back (south/west) side of the eye wall were as strong, if not stronger, than those on the front (north/east) side. This goes against the common, but sometimes erroneous, belief that the strongest winds in a hurricane are always in the right-front quadrant of the storm. This occurred over much of South Florida, and likely contributed to the heavier damage across Broward and Palm Beach counties compared to slightly lesser damage across much of Miami-Dade and Collier counties.

Wilma moved rapidly northeast across the state, with an average forward speed of 25 miles per hour, exiting the east coast over northeastern Palm Beach County near Palm Beach Gardens on the morning of October 24th as a Category 2 hurricane with maximum sustained winds of around 105 miles per hour. Damage was widespread, with large trees and power lines down virtually everywhere. Structural damage was heaviest in Broward and Palm Beach counties where roof damage and downed or split power poles were noted. The hurricane particularly affected older structures in downtown Ft. Lauderdale like the Broward County Courthouse, School Board Building, and other tall office buildings constructed before the post-Hurricane Andrew-era of more stringent wind protection standards. The glass façades of several downtown buildings, including the Templeton Building, were sheared off. Hurricane Wilma caused $20.6 billion worth of damage in Florida[8].

October 5, 2016 Hurricane Matthew
Hurricane Matthew was a powerful and devastating tropical cyclone which became the first Category 5 Atlantic hurricane since 2007. The thirteenth named storm, fifth hurricane and second major hurricane of the 2016 Atlantic hurricane season, Matthew wrought widespread destruction and catastrophic loss of life during its journey across the Western Atlantic. A total of 47 deaths have been attributed to the storm in Florida. Although Broward County did not take a direct hit from Matthew, 8,980 Florida Power and Light customers lost power as the storm passed to the east, and while damage was primarily confined to the coast, Matthew caused widespread debris and flooding.

Probability and Extent of Future Events

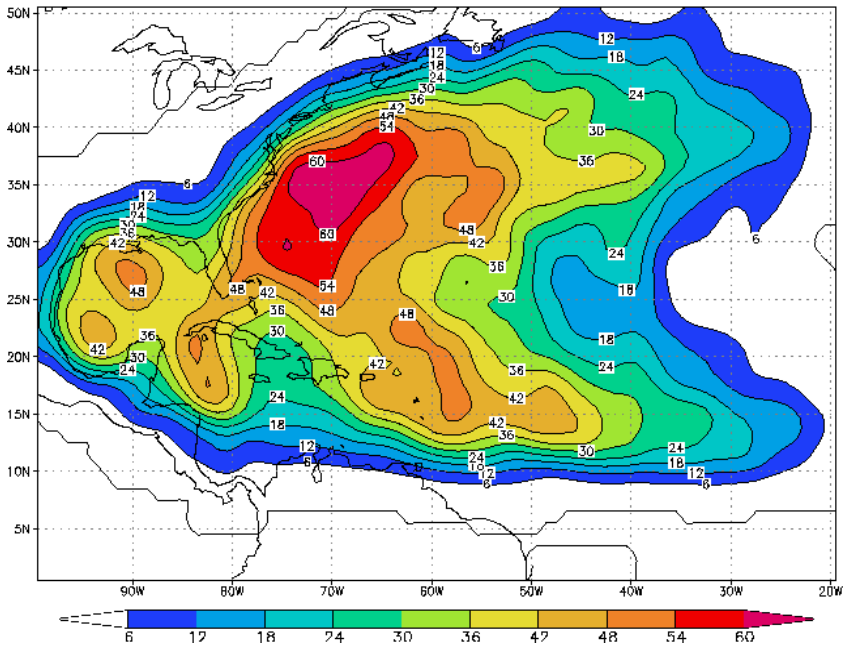
The probability of future tropical storm/hurricane events in Broward County is considered “likely”. According to statistical data provided by the National Hurricane Center, the annual probability of a hurricane and tropical storm affecting the area is between 48 and 54% per year. This empirical probability is fairly consistent with other scientific studies and observed historical data made available through a variety of federal, state, and local sources. Additional data made available through NOAA indicate that the return period for a Category 3 hurricane in Broward County is between 9 and 15% per year. In the future Broward County could be expected to be hit by tropical storms/hurricanes with wind speeds up to 160 mph and storm surge with storm tide heights up to 9.5 feet and inundation depths up to 6.5 feet at Moffett Street/NE 14th Avenue in Hallandale Beach

[8] 2012 Wikipedia entry on Hurricane Wilma

[from the 2010 Florida Statewide Regional Evacuation Study Program Storm Tide Atlas for Broward].

Figure 4.7 shows for any particular location what the chance is that a tropical storm or hurricane will affect the area sometime during the Atlantic hurricane season. This illustration was created by the National Oceanic and Atmospheric Administration's Hurricane Research Division using data from 1944 to 1999 and counting hits when a storm or hurricane was within approximately 100 miles (165 km) of each location.

Figure 4.6: Empirical Probability of a Named Hurricane or Tropical Storm



Source: National Oceanic and Atmospheric Administration, Hurricane Research Division

Table 4.20 profiles the potential peak gust wind speeds in miles per hour (MPH) that could be expected in Broward County during a hurricane event for various return periods.

Table 4.20: Average Expected Hurricane Wind Speeds (Peak Gust) by Jurisdiction

Jurisdiction	Wind Speed [MPH] vs. Return Periods [Year]						
	10	20	50	100	200	500	1000
Coconut Creek	85	103	120	131	140	152	161
Cooper City	85	103	121	132	142	154	162
Coral Springs	85	102	120	131	140	152	161

Jurisdiction	Wind Speed [MPH] vs. Return Periods [Year]						
	10	20	50	100	200	500	1000
County Regional Facility	85	103	121	132	142	154	163
Dania Beach	85	104	122	132	143	155	164
Davie	85	103	121	132	142	154	162
Deerfield Beach	86	103	120	131	141	154	162
Fort Lauderdale	81	104	121	132	142	154	163
Hallandale Beach	86	104	122	133	143	156	165
Hillsboro Beach	87	104	122	133	142	155	164
Hollywood	85	104	122	133	143	155	164
Lauderdale-By-The-Sea	86	104	121	133	142	155	163
Lauderdale Lakes	85	103	121	131	141	154	162
Lauderhill	85	103	120	131	141	153	162
Lazy Lake	86	104	121	132	142	155	163
Lighthouse Point	86	104	121	132	142	155	164
Margate	85	103	120	131	140	153	161
Miramar	85	103	121	133	142	155	164
North Lauderdale	85	103	120	131	141	153	161
Oakland Park	85	103	121	132	142	154	162
Parkland	85	102	120	131	140	152	160
Pembroke Park	85	104	122	133	143	156	165
Pembroke Pines	85	103	121	132	142	155	163
Plantation	85	103	121	131	141	153	162
Pompano Beach	86	103	121	132	141	154	163
Sea Ranch Lakes	86	104	122	133	143	155	164
Seminole Tribe of Florida	85	103	121	132	142	154	163
Southwest Ranches	85	103	120	131	141	153	161
Sunrise	85	103	120	131	141	153	161
Tamarac	85	103	120	131	141	153	161
Broward Municipal Services Districts	85	103	120	131	141	153	161
West Park	85	104	122	133	143	156	165
Weston	85	102	120	131	140	152	160
Wilton Manors	85	103	121	132	142	154	163

Source: Hazus-MH MR5 Scenario Based on Hurricane Wilma

Vulnerability Assessment

Two methods were utilized to estimate potential losses caused by tropical cyclones. Hazus-MH was utilized to conduct a loss estimation analysis for hurricane wind, while a separate GIS-based analysis was completed for storm surge inundation using NOAA's SLOSH data in combination with Broward County's local tax assessor records. These analyses are more thoroughly described earlier in this section under "risk assessment methods," and the results are provided below. See Appendix J for information on housing vulnerability to hurricane wind.

Hurricane Wind

Hazus-MH wind speed data, inventory and damage functions, and methodology were used to determine the annual expected losses due to hurricane wind. **Table 4.21** shows annualized property losses and annualized percent loss ratios by jurisdiction.

Table 4.21: Potential Annualized Losses by Jurisdiction (Hurricane Wind)

Jurisdiction	Total Exposure	Annualized Losses For Residential Buildings at Risk	Annualized Losses For Commercial Buildings at Risk	Total Annualized Expected Property Losses	Annualized Percent Loss Ratio
Coconut Creek	$3,061,603,270	$20,077,953	$2,701,953	$22,779,906	0.85%
Cooper City	$1,943,657,150	$14,283,112	$945,406	$15,228,518	0.85%
Coral Springs	$8,134,798,700	$50,443,688	$58,811,868	$59,255,556	0.81%
Dania Beach	$1,878,435,580	$11,253,369	$4,220,747	$15,474,116	1.02%
Davie	$6,711,031,880	$53,307,442	$6,752,467	$60,059,909	1.05%
Deerfield Beach	$5,161,599,440	$29,645,076	$5,872,001	$35,517,077	0.85%
Fort Lauderdale	$22,130,694,710	$131,927,103	$37,961,493	$169,888,596	0.88%
Hallandale Beach	$3,836,691,130	$38,926,804	$3,890,859	$42,817,663	1.16%
Hillsboro Beach	$810,574,300	$9,378,275	$81,263	$9,459,538	1.17%
Hollywood	$10,029,588,340	$65,836,859	$13,482,769	$79,319,628	0.91%
Lauderdale-By-The-Sea	$1,739,928,950	$16,193,293	$806,623	$16,999,916	0.98%
Lauderdale Lakes	$1,152,461,750	$7,078,126	$1,087,491	$8,165,617	0.85%
Lauderhill	$2,492,601,430	$15,717,939	$1,905,096	$17,623,035	0.83%
Lazy Lake	$4,107,550	$32,860	$0	$32,860	0.80%
Lighthouse Point	$1,261,700,120	$10,140,074	$730,255	$10,870,329	0.87%
Margate	$2,296,212,030	$12,990,439	$2,155,018	$15,145,457	0.74%
Miramar	$7,475,638,380	$64,704,961	$6,742,450	$71,447,411	1.07%
North Lauderdale	$1,260,435,790	$8,191,643	$872,629	$9,064,272	0.83%
Oakland Park	$2,473,754,560	$12,110,730	$3,279,496	$15,390,226	0.79%
Parkland	$2,682,321,260	$21,170,976	$426,482	$21,597,458	0.86%
Pembroke Park	$404,154,300	$1,362,551	$513,828	$1,876,379	1.12%
Pembroke Pines	$10,247,846,250	$83,973,781	$11,133,727	$95,107,508	1.00%
Plantation	$6,803,128,100	$41,173,210	$9,405,538	$50,578,748	0.82%
Pompano Beach	$8,981,181,420	$53,315,183	$7,475,290	$60,790,473	0.88%
Sea Ranch Lakes	$110,763,020	$927,402	$113,770	$1,041,172	0.94%
Southwest Ranches	$890,133,450	$7,821,244	$324,963	$8,146,207	1.11%
Sunrise	$5,308,400,300	$24,191,394	$10,316,132	$34,507,526	0.80%
Tamarac	$3,283,696,510	$20,394,375	$2,363,439	$22,757,814	0.76%
Broward Municipal Services Districts	$1,106,396,610	$3,155,168	$1,911,498	$5,066,666	0.98%
West Park	$331,537,990	$1,848,026	$364,252	$2,212,278	0.84%
Weston	$6,490,572,820	$60,142,219	$5,392,299	$65,534,518	1.09%
Wilton Manors	$941,493,080	$6,845,365	$940,569	$7,785,934	0.82%
TOTAL	**$131,437,140,170**	**$898,560,640**	**$152,981,671**	**$1,051,542,311**	**0.92%**

Source: Broward County Property Appraiser and Hazus-MH MR2

Future Risk Conditions Influencing Hurricane Wind Speeds

Climate change will have an impact on future hurricane wind speeds. While the impacts of sea level rise are discussed in greater detail in a subsection dedicated to this subject in Chapter 4, the following results of climate change and sea level rise, as documented by the 2011 South Florida Water Management District (SFWMD) report, will impact storm surge levels in Broward County:

- Increase the wind intensity of the tropical storms and hurricanes by 2-11%

In conclusion, the impacts of climate change will likely exacerbate the severity of future hurricane events. One interesting factor from the 2011 SFWMD report is that, due to increased wind shear over the Atlantic basin, that the number of tropical storms and hurricanes may decrease 6-34%. For more information about climate change, refer to the "Sea Level Rise/Climate Change" part in this section (starting p.138) and the Economic Hot Spot Profiles of Chapter 5.

Storm Surge

The level of exposure and potential loss estimates for storm surge were generated based on inundation zones derived from the 2014 NOAA SLOSH data described earlier in this section (and shown in Map 4.9) in combination with Broward County's geo-referenced parcel data and tax assessor records. In order to complete the analysis, every individual land parcel that is located wholly or partially within a storm surge inundation zone for a Category 3 storm event was identified, by jurisdiction. This analysis is intended for use as a general planning tool in order to provide reasonable estimates of potential at-risk properties using best available geo-referenced data. It is important to note that while using best readily available data, this GIS-based assessment does not take into account certain unknown site-specific factors that may mitigate future storm surge losses on a building-by-building basis (such as elevation, surrounding topography, flood-proofing measures, structural projects, etc.).

The objective of the GIS-based analysis is to calculate the total building value of all potentially at-risk properties in Broward County, by jurisdiction. Annualized loss estimates were then calculated based on the assumption of total building loss (worst case scenario) for those properties expected to be inundated during a Category 3 storm event based on the NOAA SLOSH data. In so doing, total exposed building value for each jurisdiction was multiplied by .09 (9% annual chance for Category 3 hurricane based on NOAA probability data[9]). The results of the GIS-based storm surge analysis for Broward County are provided in **Table 4.22**.

Future Risk Conditions Influencing Storm Surge Levels

The impacts of climate change and the attendant sea level rise will have considerable impact on future storm surge levels. While the impacts of sea level rise are discussed in greater detail in a subsection dedicated to this subject later on in Chapter 4, the following results of climate change and sea level rise, as documented by the 2011 SFWMD report, will impact storm surge levels in Broward County:

9 While NOAA probability data indicate the annual percent chance of a Category 3 event in Broward County is between 9 and 15%, the lower figure of 9% was utilized based on the lower likelihood of all conditions (storm direction and speed, tidal cycle, etc,) necessary for what would be considered a maximum "worst case" storm surge event.

- Inundation of coastal properties by higher sea level and reduced effectiveness of existing storm surge barriers in Broward County
- Higher storm surge levels

In conclusion, the impacts of climate change, global warming, and sea level rise will likely exacerbate the severity of future storm surge events. Additional factors that could mitigate storm surge include the construction of additional structures on the canal system closer to the Atlantic Ocean that would block even more inland storm surge penetration via the canals. One interesting factor from the 2011 SFWMD report is that, due to increased wind shear over the Atlantic basin, that the number of tropical storms and hurricanes may decrease 6-34%. For more information about climate change, refer to the "Sea Level Rise/Climate Change" part in this section (starting p.138) and the Economic Hot Spot Profiles of Chapter 5.

Table 4.22: Total Building Value of At-Risk Properties by Jurisdiction (Maximum Category 3 Storm Surge)

Jurisdiction	Number of At-Risk Properties	Total Building Value	Annualized Loss Estimate
Coconut Creek	0	$0.00	$0.00
Cooper City	0	$0.00	$0.00
Coral Springs	0	$0.00	$0.00
Dania Beach	984	$709,977,650.00	$63,897,988.50
Davie	246	$982,643,980.00	$88,437,958.20
Deerfield Beach	648	$251,459,500.00	$22,631,355.00
Fort Lauderdale	9900	$10,535,176,680.00	$948,165,901.20
Hallandale Beach	1080	$714,584,710.00	$64,312,623.90
Hillsboro Beach	75	$239,122,050.00	$21,520,984.50
Hollywood	3018	$2,262,823,000.00	$203,654,070.00
Lauderdale-By-The-Sea	620	$287,203,020.00	$25,848,271.80
Lauderdale Lakes	1	$13,711,430.00	$1,234,028.70
Lauderhill	9	$26,876,130.00	$2,418,851.70
Lazy Lake	0	$0.00	$0.00
Lighthouse Point	1870	$1,119,906,350.00	$100,791,571.50
Margate	0	$0.00	$0.00
Miramar	0	$0.00	$0.00
North Lauderdale	0	$0.00	$0.00
Oakland Park	996	$393,705,300.00	$35,433,477.00
Parkland	0	$0.00	$0.00
Pembroke Park	13	$41,521,890.00	$3,736,970.10
Pembroke Pines	0	$0.00	$0.00
Plantation	26	$49,479,510.00	$4,453,155.90

Jurisdiction	Number of At-Risk Properties	Total Building Value	Annualized Loss Estimate
Pompano Beach	4040	$1,511,731,930.00	$136,055,873.70
Sea Ranch Lakes	90	$88,171,610.00	$7,935,444.90
Southwest Ranches	0	$0.00	$0.00
Sunrise	0	$0.00	$0.00
Tamarac	6	$554,410.00	$49,896.90
Broward Municipal Services Districts	31	$1,286,029,070.00	$115,742,616.30
West Park	0	$0.00	$0.00
Weston	0	$0.00	$0.00
Wilton Manors	1300	$514,007,610.00	$46,260,684.90
TOTAL	**24953**	**$21,028,685,830.00**	**$1,892,581,724.70**

Sources: Broward County Property Appraiser GIS; July 2017 Download of NOAA SLOSH Model Data

Hydrologic Hazards

For the purposes of this vulnerability assessment hydrologic hazards are defined as events or incidents associated with water related damage. Hydrologic hazards account for over 75% of Federal disaster declarations in the United States, with annual costs averaging billions of dollars. Hydrologic hazards included in this section are coastal erosion, drought, flood, and rip current.

Coastal Erosion

Background

Coastal erosion is measured as the rate of change in the position of the shoreline or a reduction in the volume of sand along a shoreline over a period of time. The root cause of beach erosion is a deficit of sand in the littoral system (region between the limits of high and low tides), caused by development on or adjacent to beaches, removal of dunes, damming of rivers, and/or blockage of the alongshore movement of sand by groins, jetties, or stabilized inlets. Significant short-term fluctuations of shoreline position and sand volume can result from storms-driven waves, but chronic erosion is an effect of a shortage of sand combined with storms and disruption of sand movement. Natural recovery from erosion can take months or years, and in a sand-starved beach system, may never occur. If a beach and dune system does not recover naturally, coastal and upland property may be exposed to further damage in subsequent storm events. Death and injury are not often associated with coastal erosion; however, it can cause the destruction of buildings and infrastructure.

The majority of Broward County beaches are subject to periodic beach renourishment, which is the mechanical infusion of sand from sources relatively remote from the beach. Historically, the County's beach renourishment program is a partnership of local government, the State of Florida, and the Federal Government through the US Army Corps of Engineers. Since 1970, nearly 11 million cubic yards of sand has been placed on approximately 12 of the County's 24 miles of beach in 10 partnered projects. Broward County's shoreline is fully developed, with little of the original dune systems intact. The County strives to maintain a berm (beach) width of approximately 50-100 feet, which provides the minimally adequate level of both recreational beach space and storm wave protection for upland development. The beach is subject to 2 types of weather hazards: northeasterly low pressure systems (nor'easters) and tropical systems.

Location and Spatial Extent

The Florida Department of Environmental Protection has estimated that 21.3 of the 24 miles of Broward County's beaches are critically eroded.[10] Three critical erosion areas (21.3 miles) are specifically identified.

1. The Segment II Renourishment Project recommenced on November 1, 2016. Approximately 750,000 cubic yards sand was delivered between Hillsboro Inlet and Broward County's Port Everglades beginning on November 3, 2016 along 4.9 miles of shoreline. The renourishment focused on Lauderdale-by-the-Sea, Pompano and Fort Lauderdale beaches to restore the beaches and increase protection to shoreline, upland development from potential storms.
2. The south end of Deerfield Beach and the entire Town of Hillsboro Beach along northern Broward County is a 3.2 mile long critically eroded area (R6-R23). Private development is vulnerable throughout this area. Some seawalls exist in Hillsboro Beach and a boulder

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mound groin field exists along the Deerfield Beach shoreline. In 2011, the cities of Hillsboro Beach and Deerfield Beach completed a beach renourishment project for the southern 500 feet of Deerfield Beach and the northern 5,750 feet for Hillsboro Beach. The "HillsboroDeerfield Beach Renourishment Project" placed 340,000 cubic yards of sand on these beaches.[11]

3. South of Hillsboro Inlet and extending for 10 miles along Pompano Beach, Sea Ranch Lakes, Lauderdale-By-The-Sea, and Ft. Lauderdale is a continuous critically eroded area (R25-R77) that threatens development and recreational interests including State Road AIA. A beach restoration project has been constructed at Pompano Beach and Lauderdale-By-The-Sea, and inlet sand transfer is ongoing at Hillsboro Inlet. Numerous bulkheads and retaining walls also exist along this stretch of coast. A beach renourishment for portions of Fort Lauderdale, Lauderdale-By-The-Sea, and Pompano Beach is scheduled to begin in 2013 (known as "Segment II of the Broward County Beach Erosion Control Project").

4. Along the southern beaches of Broward County starting just south of the entrance to Port Everglades are critically eroded areas (R86-R128) that threaten recreational interests at John U. Lloyd State Park and development and recreational interests along the communities of Dania Beach, Hollywood, and Hallandale Beach. "Segment III of the Broward County Beach Erosion Control Project", which started in April 2005 and was completed in 2006, was a beach renourishment project for 6.2 miles of beaches from the Broward County line in Hallandale Beach to the John Lloyd State Park. The project also included the cities of Hollywood and Dania Beach and involved the placement of 1.7 million cubic yards of sand.[12]

Historical Occurrences

According to the National Climatic Data Center, there were 11 major climatological incidents that resulted in beach erosion in eighteen years, between 1998 and 2016. Broward County's beaches are more susceptible to erosion during nor'easter storm season and hurricane season, which run from October 1 to March 31 and June 1 to November 30, respectively. Most of the historical occurrences of tropical systems have been in September or November, with nor'easters common during the period November through March.

Some of the more notable historical events are described below:

November 1998 Tropical Storm Mitch
Tropical Storm Mitch, once a powerful Category 5 storm, crossed South Florida at Monroe and Palm Beach counties at tropical storm strength. The storm caused gusty winds, severe thunderstorms, tornadoes, and beach erosion.

September 13–22, 1999 Hurricane Floyd
Hurricane Floyd was an enormous Category 4 storm that skirted the southeast Florida coast with minimal effects, mostly to marine interests. The storm surge ranged from 3.3

[11] www.townofhillsborobeach.com

[12] www.broward.org/beachrenourishment

feet above normal in Palm Beach County to 1.5 feet above normal in Miami-Dade County, causing mostly coastal flooding and minor beach erosion.

November 2001 Coastal Flooding resulting from Hurricane Michelle

Nearly a week of moderate to strong onshore winds, culminating with the approach of Hurricane Michelle, produced coastal flooding from Hollywood Beach to Hallandale Beach. Beach erosion in Broward, Palm Beach, and Miami-Dade counties during the entire event was moderate to locally severe. Costs for remediation of beach erosion from the event were estimated at over $10 million, and property damage was estimated at $20,000.

September 5, 2004 Hurricane Frances
Hurricane Frances made landfall at Sewalls Point in Martin County as a Category 2 hurricane. Frances moved farther inland just north of Lake Okeechobee and weakened to a tropical storm before crossing the entire Florida Peninsula and exiting into the Gulf of Mexico just north of Tampa. The estimated storm surge ranged from 1-2 feet along the northeast Broward Coast, resulting in beach erosion.

September 26, 2004 Hurricane Jeanne
Hurricane Jeanne made landfall as a Category 3 hurricane near the south end of Hutchinson Island, nearly coincident with the landfall point of Hurricane Frances nearly 3 week before. The estimated storm surge ranged from 1-2 feet along the northeast Broward Coast, resulting in beach erosion.

2004 Nor'easter
Nor'easter caused beach erosion in Broward County.

August 25, 2005 Hurricane Katrina
Hurricane Katrina made landfall as a Category 1 hurricane along the southeast Florida coast. Mostly minor beach erosion and isolated incidence of coastal flooding were observed.

Probability and Extent of Future Occurrences

The probability of future erosion along the Broward County coastline is considered "likely" due to a chronic scarcity of sand in the littoral system. Beaches in Hallandale Beach, Hollywood, Dania Beach, Lauderdale-By-The-Sea, and Pompano Beach have historically participated in federal, state, and locally cost-shared beach nourishment programs, and other beaches, such as Deerfield Beach and the Town of Hillsboro Beach, have conducted small-scale beach fill projects using municipal, state, and federal funds. In the future Broward County could be expected to engage in beach re-nourishment projects every 10-12 years which mirrors the typical design life of these projects. Rates of erosion vary greatly amongst different parts of the Broward coastline and would be impossible to summarize.

Future Risk Conditions Influencing Coastal Erosion Rates

The impacts of climate change and the attendant sea level rise will have a significant impact on future coastal erosion rates due to the following likely factors of future sea levels and coastal storms (as documented by the 2011 SFWMD report):

- Inundation of coastal properties by higher sea level and likely overtopping and submersion of existing coastal erosion control structures

- Higher storm surge levels

For more information about climate change, refer to the "Sea Level Rise/Climate Change" part in this section (starting p.138).

Vulnerability Analysis

Most of Broward County's 24 miles of coastline are vulnerable to erosion. There are 3 specific areas in Broward County that are considered to be critically eroded: 1) the south end of Deerfield Beach and the entire Town of Hillsboro Beach, 2) the area south of Hillsboro Inlet and extending for 10 miles along Pompano Beach, Sea Ranch Lakes, Lauderdale-By-The-Sea, and Ft. Lauderdale, and 3) the area along the southern 8.1 miles of Broward County south of Port Everglades.

Many Broward County beaches are actively eroding, while others are relatively stable but of inadequate dimensions to provide storm protection and recreational beach space. Factors which contribute to the vulnerable condition of the County's beaches include the unmitigated erosive influence of stabilized inlets, encroaching development, storms, and removal of historic dunes. To address this vulnerability, Broward County has been engaged in shore protection and beach nourishment efforts since the early 1960's. These projects, mostly funded by a partnership of federal, state, and local government agencies, have performed as designed, in most cases exceeding their design life of 10 to 12 years. The current Broward County Beach Management Program is a comprehensive plan to replace beach sand where it is needed, to stabilize with structures the most erosive stretch of beach, and, by means of inlet sand bypassing, to "feed" those beaches which are sand-starved because of the presence of stabilized inlets. Restoring the historical southward migration of sand, in combination with the other elements of the program, will reduce the extent and frequency of beach nourishment projects and provide a nearly sustainable beach many miles downstream, especially in the Broward communities of Dania Beach, Hollywood, and Hallandale Beach[13].

Prior studies conducted for the Broward County Natural Resource and Planning Management Division have identified the economic rationale for engaging in shore protection and beach nourishment activities. There are also environmental benefits as the beaches are also a primary nesting grounds for threatened and endangered sea turtles, and are important habitat for a number of plant and animal species. Economically, according to prior studies, beaches are critical to Broward County considering the following factors:

- Broward's beaches attract 7.2 million visitors a year, who spend $422 million annually in Broward County.
- Broward's beaches contribute $548 million annually to Broward County's economy, including the creation and sustenance of 17,700 full-time equivalent jobs in the County.
- Broward's beaches add $1.4 billion to County property values.
- As a result of the beaches, local government tax revenues are increased by $29 million annually, of which the largest beneficiary is the Broward School District, which collects about $10 million annually as a result of the beaches.

[13] Natural Resource and Planning Management Division

- Broward's beaches result in an $803 million annual input to southeast Florida regional economy, and create 26,000 jobs in the region.
- Out-of-State visitors to Broward's beaches have a $598 million annual impact on the economy of the State of Florida, create 19,000 jobs in the state, and produce $19 million in annual state tax revenues.
- More than 60% of overnight tourists said that they would not have come to Broward County if there were no beaches, and a further 14.3% said they would come less frequently.
- Broward's beaches protect over $4 billion in upland property, structures, and infrastructure.
- In Florida, beaches protect $150 billion in shorefront structures and infrastructure.
- Florida's beaches alone result in an annual increase of about a half billion dollars annually in Federal income tax revenues.
- Florida's beaches attract 2 million international tourists, who spend about $1.1 billion annually in the state.

Drought

Background

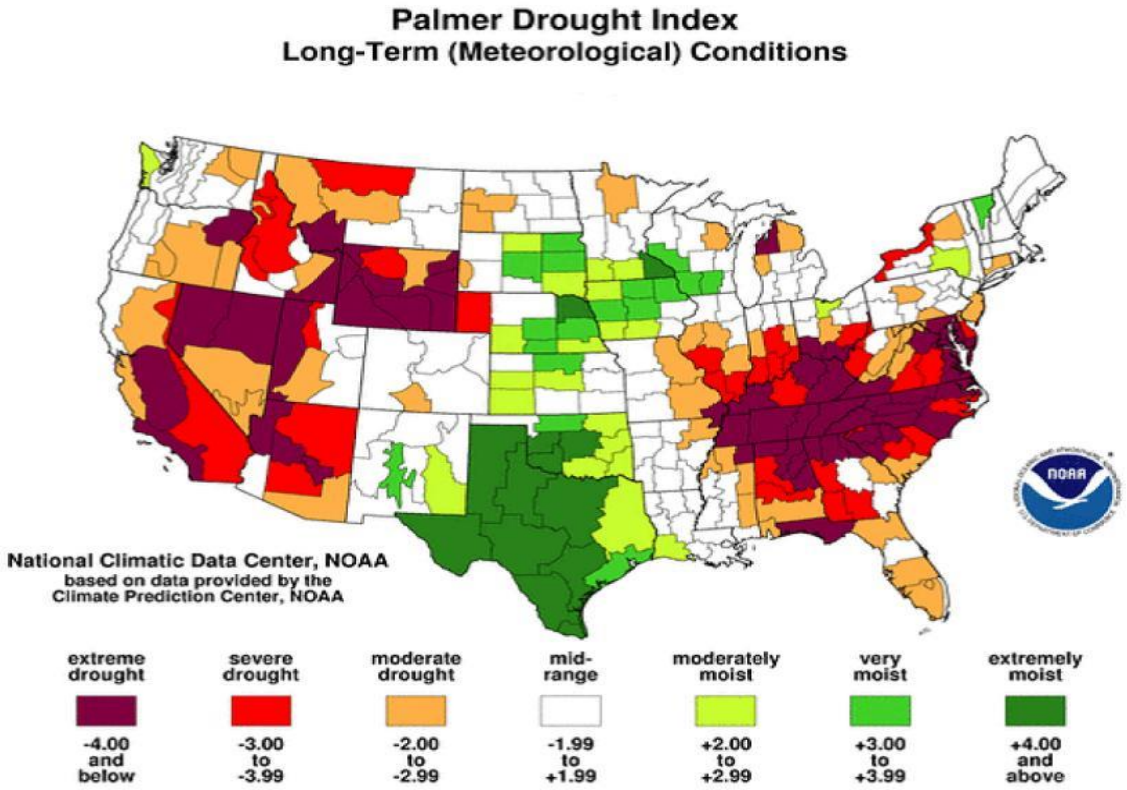
Drought is a natural climatic condition caused by an extended period of limited rainfall beyond that which occurs naturally in a broad geographic area. High temperatures, high winds, and low humidity can worsen drought conditions, and can make areas more susceptible to wildfire. Human demands and actions can also hasten drought-related impacts.

Droughts are frequently classified as one of following 4 types: meteorological, agricultural, hydrological, or socio-economic. Meteorological droughts are typically defined by the level of "dryness" when compared to an average, or normal amount of precipitation over a given period of time. Agricultural droughts relate common characteristics of drought to their specific agricultural-related impacts. Hydrological drought is directly related to the effect of precipitation shortfalls on surface and groundwater supplies. Human factors, particularly changes in land use, can alter the hydrologic characteristics of a basin. Socio-economic drought is the result of water shortages that limit the ability to supply water-dependent products in the marketplace.

Figure 4.8 shows the Palmer Drought Severity Index (PDSI) Summary Map for the United States from 1895 to 1995. PDSI drought classifications are based on observed drought conditions and range from -0.5 (incipient dry spell) to -4.0 (extreme drought). As can be seen, the Eastern United States has historically not seen as many significant long-term droughts as the Central and Western regions of the country.

Location and Spatial Extent

Figure 4.7: Palmer Drought Severity Index Summary Map for the United States



Source: National Climatic Data Center, NOAA

Drought typically impacts a large area that cannot be confined to any geographic boundaries; however, some regions of the United States are more susceptible to drought conditions than others. According to the 2017 Palmer Drought Severity Index (PDSI) Summary Map for the United States, South Florida is in a zone less than or equal to -2.9 (-2.9 indicating moderate drought conditions) meaning that moderate drought conditions are a relatively low to moderate risk for Broward County.

Drought conditions typically do not cause significant damage to the built environment, but rather drought effects are most directly felt by agricultural sectors. At times, drought may also cause community-wide impacts as a result of acute water shortages (regulatory use restrictions, drinking water supply, and salt water intrusion).

There are a few agricultural areas in the county that have greater exposure to drought. According to the Broward County Property Appraiser data, the areas with the most agricultural land use were the municipalities of Parkland, Coconut Creek, and Southwest Ranches, as well as south of

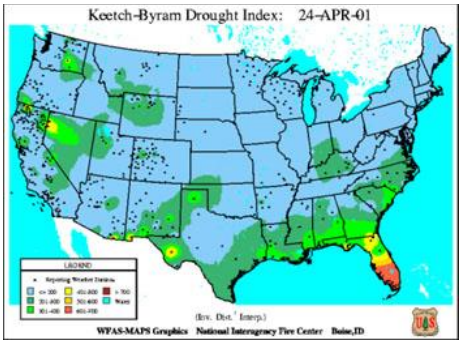
Weston and west of Cooper City. According to the Florida Department of Agriculture, there are 2,507 open acres and over 2.7 million greenhouse acres used for horticulture purposes. In urban Broward County, horticulture dominates the commercial agricultural production. Nursery production, landscape installation, landscape maintenance, and arboriculture account for over $200 million in annual sales. Hundreds of firms employ thousands of individuals.[14]

Water shortages during times of drought (and the degree of regulatory use restrictions) can have a potentially significant impact throughout Broward County and possibly higher economic costs for water supply. As a secondary effect, drought events increase the threat of wildfire in South Florida (and particularly the Everglades) which can also cause serious consequences, including the destruction of property.

Historical Occurrences

South Florida relies on its summer rains for its year-round water demands. According to the State of Florida Mitigation Plan, there have been 10 drought cycles in Florida (typically 2-year periods) since the year 1900. In Central and South Florida, severe droughts were reported in 1932, 1955–1957, 1961–1963, 1971–1972, 1973–1974, 1980–1982, 1985, 1988–1989, 1990, 2000–2001, 2006–2007, 2008-2009, and 2010-2011. According to the National Drought Mitigation Center, from January 1, 1850 to September 19, 2007, there were 134 reported drought impacts for Broward County. There were 17 agricultural, 34 fire, 32 water/energy, 18 social, and 21 other specific drought impacts.

Throughout a drought cycle in South Florida in 2000-2001 rainfall amounts fell 30% below normal. During this time, Lake Okeechobee (Florida's largest source of fresh drinking water) set daily record-breaking lows. Similarly, groundwater levels declined and there were periods when below-average levels were reached across the region. In September 2000, the water shortage was becoming a threat to agricultural, environmental, and utilities' needs. In these times of drought, the use of well water for crop irrigation lowers the water table, which exposes the water table to salt water intrusion and a serious compromise of drinking water supplies. Based on their concerns and on the precipitation forecast, the South Florida Water Management District (SFWMD) activated their Emergency Operations Center (EOC) to more effectively respond to the emergency situations. It operated approximately 12 hours a day and remained activated until July 2001.



The severity of the 2000-2001 drought in South Florida is highlighted in this static map of the Keetch-Byram Drought Index (April 24, 2001).

During 2006 to 2007 Broward County experienced extreme drought conditions. According to the Florida Department of Agriculture, drought caused $100 million in crop damage and economic losses to Florida during this period, and the figure could rise tenfold over the next 2 years. On August 1, 2007, the lake level of Lake Okeechobee was 9.20 feet above sea level. This was the lowest level ever recorded during most of the 41 years between 1965 and 2005. Water levels

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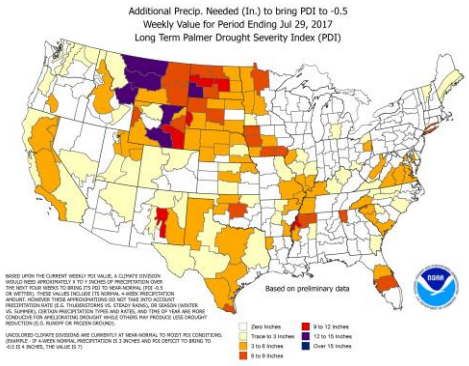
were so low that chloride levels have been a concern in sentinel monitoring wells near well-fields in Hallandale Beach and Dania Beach.

The five-month period from November 2008 to April 2009 was the second driest on record for most South Florida locations. The driest winter on record over many locations in southeast Florida led to the onset of severe drought (D2) conditions. The level of Lake Okeechobee fell from 12.2 feet at the beginning of the month to 11.1 feet by the end of the month, which was 2.5 feet below normal levels. Normal conditions began to resume with the onset of the rainy season by the end of May 2009.

Continued dry weather from January-April, 2011, coupled with long-term dryness going back to the previous summer, led to the expansion of severe drought conditions over South Florida. The period of October 2010 to February 2011 was the driest on record in the 80-year history of the SFWMD's records. This led to the continuation of extreme drought conditions (D3) over the eastern half of the peninsula. Underground water levels were in the lowest 10% of normal levels along the east coast and 10 to 30% of normal over interior and west coast areas. The level of Lake Okeechobee fell from 12.15 at the beginning of the month to 11.66 by the end of the month. This was about 2.5 feet below normal for April.

Broward County is currently experiencing a moderate drought and is closely monitoring water conditions as a result. Although this drought is not comparable to the low rainfall conditions experienced throughout Broward County in 2010-2011 or 2014-2015 when deficits were more than 17 inches, if dry conditions persist we may reach those levels again. According to the Broward County Environmental Planning and Community Resilience Division, the 2016-2017 deficit is 12.56".



Probability and Extent of Future Events

The probability of future drought events in Broward County and South Florida is considered "possible though such occurrences are typically not classified as severe in comparison to other regions. The effects, if any, of drought events on Broward County will depend on the severity and duration of drought conditions, water shortages, and the degree of regulatory water use restrictions. For a drought forecast for a future year, check the National Climatic Data Center website. Based on historical records, Broward County, in the future could be expected to be impacted by a drought ranging from severe to extreme every 10 years. As noted in the Climate Change section, the pattern of drought may change in the future. Any new historical trends should be addressed in future plan updates.

Future Risk Conditions Influencing Drought

The impacts of climate change, specifically the warming of the planet, will likely exacerbate the length and intensity of drought periods. The 2010 SFWMD report states that climate change projected scenarios consist of a 10% increase or decrease in precipitation amounts (p. 136). Fluctuations between periods of greater than average and lesser than average rainfall are expected. Therefore, drought will continue to be a factor in the future and climate change will likely exacerbate cyclical drought conditions. The main impact for the County will be minimizing impacts to the public water supply and natural resources. For more information about climate change, refer to the "Sea Level Rise/Climate Change" part in this section (pp.152-159).

Vulnerability Assessment

In order to analyze the risk of the Broward County area to drought and estimate potential losses, 100 years of statistical data from the University of Nebraska was used (this data was developed by the University based on Palmer Drought and Crop Severity Indices) as well as 2002 USDA agriculture data. A drought event frequency-impact was then developed to determine a drought impact profile on non-irrigated agriculture products and estimate potential losses due to drought in the area. **Table 4.23** shows annualized expected exposure to drought for Broward County.

Table 4.23

Table 4.23: Annualized Expected Agricultural Product Market Value Exposed to Drought

County	Total Agricultural Products Exposure (2007 Dollars)	Annualized Loss	% Loss Ratio
Broward	$51,698,987	*Negligible*	0.00%

**Negligible is less than $5,000*

Source: 2012 Broward County LMS

Note: Total includes all incorporated jurisdictions within the County

Flood

Background

Flooding is the most frequent and costly natural hazard in the United States, a hazard that has caused more than 10,000 deaths since 1900. Nearly 90% of presidential disaster declarations result from natural events where flooding was a major component.

Floods are generally the result of excessive precipitation, and can be classified under two categories: general floods, precipitation over a given river basin for a long period of time along with storm-induced wave or tidal action, and flash floods, the product of heavy localized precipitation in a short time period over a given location. The severity of a flooding event is typically determined by a combination of several major factors, including: stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing and impervious surface.

Generally, inland floods in South Florida may last for several days due to a relative lack of topography to drain flood waters, heavy urbanization, and impacts of tides on outfall toward the Atlantic Ocean. The primary types of general flooding include riverine, coastal, and urban flooding. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Coastal flooding[15] is typically a result of storm surge, wind-

15 While briefly mentioned here, coastal flooding is more thoroughly addressed under the "Tropical Cyclone" hazard.

driven waves, and heavy rainfall produced by hurricanes, tropical storms, and other large coastal storms. Urban flooding occurs where manmade development has obstructed the natural flow of water and decreased the ability of natural groundcover to absorb and retain surface water runoff.

Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. However, flash flooding events may also occur from a dam or levee failure within minutes or hours of heavy amounts of rainfall, or from a sudden release of water held by a retention basin or other stormwater control facility. Although flash flooding occurs most often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces.

The periodic flooding of lands adjacent to rivers, streams, and shorelines (land known as floodplain) is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will be covered by the 10-year flood and the 100-year floodplain by the 100-year flood. Flood frequencies such as the 100-year flood are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. Another way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1% chance of occurring in any given year. The 500-year flood has a 0.2% chance of occurring in any given year.

Location and Spatial Extent

Much of Broward County is susceptible to localized flooding, particularly during the rainy season of June through October. The county is surrounded by and interspersed with man-made canals, storm water management lakes, freshwater ponds, rivers such as the Middle and the New Rivers, the Everglades, the Atlantic Ocean, and the Intracoastal Waterway. There are 7 primary canals and numerous secondary and tertiary canals that provide flood control and water supply protection for the area's enormous growth and development. Stormwater management ponds are also used for flood protection as well as stormwater treatment, and are created by removing rock to build up the surrounding land for homes. The western portion of Broward County has undergone significant development over the last 25 to 30 years which has resulted in the filling of wetlands to accommodate new housing developments.

Broward County lies close to sea level (with elevation ranging from 5 to 25 feet) and is relatively flat, which often results in extensive “ponding” due to the lack of elevation gradients to facilitate adequate stormwater runoff. Further, its water supply lies just below the surface of the ground. Major rainfall events sometimes leave rainwater nowhere to drain, causing flooding near rivers and canals as well as in urban areas due to poor percolation rates and the low elevations (particularly in western parts of the county). Coastal flooding along the county’s immediate shoreline is typically associated with tidal surge caused by landfalling tropical storms and hurricane events (note: storm surge is addressed under “Tropical Cyclone”).

The severity of flooding is directly related to the amount and duration of the rainfall event. The areas affected by flooding in Broward County could increase. For the barrier island communities, should a significant rainfall event occur at the same time as high-tide, on-shore winds, or a

combination of both, the severity could be devastating. Flooding of up to 4 feet could be expected in some areas. Broward County could easily be caught "off-guard" and people living in flood-prone areas would be at an increased risk to property damage and life safety.

Based upon a Category 5 hurricane event, similar to the Hurricane Ono scenario that was exercised during the Florida Catastrophic Planning Workshop in 2007, Broward County could see storm surges of over 6 feet above normal tide levels, resulting in significant to severe flooding the barrier islands. This could inundate the barrier islands with 4 to 6 feet of water and sand. The storm tide would also penetrate inland for several miles, reaching Federal Highway with expected flooding of 1 to 2 feet, including downtown Fort Lauderdale.

Map 4.12 illustrates the location and extent of currently mapped special flood hazard areas for Broward County based on FEMA digital Q3 flood data which was still effective in 2011. This includes Zones A/AE (100-year floodplain), Zone VE (100-year coastal flood zones, associated with wave action), Zone AH (areas subject to shallow flooding) and Zone X500 (500-year floodplain which is also known as the shaded X zone). It is important to note that flooding and flood-related losses do occur outside of delineated special flood hazard areas, and according to Broward County officials, there are known inaccuracies with the currently mapped, FEMA-identified flood hazard zones. Broward County is currently coordinating with FEMA on map modernization and undergoing limited re-studies for some flood zones which will assist in correcting some of these data accuracy deficiencies.

Historical Occurrences

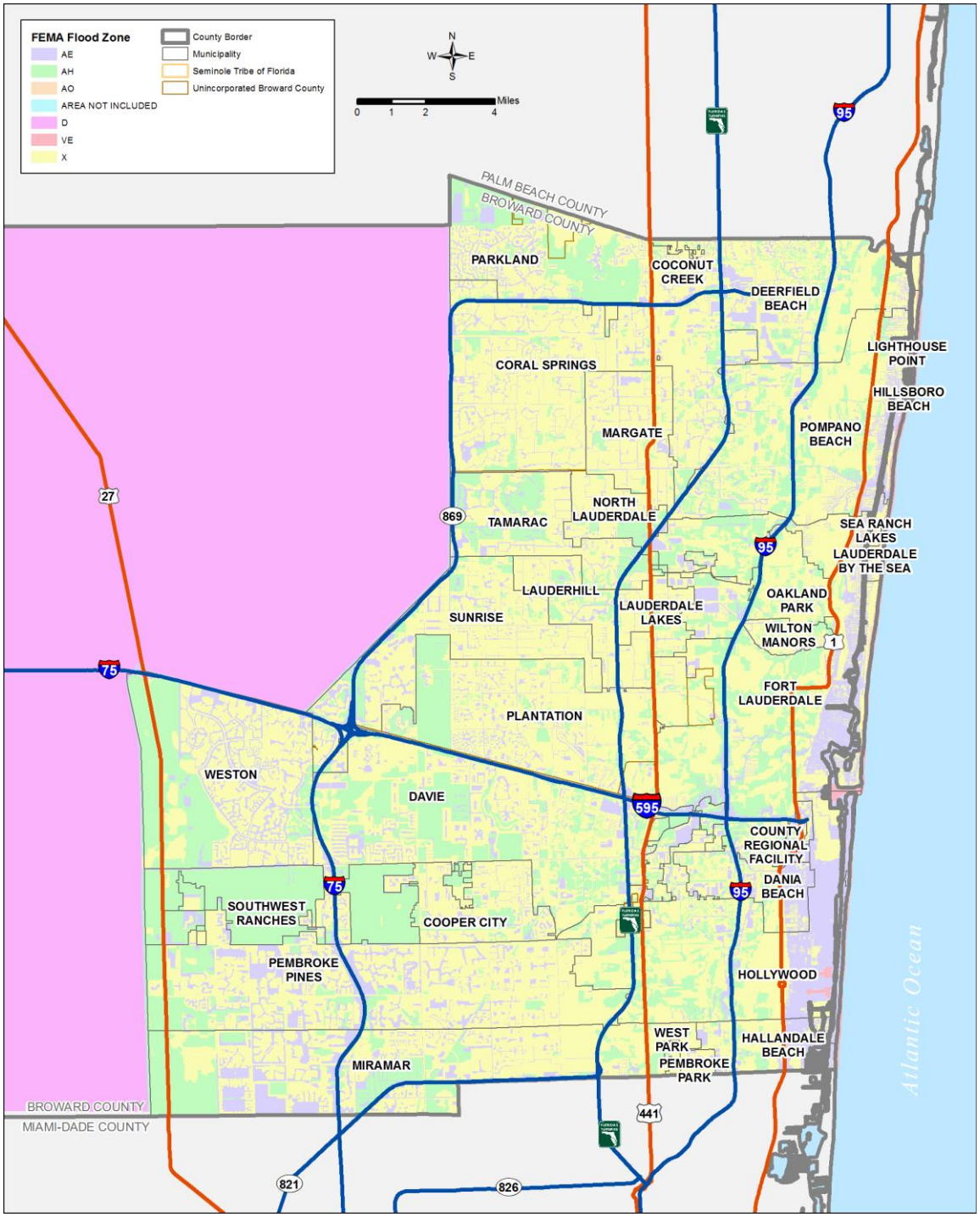
According to the National Climatic Data Center, there have been 22 reported flood events in Broward County from January 1, 1994 through September 30, 2011. According to the data, there were no deaths or injuries associated with these storms, but there was nearly $500 million in property damage (not including recorded agricultural losses). Some of the more notable events are described below:

June 1998 – Flash Flood
Excessive rains caused localized heavy flooding from Boca Raton to Miami Beach. The greatest official 24-hour rainfall was 13.75 inches at Pompano Beach with over 7 inches reported at Boca Raton and Miami Shores. Numerous streets were flooded and several vehicles became submerged in parking lots with their occupants having to be rescued. 3 Broward mobile homes had to be evacuated, several roofs collapsed and numerous dwellings had flood waters inside. Property damage was estimated at $1 million.

October 1999 – Flash Flood resulting from Hurricane Irene
After crossing Florida Bay, the center of Irene made landfall on the peninsula near Cape Sable on October 15 as a Category 1 hurricane. It moved northeast across central Miami-Dade and Broward counties before exiting into the Atlantic on October 16 near Jupiter in northeast Palm Beach County. Heavy rains and sustained winds of tropical storm force caused widespread flooding and power outages in the metropolitan areas of Miami-Dade, Broward, and Palm Beach counties. Within a 24-hour period, rainfall totals in southeast Florida ranged from 6 to 17 inches with many areas getting 10 to 15 inches. Cooper City had over 15 inches of water, West Pembroke Pines had over 14 inches, Ft. Lauderdale and Hollywood had over 13 inches, Plantation had nearly 12 inches, and Lauderdale Lakes and Pompano Beach had over 9 inches. Property damages were estimated by the

National Climatic Data Center to be approximately $600 million, which includes $335 million in agricultural losses. An estimated 700,000 customers lost electricity. Flooding in a few residential areas lasted for a week, displacing several hundred persons and isolating thousands more. It was reported that 8,000 people suffered flood damages. Some roads were impassible for weeks, electricity was out in certain areas, and residents and businesses suffered heavy losses.

Map 4.13: FEMA Flood Zones Effective in 2017



Source: FEMA NFHL May 25, 2017 Data

October 2000 – "No Name" or "Pre-Leslie" Storm
On October 3, 2000, a low-pressure system, later to become Tropical Storm Leslie, developed off the west coast of Cuba, and headed toward South Florida. Water managers and weather officials closely tracked the storm, and preemptive measures were taken to start moving water out of the canals. However, weather forecasts called for 4-8 inches of rainfall from this storm, and unfortunately, once the storm passed over South Florida, it dumped 14-18 inches of rainfall over a linear area in the center of the county. An estimated 93,000 houses with about 214,000 persons were isolated by flood waters. Power was cut to 13,000 people. There were 3 indirect deaths including 2 males who drove vehicles into canals and 1 man who fell from a roof while repairing a leak.

October 2001 – Flash Flood
Up to 10 inches of rain fell in 2 hours at Lighthouse Point and up to a total of 12 inches fell across portions of northeast metropolitan Broward County. Severe street flooding caused many stalled vehicles and 25 houses and 25 to 30 apartments suffered flood damage. Property damage was estimated at $100,000.

November 2001 – Coastal Flooding resulting from Hurricane Michelle
Nearly a week of moderate to strong onshore winds, culminating with the approach of hurricane Michelle, produced coastal flooding from Hollywood Beach to Hallandale Beach. The flooding was worst near the time of high tide and involved damage to sea walls and other coastal structures. Water flowed across the "broadwalk" and into some businesses. Beach erosion in Broward, Palm Beach, and Miami-Dade counties during the entire event was moderate to locally severe. Beach renourishment costs are estimated at over $10 million, and property damage was estimated at $20,000.

May 2003 – Flash Flood
A weak tropical wave extending north from the west Caribbean Sea in combination with a mid/upper level trough of low pressure in the east Gulf of Mexico caused locally extreme rainfall over portions of the Broward-Miami-Dade metropolitan areas. The most rain occurred in a swath from Hollywood to Pompano Beach with an official maximum of 10.21" measured at Fort Lauderdale-Hollywood International Airport. Of that total, 7.36 inches fell from 6 to 8 PM which exceeds the 100-year maximum rate for that time period. Radar estimates of 12 to 14 inches of rain were made near Oakland Park and Wilton Manors. According to Emergency Management estimates, 492 homes and businesses suffered some flood damage and many roadways were impassable. Property damage was estimated at $1 million.

November 2005 – Flash Flood
Law enforcement reported flooding of homes, cars, and streets in northeastern Broward County from Deerfield Beach south to Pompano Beach and Oakland Park. Persistent showers developed over northeastern Broward County late in the evening of Friday, November 19 and reached its peak during the early morning hours of Saturday November 20. Doppler radar estimated up to 5 inches of rain in a 2-hour period between midnight and 2:00 AM fell over these areas.

December 2009 Flash Flood
Extensive and severe flooding occurred over southeastern Broward County. Hardest-hit communities were Dania Beach, Hollywood, Hallandale Beach, and Pembroke Park. As much as 14 inches of rain fell in about 6 hours with other mesonet reports along with radar estimates

showing an area of 8 to 13 inches of rain primarily along and east of I-95 in the above-mentioned communities. Severe flooding began around 7:30 PM in Dania Beach, gradually progressing southward between 8 and 10 PM to cover the rest of the affected area. A total of 101 homes sustained major flood damage in Broward County, with an additional 88 homes having minor damage. Water was reported to be as high as 2 feet deep inside some homes, and a mobile home park in Pembroke Park had to be evacuated due to the rising water. Shelters were opened in Hallandale Beach and Hollywood to accommodate the evacuees. 6 businesses also sustained significant water damage. One building had a roof collapse in Hallandale Beach. Hundreds of cars were damaged or destroyed by the water. In addition to the water damage, about 2,000 customers lost power in Broward and Miami-Dade counties.

Historical Summary of Insured Flood Losses

According to FEMA flood insurance policy records, there have been more than 22,000 flood losses reported in Broward County through the National Flood Insurance Program (NFIP), totaling more than $64 million in claims payments. **Table 4.24** lists the number of losses and total claims payments, by jurisdiction for both 2009 and 2011 (for comparison). It should be noted that this listing includes only those losses to structures that were insured through the NFIP policies, and for losses in which claims were sought. It is likely that many additional instances of flood losses in Broward County were either uninsured or have gone unreported.

Table 4.24: National Flood Insurance Program Loss Statistics by Jurisdiction (as of November 1, 2011)

Jurisdiction	Number of Losses		Total Claims Payments	
	2009	2011	2009	2011
Coconut Creek	120	33	$42,672	$47,166
Cooper City	503	202	$647,785	$668,011
Coral Springs	1,241	485	$1,907,109	$1,957,807
Dania Beach	238	143	$1,019,800	$1,516,027
Davie	980	421	$2,417,427	$2,427,823
Deerfield Beach	257	95	$301,593	$324,696
Fort Lauderdale	1,685	759	$6,331,259	$6,519,475
Hallandale Beach	948	879	$10,522,437	$22,576,333
Hillsboro Beach	40	22	$1,277,532	$1,277,532
Hollywood	2,263	1,475	$8,374,031	$15,682,192
Lauderdale-By-The-Sea	35	14	$83,179	$83,179
Lauderdale Lakes	796	347	$1,213,177	$1,213,177
Lauderhill	1,468	758	$3,746,779	$3,750,760
Lazy Lake	2	0	$0	$0.00
Lighthouse Point	152	65	$399,769	$399,769
Margate	939	384	$815,385	$821,547
Miramar	1,464	566	$2,640,374	$2,640,236

Jurisdiction	Number of Losses		Total Claims Payments	
	2009	2011	2009	2011
North Lauderdale	743	317	$929,836	$929,836
Oakland Park	576	300	$2,678,389	$2,667,731
Parkland	59	16	$83,793	$119,605
Pembroke Park	75	72	$965,857	$1,403,054
Pembroke Pines	1,344	485	$3,166,882	$3,185,918
Plantation	1,110	407	$1,726,885	$1,738,163
Pompano Beach	831	285	$2,101,354	$2,673,373
Sea Ranch Lakes	9	4	$271,081	$271,081
Southwest Ranches	3	2	$14,434	$21,596
Sunrise	1,356	462	$1,438,353	$1,443,665
Tamarac	997	348	$1,097,343	$1,109,986
Broward Municipal Services Districts	2,175	933	$8,055,124	$8,247,260
West Park	0	0	$0	$0
Weston	39	4	$20,130	$43,107
Wilton Manors	166	73	$530,085	$530,085
TOTAL	**22,614**	**10,356**	**$64,777,182**	**$86,290,190**

Source: Federal Emergency Management Agency

Probability and Extent of Future Events

The probability that Broward County will continue to experience flooding associated with large tropical storms, hurricanes, and heavy rainfall events is "highly likely". Flooding is a very geographic-specific hazard and in Broward County, the source can either be inland flooding (heavy rainfall and high water table) and/or storm surge. In the future Broward County could be expected to be hit by large floods, either from large rainstorms or tropical storms/hurricanes, with typical floodwater depths from to 6 inches to 2 feet and near maximum floodwater depths could ranging up to 8 feet (floodwaters of this depth were recorded in parts of Broward County from the Cape Sable hurricane of 1947).

Future Risk Conditions Influencing Flood

The impacts of climate change and the attendant sea level rise will have considerable impact on future flood conditions. While the impacts of sea level rise are discussed in greater detail in a subsection dedicated to this subject in Section 4, the following results of climate change and sea level rise, as documented by the 2011 SFWMD report, will impact flooding in Broward County:

- Inundation of coastal properties by higher sea level
- A potential 10% increase in overall precipitation (however, it should be noted that some experts have projected a 10% decrease)
- Higher storm surge levels

- Higher sea levels limit the ability of coastal drainage systems to outfall inland stormwater runoff into marine systems thus exacerbating flooding and reducing the effectiveness of the larger drainage system
- Rainfall increases of up to 20% within 60 miles of tropical storms and hurricanes

In conclusion, the impacts of climate change, global warming, and sea level rise will likely exacerbate the severity and duration of floods, both ones caused by tropical cyclones and ones not caused by these storms.

Vulnerability Assessment

In order to assess flood risk, two distinct vulnerability assessment approaches were applied for Broward County in order to assess exposure and potential losses to flood hazard events. This includes (1) a Hazus-MH analysis for riverine (or "non-coastal") flood events; and (2) a GIS-based analysis for riverine and coastal flood events using FEMA's digital Q3 flood data (as shown in Map 4.11) in combination with Broward County's local tax assessor records.

First, riverine flood hazards were modeled using Hazus-MH for the 10-, 50-, 100-, and 500-year flood events. Flood depth was estimated at the pixel level for affected areas, along with proportion of the area affected within the census block. Hazus-MH was utilized to estimate floodplain boundaries, potential exposure for each event frequency, and loss estimates based on probabilistic scenarios using a Level 1 analysis.[16] **Table 4.25** shows potential building losses for 10- and 50-year riverine flood events by jurisdiction, and **Table 4.26** shows potential building losses for 100- and 500-year riverine flood events by jurisdiction.

Table 4.25: Potential Building Losses by Jurisdiction (10- and 50-year Riverine Flood Events)

Jurisdiction	Total Exposure	10-Year			50-Year		
		Residential	Commercial	Industrial	Residential	Commercial	Industrial
Coconut Creek	$3,061,603,270	$291,110	*Negligible*	*Negligible*	$552,120	*Negligible*	*Negligible*
Cooper City	$1,943,657,150	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Coral Springs	$8,134,798,700	$44,516,190	$443,730	$126,760	$52,586,240	$1,196,600	$1,672,740
Dania Beach	$1,878,435,580	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Davie	$6,711,031,880	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Deerfield Beach	$5,161,599,440	$229,320	$56,310	$150,520	$512,810	$124,510	$337,660
Fort Lauderdale	$22,130,694,710	$10,703,830	$184,520	$92,120	$16,108,420	$782,980	$829,050
Hallandale Beach	$3,836,691,130	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Hillsboro Beach	$810,574,300	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Hollywood	$10,029,588,340	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Lauderdale-By-The-Sea	$1,739,928,950	$2,434280	$55,540	*Negligible*	$2,500,100	$155,870	*Negligible*
Lauderdale Lakes	$1,152,461,750	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Lauderhill	$2,492,601,430	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*

16 According to FEMA's Hazus Web site, "a Level 1 analysis yields a rough estimate based on the nationwide database and is a great way to begin the risk assessment process and prioritize high-risk communities."

Jurisdiction	Total Exposure	10-Year			50-Year		
		Residential	Commercial	Industrial	Residential	Commercial	Industrial
Lazy Lake	$4,107,550	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Lighthouse Point	$1,261,700,120	*Negligible*	*Negligible*	*Negligible*	$136,000	*Negligible*	*Negligible*
Margate	$2,296,212,030	$10,548,780	$248,200	$39,920	$17,173,400	$718,770	$252,010
Miramar	$7,475,638,380	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
North Lauderdale	$1,260,435,790	$840,840	$90,980	*Negligible*	$6,246,740	$351,530	$59,580
Oakland Park	$2,473,754,560	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Parkland	$2,682,321,260	$29,746,130	$78,060	*Negligible*	$30,233,850	$78,060	*Negligible*
Pembroke Park	$404,154,300	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Pembroke Pines	$10,247,846,250	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Plantation	$6,803,128,100	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Pompano Beach	$8,981,181,420	$33,942,220	$2,477,240	$9,686,510	$67,084,270	$5,607,320	$18,322,110
Sea Ranch Lakes	$110,763,020	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Southwest Ranches	$890,133,450	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Sunrise	$5,308,400,300	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Tamarac	$3,283,696,510	$5,522,610	*Negligible*	*Negligible*	$23,560,490	$93,600	*Negligible*
Broward Municipal Services Districts	$1,106,396,610	$107,630	$17,350	$33,260	$171,000	$39,180	$75,050
West Park	$331,537,990	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Weston	$6,490,572,820	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Wilton Manors	$941,493,080	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
TOTAL	**$131,437,140,170**	**$138,882,940**	**$3,651,930**	**$10,129,090**	**$216,912,220**	**$9,148,420**	**$21,548,200**

** Negligible means less than $5,000*

Source: Broward County Property Appraiser and Hazus-MH MR2

Table 4.26: Potential Building Losses by Jurisdiction (100- and 500-year Riverine Flood Events)

Jurisdiction	Total Exposure	100-Year			500-Year		
		Residential	Commercial	Industrial	Residential	Commercial	Industrial
Coconut Creek	$3,061,603,270	$840,020	*Negligible*	*Negligible*	$706,560	*Negligible*	*Negligible*
Cooper City	$1,943,657,150	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Coral Springs	$8,134,798,700	$53,765,270	$1,435,120	$1,864,120	$61,010,430	$4,714,770	$7,227,810
Dania Beach	$1,878,435,580	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Davie	$6,711,031,880	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Deerfield Beach	$5,161,599,440	$660,040	$162,290	$443,430	$2,243,370	$300,690	$742,450
Fort Lauderdale	$22,130,694,710	$19,225,060	$919,290	$1,050,810	$23,874,870	$1,787,050	$2,285,860
Hallandale Beach	$3,836,691,130	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Hillsboro Beach	$810,574,300	*Negligible*	*Negligible*	*Negligible*	$909,900	$42,300	*Negligible*
Hollywood	$10,029,588,340	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Lauderdale-By-The-Sea	$1,739,928,950	$5,487,730	$193,500	*Negligible*	$11,498,500	$481,050	*Negligible*
Lauderdale Lakes	$1,152,461,750	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Lauderhill	$2,492,601,430	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Lazy Lake	$4,107,550	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Lighthouse Point	$1,261,700,120	$196,220	*Negligible*	*Negligible*	$5,022,540	$37,250	*Negligible*

Jurisdiction	Total Exposure	100-Year			500-Year		
		Residential	Commercial	Industrial	Residential	Commercial	Industrial
Margate	$2,296,212,030	$19,102,270	$1,599,370	$522,720	$24,953,830	$2,091,590	$1,319,960
Miramar	$7,475,638,380	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
North Lauderdale	$1,260,435,790	$6,688,620	$355,660	$61,500	$8,161,780	$2,706,750	$1,097,330
Oakland Park	$2,473,754,560	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Parkland	$2,682,321,260	$30,417,440	$78,060	*Negligible*	$32,291,920	$646,270	*Negligible*
Pembroke Park	$404,154,300	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Pembroke Pines	$10,247,846,520	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Plantation	$6,803,128,100	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Pompano Beach	$8,981,181,420	$78,029,050	$6,935,920	$22,599,440	$151,152,010	$10,806,250	$36,645,670
Sea Ranch Lakes	$110,763,020	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Southwest Ranches	$890,133,450	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Sunrise	$5,308,400,300	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Tamarac	$3,283,696,510	$23,572,450	$94,490	$236,240	$27,554,200	$619,550	$333,520
Broward Municipal Services Districts	$1,106,396,610	$229,600	$50,970	$98,360	$321,570	$108,520	$176,390
West Park	$331,537,990	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Weston	$6,490,572,820	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Wilton Manors	$941,493,080	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
TOTAL	**$131,437,140,170**	**$238,213,770**	**$11,824,670**	**$26,876,620**	**$348,791,580**	**$24,299,740**	**$49,828,990**

** Negligible means less than $5,000*

Source: Broward County Property Appraiser and Hazus-MH MR2

The second approach to assessing each jurisdiction's exposure and potential losses to riverine and coastal flood hazard events included an independent GIS-based analysis using FEMA's digital Q3 flood data in combination with Broward County's local tax assessor records and critical facilities data. In order to complete the assessment, initially every individual land parcel and critical facility that is located wholly or partially within a FEMA Zone A, AE, or V special flood hazard area with a 1% annual chance of flooding (100-year floodplain) was identified, by jurisdiction. It should be noted in this revised Plan, critical facilities in FEMA AH Zone has been added to broaden the analysis. This analysis is intended for use as a general planning tool in order to provide reasonable estimates of potential at-risk properties or facilities using best available georeferenced data in comparison to the results of the Hazus-MH loss estimation results. It is important to note that while the GIS-based assessment does use specific attribute data tied to each individual at-risk property (i.e., year built and building value), it does not take into account certain unknown site-specific factors that may mitigate future flood losses on a building-by-building basis (such as elevation, surrounding topography, flood-proofing measures, drainage, etc.).

The identification of at-risk properties (and subsequently buildings) was completed using local parcel data layers in combination with local tax assessor records. To further narrow down the list of initially identified floodplain properties to those with buildings potentially at-risk to flood events, GIS selection criteria was utilized to identify only those properties with buildings constructed prior to 1972 (pre-NFIP), under the assumption that those built after 1972 would be protected to the 100-year flood level due to the availability of flood hazard maps and the adoption of local flood damage prevention ordinances. The objective of the GIS-based analysis is to calculate the total

building value of all potentially at-risk properties in Broward County, by jurisdiction. The results of the GIS-based flood analysis for Broward County are provided in **Tables 4.27, 4.27a and 4.27b.**

Table 4.27 Total Building Value of At-Risk Properties by Jurisdiction (Riverine / Coastal Flood Events)

Jurisdiction	Number of Floodplain Properties	Total Building Value	Pre-NFIP Building Value (pre-1972)
Coconut Creek	1,869	$1,306,681,800	$71,100,070
Cooper City	1,624	$810,494,740	$23,743,350
Coral Springs	5,745	$3,180,227,640	$63,828,780
Dania Beach	4,445	$1,776,980,710	$414,616,870
Davie	8,759	$5,546,165,150	$255,383,400
Deerfield Beach	6,011	$3,005,807,940	$611,475,750
Fort Lauderdale	25,141	$19,222,038,200	$7,228,275,670
Hallandale Beach	3,239	$1,366,926,790	$509,567,500
Hillsboro Beach	138	$466,685,750	$48,759,060
Hollywood	17,362	$7,277,525,630	$3,681,864,720
Lauderdale-By-The-Sea	954	$478,142,800	$332,620,530
Lauderdale Lakes	1,130	$399,942,840	$150,473,660
Lauderhill	2,371	$1,331,798,790	$124,890,330
Lazy Lake	12	$3,772,250	$2,025,340
Lighthouse Point	2,772	$1,503,893,870	$685,591,480
Margate	2,682	$938,879,450	$139,698,440
Miramar	4,741	$2,981,240,320	$258,243,450
North Lauderdale	2,655	$799,415,090	$162,504,030
Oakland Park	4,182	$1,398,811,920	$864,880,250
Parkland	4,633	$2,586,319,670	$10,078,630
Pembroke Park	306	$205,287,170	$47,088,900
Pembroke Pines	7,913	$4,503,655,510	$509,111,850
Plantation	6,449	$4,550,651,810	$518,163,740
Pompano Beach	9,605	$4,927,487,700	$1,824,301,550
Sea Ranch Lakes	129	$122,818,790	$86,313,460
Southwest Ranches	2,573	$1,240,036,790	$78,789,600
Sunrise	3,430	$2,678,798,050	$90,502,690
Tamarac	7,227	$1,795,652,310	$342,940,630
Broward Municipal Services Districts	937	$2,221,672,880	$406,286,560
West Park	947	$132,576,650	$94,767,740
Weston	5,705	$3,613,148,570	$2,240,750
Wilton Manors	1,754	$658,071,090	$525,374,870
TOTAL	**147,440**	**$83,031,608,670**	**$20,165,503,650**

Sources: Broward County Property Appraiser; Federal Emergency Management Agency National Flood Hazard Layer

Table 4.27a: Total Building Value of At-Risk Properties by Jurisdiction and Type (Riverine / Coastal Flood Events) June 2017

Jurisdiction	Residential	Commercial	Industrial	Other*	Total
Coconut Creek	$728,164,410	$211,142,210	$78,166,980	$289,208,200	$1,306,681,800
Cooper City	$571,558,220	$49,570,950	$7,459,790	$181,905,780	$810,494,740
Coral Springs	$1,974,038,740	$631,852,380	$130,130,650	$444,205,870	$3,180,227,640
Dania Beach	$823,322,850	$539,305,710	$316,741,530	$97,610,620	$1,776,980,710
Davie	$3,574,966,430	$549,964,800	$315,564,580	$1,105,669,340	$5,546,165,150
Deerfield Beach	$1,498,836,230	$647,854,540	$533,205,470	$325,911,700	$3,005,807,940
Fort Lauderdale	$10,126,050,210	$5,216,955,210	$918,930,240	$2,960,102,540	$19,222,038,200
Hallandale Beach	$748,735,250	$496,638,700	$32,711,410	$88,841,430	$1,366,926,790
Hillsboro Beach	$456,379,020	$8,929,340	$0	$1,377,390	$466,685,750
Hollywood	$4,174,819,290	$1,655,649,130	$389,317,270	$1,057,739,940	$7,277,525,630
Lauderdale-By-The-Sea	$412,321,620	$61,387,260	$0	$4,433,920	$478,142,800
Lauderdale Lakes	$204,539,760	$122,197,510	$20,303,030	$52,902,540	$399,942,840
Lauderhill	$1,057,774,750	$103,141,230	$28,491,620	$142,391,190	$1,331,798,790
Lazy Lake	$3,772,250	$0	$0	$0	$3,772,250
Lighthouse Point	$1,448,639,210	$48,288,070	$0	$6,966,590	$1,503,893,870
Margate	$577,324,620	$150,917,450	$44,494,870	$166,142,510	$938,879,450
Miramar	$1,525,809,110	$384,043,240	$297,006,560	$774,381,410	$2,981,240,320
North Lauderdale	$593,544,350	$99,589,610	$23,808,970	$82,472,160	$799,415,090
Oakland Park	$741,351,810	$281,076,400	$263,812,430	$112,571,280	$1,398,811,920
Parkland	$2,329,536,620	$49,941,490	$430,780	$206,410,780	$2,586,319,670
Pembroke Park	$39,356,530	$19,329,590	$110,532,470	$36,068,580	$205,287,170
Pembroke Pines	$2,905,267,930	$856,912,500	$37,165,520	$704,309,560	$4,503,655,510
Plantation	$2,970,844,770	$1,050,359,860	$58,774,790	$470,672,390	$4,550,651,810
Pompano Beach	$2,517,213,190	$668,923,610	$1,067,183,320	$674,167,580	$4,927,487,700
Sea Ranch Lakes	$122,818,790	$0	$0	$0	$122,818,790
Southwest Ranches	$1,010,094,120	$30,035,550	$430,490	$199,476,630	$1,240,036,790
Sunrise	$964,284,030	$854,728,170	$227,399,450	$632,386,400	$2,678,798,050
Tamarac	$1,295,904,110	$215,126,770	$143,901,740	$140,719,690	$1,795,652,310
Broward Municipal Services Districts	$96,547,460	$17,959,870	$27,697,580	$2,079,467,970	$2,221,672,880
West Park	$96,538,170	$18,134,350	$13,222,750	$4,681,380	$132,576,650
Weston	$2,818,908,810	$422,970,340	$204,144,270	$167,125,150	$3,613,148,570
Wilton Manors	$547,836,990	$57,693,870	$2,038,660	$50,501,570	$658,071,090
TOTAL	**$48,957,099,650**	**$15,520,619,710**	**$5,293,067,220**	**$13,260,822,090**	**$83,031,608,670**

** "Other" building occupancy category includes agriculture, religious/nonprofit, government, and education occupancies.*

Jurisdiction	Residential	Commercial	Industrial	Other*	Total

Source: Broward County Property Appraiser; Federal Emergency Management Agency National Flood Hazard Layer

Table 4.27b: Total # of Buildings At-Risk Properties by Jurisdiction and Type (Riverine / Coastal Flood Events) June 2017

Jurisdiction	Residential	Commercial	Industrial	Other*	Total
Coconut Creek	1768	33	15	53	1869
Cooper City	1550	18	1	55	1624
Coral Springs	5403	172	75	95	5745
Dania Beach	3773	246	328	98	4445
Davie	7927	284	193	355	8759
Deerfield Beach	5418	261	238	94	6011
Fort Lauderdale	21285	2192	1008	656	25141
Hallandale Beach	2954	191	50	44	3239
Hillsboro Beach	133	3	0	2	138
Hollywood	15873	945	222	322	17362
Lauderdale-By-The-Sea	879	66	0	9	954
Lauderdale Lakes	1036	59	13	22	1130
Lauderhill	2213	98	22	38	2371
Lazy Lake	12	0	0	0	12
Lighthouse Point	2706	52	0	14	2772
Margate	2542	68	33	39	2682
Miramar	4507	99	39	96	4741
North Lauderdale	2550	58	12	35	2655
Oakland Park	3223	339	537	83	4182
Parkland	4523	19	1	90	4633
Pembroke Park	222	25	47	12	306
Pembroke Pines	7685	131	10	87	7913
Plantation	6005	274	51	119	6449
Pompano Beach	8116	509	759	221	9605
Sea Ranch Lakes	129	0	0	0	129
Southwest Ranches	2214	14	2	343	2573
Sunrise	3090	179	85	76	3430
Tamarac	6982	144	56	45	7227
Broward Municipal Services Districts	716	54	23	144	937
West Park	903	24	10	10	947

Jurisdiction	Residential	Commercial	Industrial	Other*	Total
Weston	5501	134	37	33	5705
Wilton Manors	1624	96	2	32	1754
TOTAL	**133462**	**6787**	**3869**	**3322**	**147440**

** "Other" building occupancy category includes agriculture, religious/nonprofit, government, and education occupancies.*

Source: Broward County Property Appraiser

The GIS-based analysis for critical facilities identified 78 critical facilities throughout Broward County as being potentially at-risk to flood events. These include 24 city halls, 80 fire stations, 28 police stations, 14 hospital, and 201 schools (26 of which are designated as either county or local shelters). These potentially at-risk critical facilities are listed in **Table 4.28 in Appendix I.**

FEMA defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. Currently there are over 122,000 repetitive loss properties nationwide. FEMA defines a severe repetitive loss (SRL) property as with 1 of the following conditions in a 10-year period: 1) At least 4 claims payments (building and contents) over $5,000 each; 2) At least 2 building claims payments with the cumulative amount exceeding the market value of the building.

According to FEMA repetitive loss property records, there are currently 754 "non-mitigated" Repetitive Loss Properties located in Broward County. These properties have accounted for a total of 1,919 losses and more than $35 million in claims payments (building and contents) under the NFIP as shown in **Table 4.29a**. All but 1 of Broward County's municipal jurisdictions (Sea Ranch Lakes) is identified as having one or more Repetitive Loss Properties.

Also included is the list of FEMA SRL properties in **Table 4.29b.** These properties have accounted for 244 losses and more than $8.7 million in claims payments. **Map 4.13** shows the approximate location of both Repetitive Loss and SRL Properties in Broward County. Hallandale Beach has the most SRL properties with 12.

Although this information is tracked by the County in accordance with FEMA guidelines, it is protected from release by the Privacy Act of 1974, 5 U.S.C. Section 552(2).

Table 4.29a: NFIP Repetitive Loss Properties by Jurisdiction (as of June 2017)

Jurisdiction	Number of Repetitive Loss Properties	Number of Losses	Building Payments	Contents Payments	Total Payments
Coconut Creek	1	2	$2,920.00	$0.00	$2,920.00
Cooper City	4	8	$17,909.19	$2,339.00	$20,248.19
Coral Springs	14	28	$298,445.36	$87,441.62	$385,886.98
Dania Beach	32	85	$969,069.43	$265,824.40	$1,234,893.83

Jurisdiction	Number of Repetitive Loss Properties	Number of Losses	Building Payments	Contents Payments	Total Payments
Davie	20	51	$414,656.75	$417,619.23	$832,275.98
Deerfield Beach	5	11	$77,556.78	$21,607.78	$99,164.56
Fort Lauderdale	95	292	$4,222,482.96	$2,006,081.72	$6,228,564.68
Hallandale Beach	156	459	$11,637,080.08	$4,027,158.97	$15,664,239.05
Hillsboro Beach	1	2	$9,665.33	$0.00	$9,665.33
Hollywood	221	524	$7,132,172.52	$2,478,199.61	$9,610,372.13
Lauderdale-By-The-Sea	2	5	$65,685.25	$4,943.78	$70,629.03
Lauderdale Lakes	16	35	$164,199.67	$37,076.30	$201,275.97
Lauderhill	33	75	$477,677.75	$142,004.52	$619,682.27
Lazy Lake	1	2	$6,284.90	$0.00	$6,284.90
Lighthouse Point	2	4	$12,734.07	$22,263.99	$34,998.06
Margate	13	28	$81,914.95	$21,537.02	$103,451.97
Miramar	39	82	$523,156.03	$176,003.80	$699,159.83
North Lauderdale	9	19	$94,352.03	$13,018.25	$107,370.28
Oakland Park	55	150	$2,292,065.13	$815,285.66	$3,107,350.79
Parkland	0	0	$0.00	$0.00	$0.00
Pembroke Park	12	47	$506,772.23	$726,380.56	$1,233,152.79
Pembroke Pines	11	24	$169,470.42	$26,186.42	$195,656.84
Plantation	12	24	$85,701.43	$16,358.86	$102,060.29
Pompano Beach	27	64	$1,005,751.88	$134,731.79	$1,140,483.67
Sea Ranch Lakes	0	0	$0.00	$0.00	$0.00
Southwest Ranches	2	4	$18,593.03	$13,065.84	$31,658.87
Sunrise	8	21	$133,959.34	$49,166.91	$183,126.25
Tamarac	12	26	$155,217.85	$53,101.95	$208,319.80
Broward Municipal Services Districts	4	9	$49,804.95	$31,308.82	$81,113.77
West Park	18	63	$506,173.62	$260,429.46	$766,603.08
Weston	3	8	$97,828.08	$11,690.04	$109,518.12
Wilton Manors	10	28	$291,711.98	$160,963.07	$452,675.05
TOTAL	**838**	**2180**	**$31,521,012.99**	**$12,021,789.37**	**$43,542,802.36**

Source: Federal Emergency Management Agency Repetitive Loss and Severe Repetitive Loss Properties Report for Broward County, August 7, 2017 Report

Greatest increase in number of Repetitive Loss Properties (from 2009 LMS to present)

- Hallandale Beach - 83 to 150 properties
- Hollywood - 108 to 212 properties

Biggest decrease in number of Repetitive Loss Properties (from 2009 LMS to present)

- 2 less properties – multiple cities: Davie, Fort Lauderdale, and Oakland Park

Table 4.29b: NFIP SRL Properties by Jurisdiction (as of June 2017)

Jurisdiction	Number of SRL Properties	Number of Losses	Building Payments	Contents Payments	Total Payments
Coconut Creek	0	0	$0.00	$0.00	$0.00
Cooper City	0	0	$0.00	$0.00	$0.00
Coral Springs	0	0	$0.00	$0.00	$0.00
Dania Beach	2	9	$191,022.34	$48,687.46	$239,709.80
Davie	1	5	$97,956.94	$226,528.00	$324,484.94
Deerfield Beach	0	0	$0.00	$0.00	$0.00
Fort Lauderdale	4	24	$334,044.16	$34,089.33	$368,133.49
Hallandale Beach	10	68	$2,028,228.24	$400,504.05	$2,428,732.29
Hillsboro Beach	0	0	$0.00	$0.00	$0.00
Hollywood	1	4	$103,675.81	$62,373.67	$166,049.48
Lauderdale-By-The-Sea	0	0	$0.00	$0.00	$0.00
Lauderdale Lakes	0	0	$0.00	$0.00	$0.00
Lauderhill	0	0	$0.00	$0.00	$0.00
Lazy Lake	0	0	$0.00	$0.00	$0.00
Lighthouse Point	0	0	$0.00	$0.00	$0.00
Margate	0	0	$0.00	$0.00	$0.00
Miramar	0	0	$0.00	$0.00	$0.00
North Lauderdale	0	0	$0.00	$0.00	$0.00
Oakland Park	0	0	$0.00	$0.00	$0.00
Parkland	0	0	$0.00	$0.00	$0.00
Pembroke Park	0	0	$0.00	$0.00	$0.00
Pembroke Pines	0	0	$0.00	$0.00	$0.00
Plantation	0	0	$0.00	$0.00	$0.00
Pompano Beach	0	0	$0.00	$0.00	$0.00
Sea Ranch Lakes	0	0	$0.00	$0.00	$0.00
Southwest Ranches	0	0	$0.00	$0.00	$0.00
Sunrise	0	0	$0.00	$0.00	$0.00
Tamarac	0	0	$0.00	$0.00	$0.00
Broward Municipal Services Districts	0	0	$0.00	$0.00	$0.00
West Park	2	9	$123,333.30	$61,573.27	$184,906.57
Weston	0	0	$0.00	$0.00	$0.00
Wilton Manors	0	0	$0.00	$0.00	$0.00
TOTAL	**20**	**119**	**$2,878,260.79**	**$833,755.78**	**$3,712,016.57**

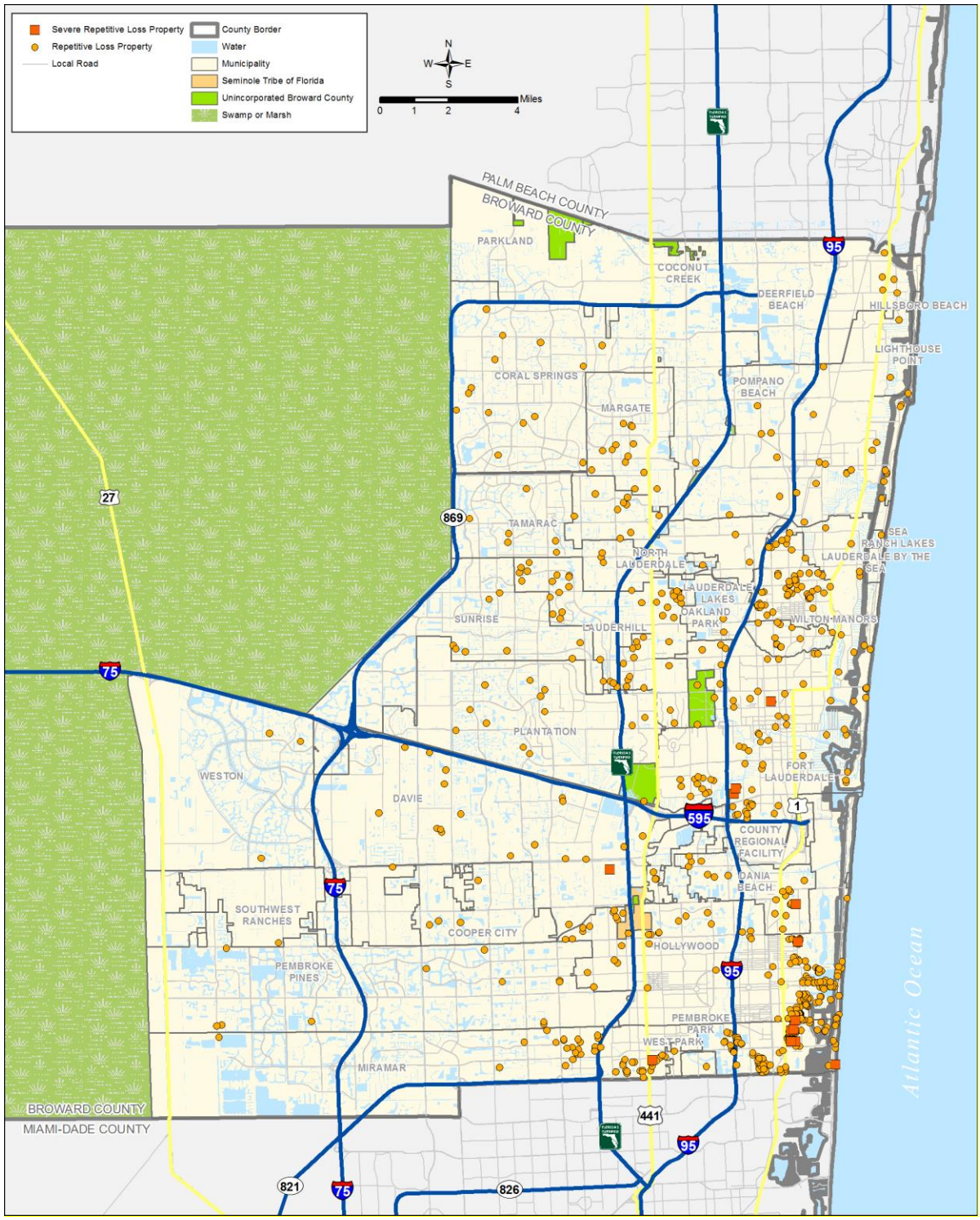
Source: Federal Emergency Management Agency Repetitive Loss and Severe Repetitive Loss Properties Report for Broward County, August 7, 2017 Report

Table 4.30: Breakdown of NFIP Repetitive Loss (RL) Properties and Severe Repetitive Loss (SRL) Properties and Total NFIP payments by Jurisdiction (as of July 2017) RL includes SRL

Jurisdiction	Single Family Residential		2-4 Family Residential		Condo		Other Residential		Non-Residential	
	RL	SRL	RL	SRL	RL	SRL	RL	SRL	RL	SRL
Coconut Creek	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Coconut Creek Payments	$2,920.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Cooper City	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Cooper City Payments	$20,248.19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Coral Springs	**13**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**
Coral Springs Payments	$344,208.24	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$41,678.74	$0.00
Dania Beach	**25**	**2**	**2**	**0**	**0**	**0**	**2**	**0**	**3**	**0**
Dania Beach Payments	$937,451.52	$239,709.80	$55,959.59	$0.00	$0.00	$0.00	$38,853.87	$0.00	$202,628.85	$0.00
Davie	**17**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**2**	**0**
Davie Payments	$662,766.04	$324,484.94	$0.00	$0.00	$156,065.43	$0.00	$0.00	$0.00	$13,444.51	$0.00
Deerfield Beach	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**
Deerfield Beach Payments	$92,207.11	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$6,957.45	$0.00
Fort Lauderdale	**64**	**3**	**8**	**0**	**5**	**0**	**4**	**1**	**14**	**0**
Fort Lauderdale Payments	$2,423,121.67	$144,246.00	$391,983.41	$0.00	$1,339,310.67	$0.00	$853,977.70	$223,887.49	$1,220,171.23	$0.00
Hallandale Beach	**101**	**9**	**22**	**0**	**3**	**0**	**19**	**1**	**11**	**0**
Hallandale Beach Payments	$6,052,280.24	$1,570,162.03	$1,352,537.15	$0.00	$771,630.92	$0.00	$2,476,532.22	$858,570.26	$5,011,258.52	$0.00
Hillsboro Beach	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**
Hillsboro Beach Payments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$9,665.33	$0.00
Hollywood	**189**	**1**	**10**	**0**	**1**	**0**	**9**	**0**	**12**	**0**
Hollywood Payments	$6,752,501.66	$166,049.48	$627,625.32	$0.00	$24,053.67	$0.00	$1,225,259.97	$0.00	$980,931.51	$0.00
Lauderdale-By-The-Sea	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**
Lauderdale-By-The-Sea Payments	$21,918.03	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$48,711.00	$0.00
Lauderdale Lakes	**16**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Lauderdale Lakes Payments	$201,275.97	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Lauderhill	**32**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Lauderhill Payments	$616,416.70	$0.00	$3,265.57	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Lazy Lake	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Lazy Lake Payments	$6,284.90	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Lighthouse Point	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Lighthouse Point Payments	$34,998.06	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Margate	**13**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Margate Payments	$103,451.97	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Miramar	**39**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Miramar Payments	$699,159.83	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
North Lauderdale	**9**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
North Lauderdale Payments	$107,370.28	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Oakland Park	**34**	**0**	**2**	**0**	**0**	**0**	**3**	**0**	**16**	**0**
Oakland Park Payments	$1,335,596.89	$0.00	$32,189.44	$0.00	$0.00	$0.00	$127,833.10	$0.00	$1,611,731.36	$0.00
Parkland	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Parkland Payments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pembroke Park	**2**	**0**	**1**	**0**	**2**	**0**	**1**	**0**	**6**	**0**
Pembroke Park Payments	$52,167.95	$0.00	$15,113.82	$0.00	$538,752.90	$0.00	$36,567.30	$0.00	$590,550.82	$0.00
Pembroke Pines	**9**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**
Pembroke Pines Payments	$158,899.43	$0.00	$0.00	$0.00	$0.00	$0.00	$36,757.41	$0.00	$0.00	$0.00
Plantation	**12**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Plantation Payments	$102,060.29	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pompano Beach	**13**	**0**	**4**	**0**	**0**	**0**	**1**	**0**	**9**	**0**
Pompano Beach Payments	$331,619.91	$0.00	$173,505.01	$0.00	$0.00	$0.00	$53,802.60	$0.00	$581,556.15	$0.00
Sea Ranch Lakes	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Sea Ranch Lakes Payments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Southwest Ranches	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**
Southwest Ranches Payments	$10,759.89	$0.00	$0.00	$0.00	$0.00	$0.00	$20,898.98	$0.00	$0.00	$0.00
Sunrise	**8**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Sunrise Payments	$183,126.25	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Tamarac	**12**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Tamarac Payments	$208,319.80	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Broward Municipal Services Districts	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**
Broward Municipal Services Districts Payments	$69,398.86	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$11,714.91	$0.00
West Park	**18**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
West Park Payments	$766,603.08	$184,906.57	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Weston	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**
Weston Payments	$24,792.28	$0.00	$8,387.34	$0.00	$0.00	$0.00	$76,338.50	$0.00	$0.00	$0.00
Wilton Manors	**8**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**
Wilton Manors Payments	$355,346.50	$0.00	$13,049.88	$0.00	$0.00	$0.00	$0.00	$0.00	$84,278.67	$0.00
Total	**652**	**18**	**52**	**0**	**12**	**0**	**43**	**2**	**79**	**0**
Total Payments	**$22,677,271.54**	**$2,629,558.82**	**$2,673,616.53**	**$0.00**	**$2,829,813.59**	**$0.00**	**$4,946,821.65**	**$1,082,457.75**	**$10,415,279.05**	**$0.00**

Map 4.14: Repetitive Loss and SRL Properties in Broward County (as of July 2017)



Source: Federal Emergency Management Agency Repetitive Loss and Severe Repetitive Loss Properties Report for Broward County, August 7, 2017 Report

Sea Level Rise/Climate Change

Background

Sea level rise, caused by climate change, is a phenomenon resulting from a consistent change in the earth's temperature that leads to changes in climatic patterns which ultimately alters weather patterns including with subsequent atmospheric and hydrologic impacts. The melting of ice at the polar ice caps will cause a worldwide increase on sea level. While there is still debate on the degree of the impact, the evidence is clear that a trend is occurring and sea levels have been rising for the better part of the 20th century and into the 21st century.

This chapter will not go into the details of what is causing climate change; it will focus on the impacts from climate change on sea level rise including storm surge and coastal flooding. The mitigation strategies section will follow up to propose potential adaptation and mitigation actions. Sea level rise and climate change also affect atmospheric and hydrologic patterns which in turn impact other hazards like inland flood (increased rainfall periods), drought (decreased rainfall periods), and wildfire (exacerbated by vegetative fuel growth in periods of higher rainfall and then burn risk in drier periods). The impact of climate change on these hazards will be discussed in the appropriate hazard subsections of Chapter 4. For this subsection, the impacts of sea level rise will be discussed.

An article from Nature Geoscience by T.R. Knutson, et al. entitled "Tropical Cyclones and Climate Change" (2010) referenced in the SFWMD report entitled "Past and Projected Trends in Climate and Sea Level Rise for South Florida – External Review Draft" (2011) reveals that the potential impacts of climate change, particularly global warming, for the Atlantic Ocean basin are the following:

- Decrease in the number of tropical storms and hurricanes from 6-34% (due to increased wind shear over the Atlantic basin)
- Increase in the wind intensity of the hurricanes from 2-11%
- Increase in the height and strength of hurricane storm surge (due to higher sea level and wind intensity)
- Rainfall increases of up to 20% within 60 miles of tropical storms and hurricanes
- At this time, there is no indication of large alterations of historical storm origin and tracks so south Florida continues to be a target of high probability

The SFWMD report states that the main concerns with sea level rise for South Florida are the following:

- Saltwater intrusion into coastal aquifers and a diminishing of fresh groundwater which negatively impacts the public water supply
- Less capacity to drain overland flooding and stormwater from inland areas to marine waters because the higher sea levels effectively block positive drainage from west to east (i.e., due to low South Florida surface elevations, most larger and local drainage systems depends on a differential between upstream and downstream water levels, headwater and tailwater respectively, where the downstream areas are generally in tidal/marine areas).
- Increased tropical storm and hurricane surge levels
- More frequent coastal flooding and some inundation of coastal real estate by marine water

Location and Spatial Extent

As a coastal county, the impact of sea level rise on Broward County has the potential to be high to severe in the long term. The Southeast Florida Climate Change Regional Compact, working

closely with the Broward County Climate Change Task Force and the SFWMD, has outlined 3 potential scenarios in its August 2012 "Analysis of Vulnerability of Southeast Florida to Sea Level Rise": a 1 foot rise in sea level (estimated time occurrence between 2040-2070); a 2 foot rise (estimated between 2060-2115); and a 3 foot rise (estimated between 2075-2150; see **Maps 4.14-4.16**). The overlaps in time periods between the 3 scenarios are due to the uncertainty in making these types of projections. To discuss the impacts of the scenario in the near term, the Economic Vulnerability section also focuses on the impacts of sea level rise to coastal communities and concentrations of economic activity closest to the coast.

Historical Occurrences

The 2011 SFWMD report also states that, according to measurable changes in its coastal water control structures, sea level rise has already occurred. A majority of the coastal water control infrastructure managed by the SFWMD was constructed between 1950 and 1960. The Standard Flood design criteria for many of these structures assumes a headwater-tailwater differential of 6 inches. Due to the fact that several of these structures now have their discharge controlled by the tide (a rise in mean tailwater elevation), and what has been measured by tide gauges. Recent analyses of tide gauge records acquired along the US Atlantic coast indicate a rapid acceleration in the rate of sea level rise since 2000, from the period 1950-2010, approximately 5.5 inches of sea level rise has occurred. Overall the report states that the sea level in Florida has risen about 9 inches over the past century.

Probability and Extent of Future Occurrences

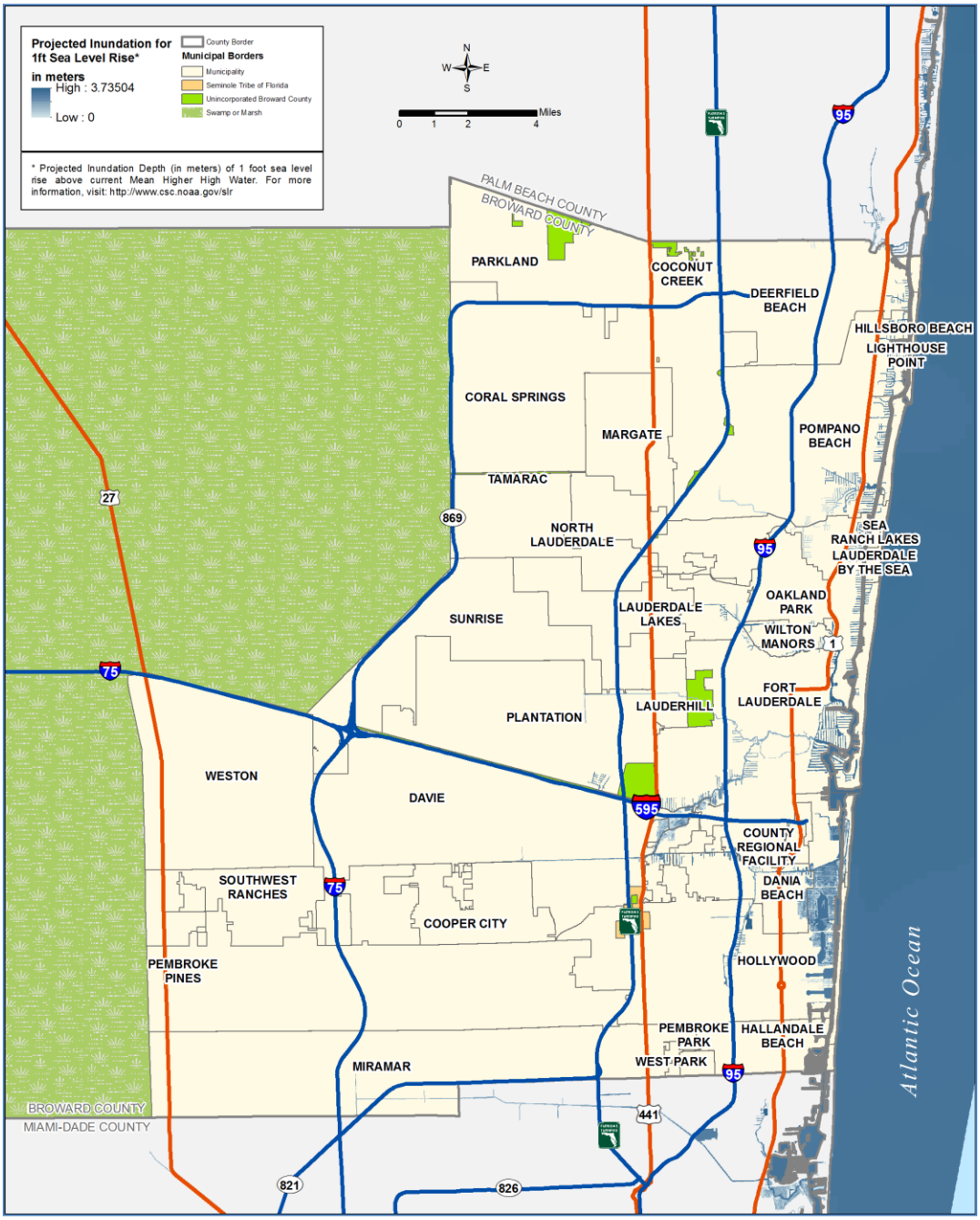
The probability of future sea level rise events in Broward County is considered "likely". The SFWMD report states that sea level rise projections for the year 2100, from governmental and peer-reviewed scientific literature, indicate a potential range from 1.5 to 6.5 feet. The main variable affecting this variation of these estimates is the uncertainty in knowing the rate of glacial and polar ice melting. More specifics about the scenarios developed for Broward County by the Southeast Florida Regional Compact Climate Change is in the subsection below.

Vulnerability Assessment

While there is considerable non-scientific debate about the probability of sea level rise, and variation within the scientific community on the severity of sea level rise (but consensus on the probability), the County is likely to continue to be vulnerable to the impacts of sea level rise. The level of impact ranges from moderate to severe.

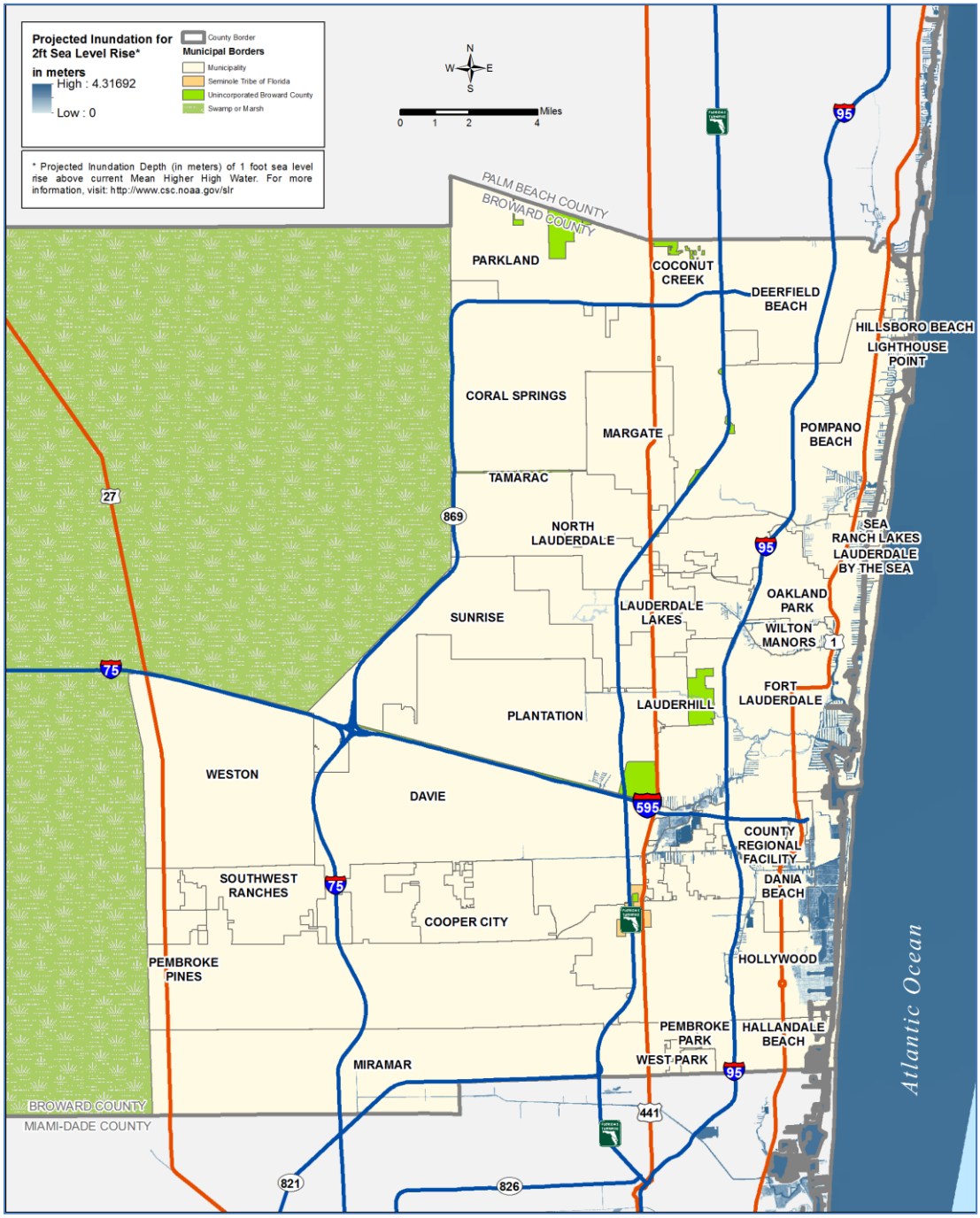
From the Southeast Florida Regional Compact Climate Change's "Analysis of the Vulnerability of Southeast Florida to Sea Level Rise" document from August 2012: "At the one foot scenario, property with a current taxable value of $403-828M was vulnerable. At three feet of sea level rise, properties valued at $6,901-12,109M were impacted. Under a one foot sea level rise scenario, 1.3% of the County is impacted with conservation lands being the major land use type inundated. At the two foot scenario, 3% of the land is impacted with Electrical Generation Facilities among the top ranked impacted. At the three foot scenario, 7% of the total land mass of the County is impacted including 28% of the agricultural lands and 10% of the transit oriented development. In terms of acres inundated, wetland hardwood forest and vegetated non-forested wetlands are among the major habitats impacted." See **Maps 4.14 - 4.16** below for a spatial depiction of the impacts from the 3 sea level rise scenarios. **Tables 4.32- 4.35**, after the maps, show the projected damage impacts and level of inundation by land use for the 3 scenarios.

Map 4.15: 1 foot Sea Level Rise in Broward County



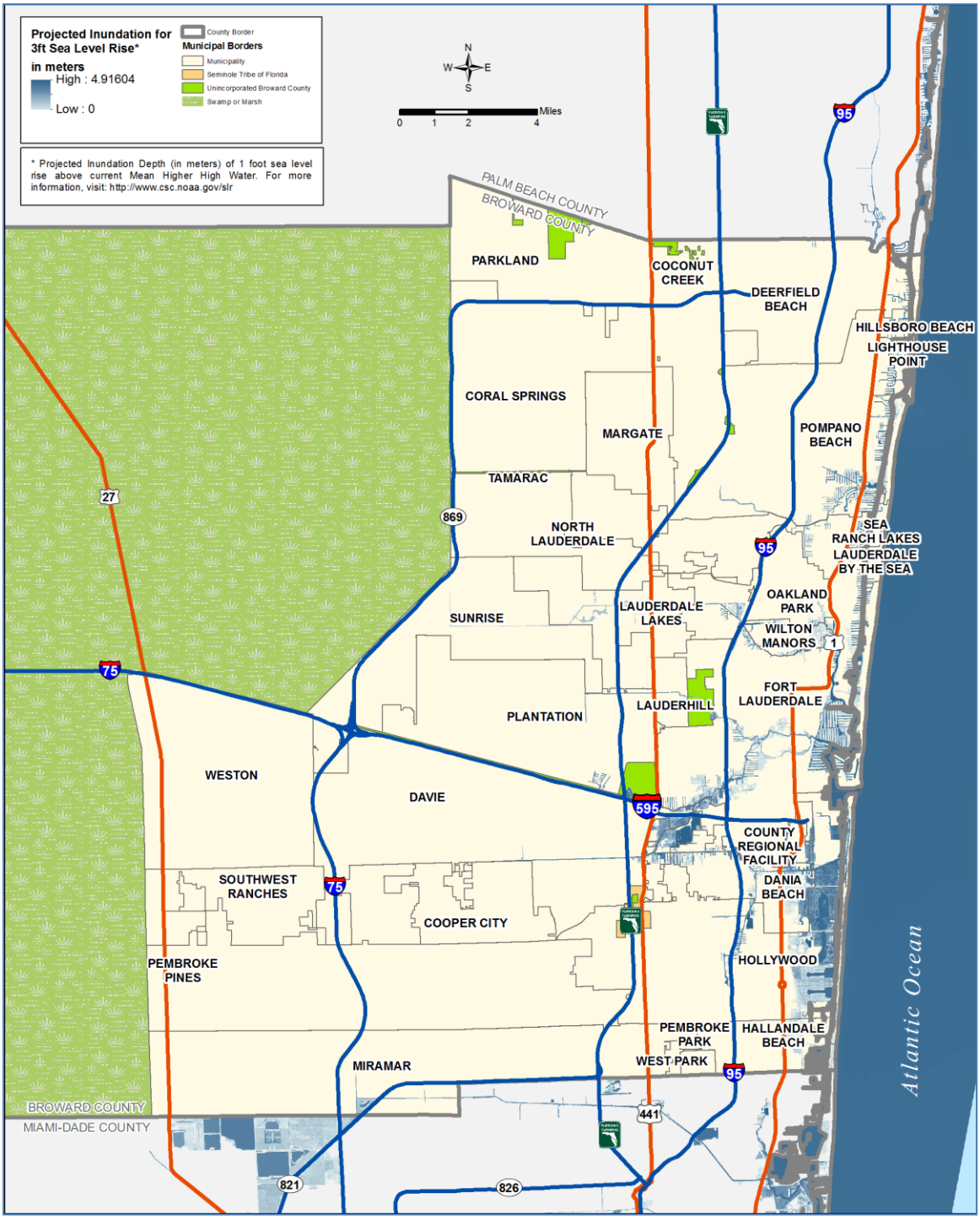
Source: NOAA Coastal Services Center

Map 4.16: 2 foot Sea Level Rise in Broward County



Source: NOAA Coastal Services Center

Map 4.17: 3 foot Sea Level Rise in Broward County



Source: NOAA Coastal Services Center

Table 4.32: Loss Estimation of Broward Commercial Properties for 3 Sea Level Rise Scenarios

Level of Inundation	Value for Vulnerable Commercial Properties	Approximate Level of Damages*
1 Foot	$1,272,457,260.00	$254,491,452.00
2 Foot	$1,743,438,840.00	$348,687,768.00
3 Foot	$3,602,999,620.00	$720,599,924.00

Source: Broward County Appraiser GIS, HAZUS 4.0

** Sum of commercial property building values in inundation zone*
*** Multiply total building value in inundation zone by 20% to estimate building and content damage*

Table 4.33: Impact of Sea Level Rise on different types of land use at 1 foot scenario

Land Use	Total Partial or Full Affected Inundation Parcel Areas (acres)	Total Land Use Coverage (acres)	Percent Inundation of that Land Use
Residential	3,187.90	110,323.20	2.89%
Commercial	1,014.70	28,834.60	3.52%
Industrial	226.20	10,291.70	2.20%
Agriculture and Timber Lands	74.90	5,925.30	1.26%
Conservation Land/ Open Space & Recreation	2,830.10	13,496.20	20.97%
Utilities / Transportation	2,276.50	34,864.70	6.53%
Other	8,155.40	68,354.70	11.93%

Source: Broward County Property Appraiser GIS, NOAA Coastal Services Center

The following land use codes from the Broward County Property Appraiser's Office we utilized Residential <10; Commercial 10-39; Industrial 40-49; Agricultural and Timber Lands 50-69

Table 4.34: Impact of Sea Level Rise on different types of land use at 2 foot scenario

Land Use	Total Partial or Full Inundation Affected Parcel Areas (acres)	Total Land Use Coverage (acres)	Percent Inundation of that Land Use
Residential	4,452.00	110,323.20	4.04%
Commercial	1,471.30	28,834.60	5.10%
Industrial	328.40	10,291.70	3.19%
Agriculture and Timber Lands	92.70	5,925.30	1.56%
Conservation Land/ Open Space & Recreation	2,923.40	13,496.20	21.66%

Utilities / Transportation	2,766.90	34,864.70	7.94%
Other	9,130.40	68,354.70	13.36%

Source: Broward County Property Appraiser GIS, NOAA Coastal Services Center

The following land use codes from the Broward County Property Appraiser's Office we utilized Residential <10; Commercial 10-39; Industrial 40-49; Agricultural and Timber Lands 50-69

Table 4.35: Impact of Sea Level Rise on different types of land use at 3 foot scenario

Land Use	Total Partial or Full Inundation Affected Parcel Areas (acres)	Total Land Use Coverage (acres)	Percent Inundation of that Land Use
Residential	6,208.90	110,323.20	5.63%
Commercial	2,166.80	28,834.60	7.51%
Industrial	440.10	10,291.70	4.28%
Agriculture and Timber Lands	210.20	5,925.30	3.55%
Conservation Land/ Open Space & Recreation	3,097.40	13,496.20	22.95%
Utilities / Transportation	3,620.30	34,864.70	10.38%
Other	10,498.20	68,354.70	15.36%

Source: Broward County Property Appraiser GIS, NOAA Coastal Services Center

The following land use codes from the Broward County Property Appraiser's Office we utilized Residential <10; Commercial 10-39; Industrial 40-49; Agricultural and Timber Lands 50-69

Geologic Hazards

For the purposes of this risk assessment geologic hazards are events or incidents that involve seismic or non-seismic ground failures such as earthquakes, landslides, sinkholes, land subsidence, and expansive soils as well as the hazards of tsunami and volcano. The occurrence of geologic hazards is often interrelated with other natural phenomena.

Other Natural Hazards

For the purposes of this vulnerability assessment, "other" natural hazards are limited to wildfire.

Wildfire

Background

A wildfire is any fire occurring in a wildland area (i.e. grassland, forest, brush land) except for fire under prescription.[17] Wildfires are part of the natural management of forest ecosystems, but may

17 Prescription burning, or "controlled burn," undertaken by land management agencies is the process of igniting fires under selected conditions, in accordance with strict parameters.

also be caused by human factors. Nationally, over 80% of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning.

There are 3 classes of wildland fires: surface fire, ground fire, and crown fire. A surface fire is the most common of these 3 classes and burns along the floor of a forest, moving slowly and killing or damaging trees. A ground fire (muck fire) is usually started by lightning or human carelessness and burns on or below the forest floor. Crown fires spread rapidly by wind and move quickly by jumping along the tops of trees. Wildland fires are usually signaled by dense smoke that fills the area for miles around.

Wildfire probability depends on local weather conditions, outdoor activities such as camping, debris burning, and construction, and the degree of public cooperation with fire prevention measures. Drought conditions and other natural hazards (such as tornadoes, hurricanes, etc.) increase the probability of wildfires by producing fuel in both urban and rural settings. Forest damage from hurricanes and tornadoes may also block interior access roads and fire breaks, pull down overhead power lines, or damage pavement and underground utilities.

Many individual homes and cabins, subdivisions, resorts, recreational areas, organizational camps, businesses, and industries are located within high wildfire hazard areas. Further, the increasing demand for outdoor recreation places more people in wildlands during holidays, weekends, and vacation periods. Unfortunately, wildland residents and visitors are rarely educated or prepared for wildfire events that can sweep through the brush and timber and destroy property within minutes.

Wildfires can result in severe economic losses as well. Businesses that depend on timber, such as paper mills and lumber companies, experience losses that are often passed along to consumers through higher prices, and sometimes jobs are lost. The high cost of responding to and recovering from wildfires can deplete state resources and increase insurance rates. The economic impact of wildfires can also be felt in the tourism industry if roads and tourist attractions are closed due to health and safety concerns.

State and local governments can impose fire safety regulations on home sites and developments to help curb wildfire. Land treatment measures such as fire access roads, water storage, helipads, safety zones, buffers, firebreaks, fuel breaks, and fuel management can be designed as part of an overall fire defense system to aid in fire control. Fuel management, prescribed burning, and cooperative land management planning can also be encouraged to reduce fire hazards.

Location and Spatial Extent

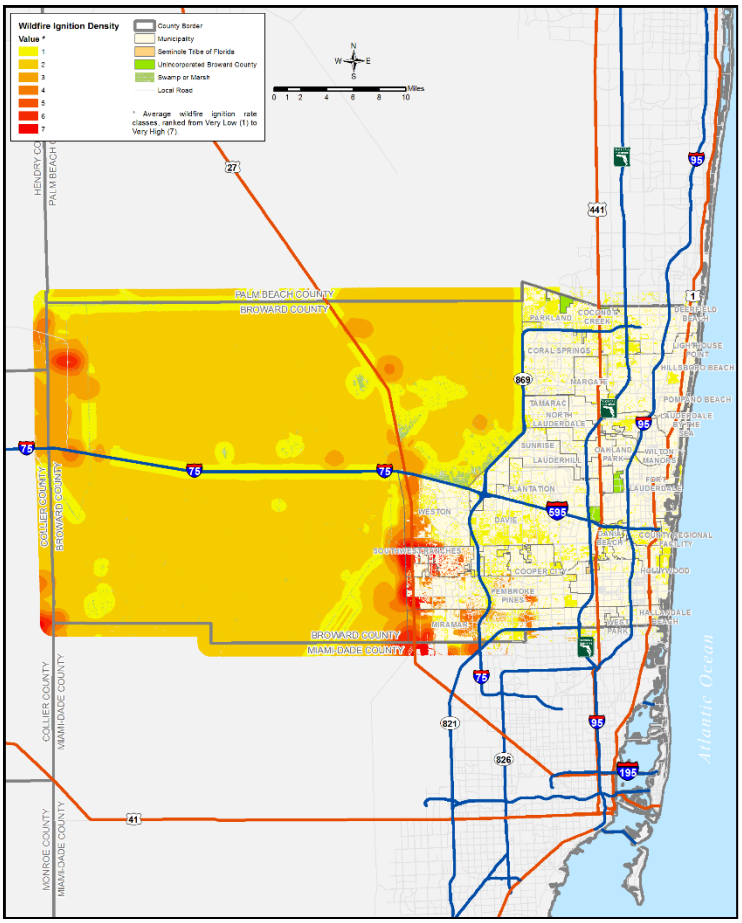
Wildfires remain a major hazard of concern throughout the State of Florida. According to the Florida Division of Forestry, nearly 5 million acres have been burned across the state by wildfire since 1981. This includes nearly 125,000 distinct fires, equating to an average wildfire size of 40 acres though many of the larger uncontrolled wildfires may burn hundreds of thousands of acres before being suppressed. The leading causes have been wildfires in Florida have been identified as lightning (particularly in the summer months), incendiary (arson), and debris burning.

Broward County is comprised of 1,197 square miles of land, of which 787 square miles lie within the Everglades Conservation Area. Despite the fact that the Everglades are typically thought as of being boggy or wet, a substantial part of the everglades is comprised of sawgrass and mellaluca trees that can rapidly burn. Most fires in the Everglades are started by lightning, a very frequent

phenomenon in the Everglades, due to large thunderstorms that form inland. Other fires are caused by improper burning at campfires, or arson.

The Florida Division of Forestry recently completed the development of the Florida Wildfire Risk Assessment System (FRAS). The primary purpose of FRAS is to provide an automated tool for Division staff, as well as other Florida fire specialists, to access and use a series of spatial map data that has been compiled and derived to support operational staff in the future assessment and management of wildland fire risk across the state. This data has been derived by a team of fire experts and reflects the latest and most accurate data describing the wildland fire risk situation based on burnable areas within Florida. **Figure 4.9** illustrates the default FRAS data for Broward County.

Figure 4.8: Wildfire Risk Areas in Broward County



Source: Southern Wildfire Risk Assessment August 2017

According to FRAS, the municipalities in western Broward County are at greatest risk to wildfire. They are Coral Springs, Miramar, Parkland, Pembroke Pines, Southwest Ranches, Sunrise, Tamarac, and Weston.

While most of the Broward County municipalities are not likely to be heavily impacted directly by wildfire, the secondary effects of smoke and ash pose significant threats to air quality throughout the area. Human respiratory health is a related concern with regard to wildfires occurring not only in the county, but also elsewhere in south Florida.

Historical Occurrences

According to the Florida Division of Forestry, there have been 21significant fires in Broward County since 1981 (burning 10,000 acres or more). These incidents are listed in **Table 4.37**.

Most of these large wildfire events occur in the undeveloped, western portions of Broward County, including the Everglades, and most have occurred during Broward County's dry season which extends from January through May. Common causes of wildfires within the county are drought, lightning, arson; carelessness by smokers; debris burning; equipment operation; and children playing with matches.

Table 4.37: Significant Broward County Wildfires Since 1981

Fire Name	Date Started	Acres Burned
Tower	01/29/1985	30,000
Brown's Farm	06/29/1988	10,000
Palmers	05/24/2988	23,040
Palmers 2	05/24/1988	23,040
Conservation	02/26/1989	17,000
Big Cypress	03/16/1989	52,000
Mud Fire	05/25/1989	96,000
L-68 Fire	07/31/1989	11,550
Basshole	05/03/1994	80,000
County Line	03/24/1996	15,000
Oh No Fire	02/22/1997	41,000
27 Fire	08/01/1998	10,700
Macs Fish Camp	05/18/1999	10,000
Deceiving	04/16/1999	173,000
No Roads	02/25/2001	10,500
Markham Park	06/17/2001	25,000
Four Mile	06/05/2001	14,700
Heat Fire	05/06/2006	13,700
4 Track	06/02/2006	49,500
Darkness	04/07/2007	12,200
Frances Taylor	04/16/2007	39,000

Source: Florida Division of Forestry, 2017

Residential development within the past 10 years has encroached on environmentally sensitive land, including the Everglades Conservation Area. The impact of wildfires in Broward County is seen by reduced air quality, closure of roads, in particular Interstate 75 (Alligator Alley) which is a main link with the west coast of Florida, and in some cases fires can be a threat to residential

and business structure. Wildfires also potentially impact the Miccosukee and Seminole tribal activities in the Everglades.

During May 2007, at least 233 fires burned roughly 100,000 acres in 52 of the 67 Florida Counties, mostly in the northern, central, and southwest. Although most of the acreage burnt by these fires occurred outside of Broward County, the county was blanketed with smoke. This resulted in the closure of major roads and forced many people indoors. On May 9th, the Air Quality Index reached an "unhealthy" range of 154, meaning that the air was unhealthy for sensitive people who have asthma and heart disease. No significant wildfires have occurred in Broward County since 2007.

Probability and Extent of Future Events

The probability of future large wildfire events in western portions of Broward County is considered "likely", particularly during drought cycles and abnormally dry conditions in the Everglades. Of more concern to Broward County emergency management officials are the smaller, more frequent brush fires that ignite in pockets of undeveloped natural areas during periods of dry conditions that are immediately adjacent to developed properties in the urban areas of the County. In the future Broward County is likely to be impacted by significant wildfires that could burn over 10,000 acres or more.

Future Risk Conditions Influencing Wildfire

As discussed earlier in the drought subsection, climate change will likely bring periods of extended drought and higher temperatures which would exacerbate the risk of wildfire in already vulnerable areas.

Vulnerability Assessment

According to the 2011 State of Florida Wildfire Hazard Mitigation Plan Annex, the Florida Fire Service (FFS) maintains a Fire Activity Report database that includes information on all wildfires that FFS responded to dating back to 1980. According to these records, there have been 141,230 fires that have burned over 5 million acres in the past 30 years in Florida. The 2009 parcel data remained the same for Broward County.

Table 4.38: Estimated Number of Structures at Risk from Wildfire

Structure Type	Number of At-Risk Structures
Single-Family Homes	30,840
Mobile Homes	3,980
Multi-Family Homes	21,105
Commercial	1,420
Agriculture	418
Gov./Institutional	372
Total	**58,135**

Human Caused Hazards

Human caused hazards can affect localized or regional areas are often unpredictable, can cause loss of life and property damage, and can significantly impact infrastructure in Broward County. This section includes human caused hazards that pose the greatest risk in Broward County. Human caused hazards are categorized as biological, societal, and technological. Hazards are listed alphabetically by category.

Biological Hazards

Pandemic/Infectious Disease

Background

Infectious diseases are a constant threat to humanity. Societal, environmental, and technological factors impact the occurrence and persistence of infectious diseases worldwide, as new diseases (e.g. SARS, West Nile Virus) continue to emerge each year and old diseases reappear or evolve into new drug-resistant strains (e.g. malaria, tuberculosis, bacterial pneumonias). Infectious diseases can be carried by infected people, animals and insects, and can also be contained within commercial shipments of contaminated food.

Three terms are commonly used to classify disease impacts: endemic, epidemic, and pandemic. An endemic is present at all times at a low frequency (e.g. chicken pox in the U.S.). An epidemic is a sudden severe outbreak of disease (e.g. the bubonic plague during Medieval times), and a pandemic is an epidemic that becomes very widespread and affects a whole region, a continent, or the world (e.g. the 1957 flu pandemic caused at least 70,000 deaths in the U.S. and 1-2 million deaths worldwide.). Fears of pandemic have risen in recent years as our globalized economy and growing population fosters large scale international travel and trade. Also, growing populations increases the vulnerability of all areas to disease as it can travel more quickly and creates difficulty in preventing the spread of infection.

Location and Spatial Extent

Disease impacts all areas of the world, and all areas are vulnerable. Third world countries have fewer resources to fight disease and may be more vulnerable than more industrialized nations. In the United States, the public health system works at the federal, state, and local levels to monitor diseases, plan and prepare for outbreaks, and prevent epidemics where possible. But, in the age of air travel and worldwide shipping, it is becoming increasingly difficult to contain localized outbreaks as infected or exposed people travel and work, sending the disease across the globe in a matter of hours. Therefore, in an increasing globalized world, public health threats that are not endemic to Florida can impact the region very quickly from halfway around the world.

For example – the largest, and first world-wide epidemic of Ebola Hemorrhagic Fever began in December 2013 in the West African Countries of Guinea, Nigeria, Liberia, Sierra Leone, and Mali, and lasted until June 2016. Many U.S.-based medical professionals and Non-Governmental Organizations (NGOs) joined an international relief effort for the populations of the affected regions. In some cases, these relief workers contracted the virus and were medically evacuated to specialized hospitals within the U.S., which resulted in at least one limited outbreak in Dallas, Texas. While there are no known cases of Ebola in Florida, a woman with ties to Central Florida

was diagnosed while treating Ebola patients in Liberia. The *Rafiki Foundation*, for whom she worked, is based in Eustis, Florida. She was medically evacuated to Atlanta, Georgia and later released. There has not been any other significant Ebola nexus to Florida; however, a subsequent Ebola outbreak has been reported in the Democratic Republic of the Congo in May 2017, which may see a response by Florida based relief workers.

Zika is an emerging public health hazard that has directly impacted southern Florida. The mosquito-borne illness is still not well understood by medical science, but affects fetal development causing severe birth defects. There have been 182 cases of Zika reported in Broward County from 2016 – 2017. As an emerging hazard, statistics were not tracked prior to 2015.

Historical Occurrences

The Florida Department of Health and the Broward County Health Department maintain disease surveillance for the County, reporting all known medical diagnoses of certain diseases. Since 2000, Broward County has reported over 31,000 cases of such diseases, as listed in **Table 4.39** below.

Table 4.39: Broward County Communicable Disease Cases, January 2000 – September 2017

Reportable Communicable Disease	Total Reported Cases	Percent of total county population impacted*
Amebiasis	3	0.0%
Animal Rabies	49	0.0%
Brucellosis	3	0.0%
Campylobacteriosis	1,134	0.06%
Ciguatera	28	0.0%
Creutzfeldt-Jakob Disease (CJD)	5	0.0%
Cryptosporidiosis	397	0.02%
Cyclosporiasis	62	0.0%
Dengue Fever	68	0.0%
Ebola	0	0.0%
E. Coli Shiga Toxin + (Not Serogrouped)	25	0.0%
E. Coli Shiga Toxin + (Serogroup Non-O157)	6	0.0%
E. Coli Shiga Toxin Producing	33	0.0%
Encephalitis, Other	4	0.0%
Enterohemorrhagic E. Coli (EHEC) O157:H7	38	0.0%
Giardiasis	1,062	0.06%
H. Influenzae Epiglottitis	1	0.0%
H. Influenzae Meningitis	2	0.0%
H. Influenzae Pneumonia	5	0.0%
H. Influenzae (Invasive Disease)	224	0.01%
H. Influenzae Septic Arthritis	1	0.0%
Hemolytic Uremic Syndrome	1	0.0%
Hepatitis A	611	0.03%
Hepatitis B (+Hbsag in pregnant women)	634	0.04%
Hepatitis B Perinatal	2	0.0%

Reportable Communicable Disease	Total Reported Cases	Percent of total county population impacted*
Hepatitis B, Acute	515	0.03%
Hepatitis B, Chronic	1,940	0.11%
Hepatitis C, Acute	18	0.0%
Hepatitis C, Chronic	14,928	0.85%
Hepatitis E	1	0.0%
Influenza A, Novel or Pandemic Strains	380	0.02%
Human Rabies	1	0.0%
Lead Poisoning	553	0.03%
Legionellosis	134	0.01%
Leprosy (Hansen's Disease)	10	0.0%
Listeriosis	54	0.0%
Lyme Disease	14	0.0%
Malaria	140	0.01%
Measles	1	0.0%
Melioidosis	1	0.0%
Meningitis, Group B Strep	15	0.0%
Meningitis, Listeria Monocytogenes	8	0.0%
Meningitis, Meningococcal	12	0.0%
Meningitis, Other	263	0.02%
Meningitis, Strep Pneumoniae	40	0.0%
Meningococcal Disease	53	0.0%
Meningococcemia, Disseminated	28	0.0%
Mercury Poisoning	35	0.0%
Mumps	8	0.0%
Neurotoxic Shellfish Poisoning	2	0.0%
Pertussis	55	0.0%
Psittacosis	1	0.0%
Rocky Mountain Spotted Fever	1	0.0%
Salmonellosis	3,978	0.23%
Shigellosis	1,697	0.1%
Strep Pneumoniae, Invasive Disease, Drug-R	827	0.05%
Strep Pneumoniae, Invasive Disease, Suscept	443	0.03%
Streptococcal Disease Invasive Group A	299	0.02%
Tetanus	3	0.0%
Toxoplasmosis	3	0.0%
Typhoid Fever	30	0.0%
Varicella	200	0.01%
Vibrio Alginolyticus	19	0.0%
Vibrio Cholerae Non-O1	7	0.0%
Vibrio Cholerae Type-O1	4	0.0%
Vibrio Fluvialis	3	0.0%
Vibrio Hollisae	1	0.0%
Vibrio Parahaemolyticus	8	0.0%
Vibrio Vulnificus	18	0.0%
Vibrio, Other	6	0.0%

Reportable Communicable Disease	Total Reported Cases	Percent of total county population impacted*
West Nile Virus, Neuroinvasive	6	0.0%
West Nile Virus, Non-Neuroinvasive	0	0.0%
Zika	182	0.01%
Total:	**31,162**	**1.78%**

Source: Data Source: Communicable Disease Frequency Report, Florida Department of Health
**Based on 2010 Census population*

Probability of Future Occurrences

Historical evidence shows that the population of Broward County is vulnerable to disease outbreak, and it is probable that epidemics of infectious disease will impact Broward County in the future warranting a probability level of "possible". State and local public health officials maintain surveillance in hopes of identifying disease prominence and containing potential threats before they become epidemics.

Vulnerability Assessment

Estimated potential losses are difficult to calculate because infectious disease causes little damage to the built environment and damages generally are experienced through public health response and medical costs as well as lost wages by patients. Therefore, it is assumed that all buildings and facilities are exposed to disease but would experience negligible damage in the occurrence of an outbreak, but the costs to the public health sector for responding to an outbreak as well as impact to humans may be great.

Hand washing is an effective means of preventing the spread of many diseases, including colds, influenza, norovirus, and shigellosis. Increasing participation in immunization programs will help decrease the vulnerability of some portions of the population to vaccine-preventable diseases. Additional prevention measures continue to be taken in Broward County to limit exposure to insect borne disease (Encephalitis, West Nile Virus, etc.), which primarily means limiting exposure to mosquitoes. Additional spraying of ponds, standing water, and neighborhoods is occurring throughout Broward County to limit mosquito reproduction.

Societal Hazards

Mass Migration

Background

Mass migration is defined as large numbers of foreign refugees illegally entering into the United States whether by air, land, or sea. The control of migration into the United States is entirely the responsibility of the United States Department of Homeland Security (DHS). As necessary, DHS will deploy resources and direct multi-agency operations to address a potential and full-scale mass migration event in coordination with state and local agencies. Refugees will be processed by the United States Immigration and Naturalization Service, and anyone who is denied entry but remains in the United States will be classified as an illegal alien. Persons entering the United States illegally, or entering through legal manner, such as under Visas etc., but overstay the expiration of the Visa are also considered illegal aliens.

A large uncontrolled influx of immigrants has the potential of significantly disrupting the social and economic stability of local communities by overwhelming the delivery of essential services such

as medical response and public safety. While the federal government has the primary responsibility for assuming control of mass migration emergencies, Broward County may have to provide basic care including: shelter, food, water, medical, and other social services.

Mass migration events can have widespread and lasting social and economic impacts, including:

- Adverse impacts on the capacity of public schools, public hospitals, and other public facilities to serve the resident population.
- Negative impacts on the wages and working conditions for the resident population
- Medical costs for illegal immigrants unduly burden hospitals by having to deal with the costs of unpaid medical bills.
- Increased numbers of children without health insurance.
- Contagious diseases that are generally considered to have been controlled in the United States are readily evident along the border and entry points for migration.

Another concern with mass migration events is that many countries today are not willing to take back deported citizens that have tried unsuccessfully to relocate to the United States.

Location and Spatial Extent

Generally it is assumed that all of Broward County is uniformly exposed to mass migration, and that the spatial extent of impact is large. The areas with the highest vulnerability to immediate and direct mass migration impacts are the coastal municipalities; as such an event would likely be executed by sea.

Historical Occurrences

South Florida does have some history with mass migrations from the Caribbean basin, particularly Cuba and Haiti.

April 15 – October 31 1980 (Mariel boatlift)

The Mariel boatlift was a mass movement of Cubans who departed from Cuba's Mariel Harbor for South Florida between April 15 and October 31, 1980. The boatlift was precipitated by a sharp downturn in the Cuban economy, leading to simmering internal tensions on the island and a bid by up to 10,000 Cubans to gain asylum in the Peruvian embassy. The Cuban government subsequently announced that anyone who wanted to leave could do so, and an impromptu exodus organized by Cuban-Americans with the agreement of Cuban President Fidel Castro was underway. Soon after it was discovered that a number of the exiles had been released from Cuban jails and mental health facilities, and the exodus was ended by mutual agreement between the two governments in October 1980. By that time up to 125,000 Cubans had made the journey to Florida in an estimated 1,700 boats that overwhelmed the U.S. Coast Guard. Upon arrival, many Cubans were placed in refugee camps, while others were held in federal prisons to undergo deportation hearings.

August – September 1994 (Cuban Raft Crisis)

On August 13, 1994 President Fidel Castro, in view of the increase in illegal Cuban sea exits announced in a speech that from then on he would retire the Cuban Frontier Guard from the Cuban coasts and would allow anyone who wanted to leave the country to do so. He thereby provoked the biggest raft crisis in the history of the continent, as tens of thousands of Cubans headed by sea toward South Florida. When Florida's Governor announced that the state could not cope with the surge of arriving Cuban immigrants, President Clinton declared an immigration

emergency and ordered the interception of Cuban refugees and their transfer to "safe havens" such as the U.S. Naval Base at Guantánamo Bay, Cuba. During this period a total of more than 32,000 Cuban citizens were intercepted on the high seas and transferred to Guantánamo.

Probability of Future Occurrences

As political unrest in South America and the Caribbean continues, there will always be people wanting to immigrate to South Florida where there is an existing extensive network of people from these countries in place. However, as the Department of Homeland Security (DHS) continues to increase border patrols and tightens the security requirements for inbound vessels, the likelihood of a mass migration seems less likely. The probability of future mass migration events in Broward County is considered "possible".

Vulnerability Assessment

South Florida is susceptible to mass migration events due to natural catastrophes and political unrest in foreign countries, particularly Haiti and Cuba. Mass migration events involving tens of thousands of immigrants have occurred several times within the last several decades. However, due to more stringent border patrol by DHS the vulnerability of Broward County to such events is limited to moderate.

Terrorism

Background

Information in this subsection borrows heavily from the FEMA, State, and Local Mitigation Planning How-to Guide: *Integrating Manmade Hazards into Mitigation Planning* (FEMA Publication 386-7). For the sake of brevity and consistency with other subsections of this risk assessment, each individual element of terrorism is introduced in relatively abbreviated format.

International and domestic terrorism remains a significant hazard of concern for most communities across the United States, and is even more so following the attacks of September 11, 2001 in the City of New York and Washington, DC. According to the U.S. Department of Justice, Federal Bureau of Investigation (FBI), "Terrorism is the unlawful use of force or violence, or threatened use of force or violence, against persons and places for the purpose of intimidation and/or coercing a government, its citizens, or any segment thereof for political or social goals." The FBI further characterizes terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization; however, the origin of the terrorist or person causing the hazard is far less relevant to mitigation planning than the hazard itself and its consequences.

Terrorism can include computer-based (cyber) attacks and the use of weapons of mass destruction (WMD) to include chemical, biological, radiological, nuclear, or explosive (CBRNE) agents. However, within these general categories, there are many variations. Particularly in the area of biological and chemical weapons, there are a wide variety of agents and ways for them to be disseminated.

The following types of terrorist attacks have been identified by FEMA as part of their guidance on integrating manmade hazards into mitigation planning:

Armed Attack
This element of terrorism refers primarily to tactical assault or sniping from a remote location.

Arson/Incendiary Attack
Arson/incendiary attack refers to the initiation of fire or explosion on or near a target either by direct contact or remotely via projectile.

Agriterrorism
Agriterrorism is the direct, typically covert contamination of food supplies or the introduction of pests and/or disease agents to crops and livestock.

Biological Agent
Liquid or solid contaminants can be dispersed using sprayers/aerosol generators or by point or line sources such as munitions, covert deposits, and moving sprayers.

Chemical Agent
Liquid/aerosol contaminants can be dispersed using sprayers or other aerosol generators; liquids vaporizing from puddles or containers; or munitions.

Conventional Bomb/Improvised Explosive Device
This refers to the intentional detonation of an explosive device on or near a target with the mode of delivery being via person, vehicle or projectile.

Cyber-terrorism
Cyber-terrorism refers to electronic attack using one computer system against another. Cyberthreat vectors inclusive of hacking for political, ideological and reputational status purposes, and for profit are constantly targeting private and governmental entities. The 2017 ELMS update has classified cyberthreats as an area for additional analysis and Broward County seeks to collaborate with public and private partners such as Florida's Agency for State Technology (AST), the Florida Department of Law Enforcement (FDLE), the Multi-State Information Sharing & Analysis Center (MS-ISAC), and the Southeast Florida Fusion Center for ongoing strategic planning and training initiatives of cybersecurity policy and IT systems protection.

Identified Cyberthreats Include:

Malware: Short for Malicious software, is an umbrella term used to refer to a variety of forms of hostile or intrusive software, including computer viruses, worms, trojan horses, ransomware, spyware, adware, scareware, and other malicious programs. It can take the form of executable code, scripts, active content, and other software. Malware is defined by its malicious intent, acting against the requirements of the computer user - and so does not include software that causes unintentional harm due to some deficiency. The majority of malware is propagated through user-initiated actions such as clicking on a malicious link in a spam e-mail or visiting a malicious or compromised website. In other instances, malware is disseminated through malvertising and drive-by downloads, which do not require user engagement for the infection to be successful.

Ransomware: Ransomware is a type of malware that encrypts files on the infected system/network (crypto ransomware), although a few variants are known to erase files or block access to the system using other methods (locker ransomware). Once access to the system is blocked, the ransomware demands a ransom in order to unlock the files, frequently $200 - $3,000 in bitcoins, though other currencies and gift cards are occasionally reported. Ransomware variants almost always opportunistically target victims, infecting an array of devices from computers to smartphones.

Phishing / Spear Phishing: Phishing is the attempt to obtain sensitive information such as usernames, passwords, and credit card details (and, indirectly, money), often for malicious reasons, by disguising as a trustworthy entity in an electronic communication. Phishing is typically carried out by email spoofing or instant messaging, and it often directs users to enter personal information at a fake website, the look and feel of which are almost identical to the legitimate one. Communications purporting to be from social web sites, auction sites, banks, online payment processors or IT administrators are often used to lure victims. Phishing emails may contain links to websites that are infected with malware. Spear Phishing involves social engineering that targets a preidentified victim with details pertaining to the individual.

Denial-of-Service / Distributed Denial-of-Service: Is a cyber-attack where the perpetrator seeks to make a machine or network resource unavailable to its intended users by temporarily or indefinitely disrupting services of a host connected to the Internet. Denial of service is typically accomplished by flooding the targeted machine or resource with superfluous requests in an attempt to overload systems and prevent some or all legitimate requests from being fulfilled. In a distributed denial-of-service attack (DDoS attack), the incoming traffic flooding the victim originates from many different sources. This effectively makes it impossible to stop the attack simply by blocking a single source.

SQL Injection: Is a code injection technique, used to hack data-driven applications, in which nefarious SQL statements are inserted into an entry field for execution (e.g. to dump the database contents to the attacker). SQL injection must exploit a security vulnerability in an application's software. SQL injection is mostly known as an attack vector for websites but can be used to attack any type of SQL database. SQL injection attacks also allows attackers to spoof identity, tamper with existing data, cause repudiation issues such as voiding transactions or changing balances, allow the complete disclosure of all data on the system, destroy the data or make it otherwise unavailable, and become administrators of the database server.

Intentional Hazardous Material Release
Solid, liquid, and/or gaseous contaminants may be intentionally released from either fixed or mobile containers.

Nuclear Bomb
A nuclear device may be detonated underground, at the surface, in the air or at high altitude.

Radiological Agent
Radioactive contaminants can be dispersed using sprayers/aerosol generators, or by point or line sources such as munitions, covert deposits, and moving sprayers.

Location and Spatial Extent
The location of terrorist attacks is unpredictable, though certain critical facilities and venues for large public gatherings are usually considered to have more inherent vulnerability. With miles of strip malls, about 7.5 million tourists visiting every year and a growing degree of diversity, many say Broward County, and all of South Florida, is an ideal place to keep a low profile. Some observers say the county's growth and diversity have added a layer of anonymity for potential wrongdoers. Others point to the proximity of Port Everglades in Fort Lauderdale and the Port of Miami, 2 of the state's busiest ports, and the region's airports and flight schools.

Broward County, like most major metropolitan communities, has the potential to be a target of the terrorist. The county has a number of sites that would be attractive to a terrorist based on location, potential for publicity, and other targeting factors too numerous to mention here. The world is shrinking and geographical boundaries and proximity are no longer major factors. Terrorism and drug-related crime have been linked in the past and the area has the potential to be a spawning ground for these illegal and criminal activities, factors that increase risk. Broward County has a population that is ethnically, racially, and economically diverse. While these factors, in and of themselves are of no immediate concern, they can provide individuals and groups commonly associated with terrorism, some degree of freedom to stage and conduct activities. Terrorists have and will take advantage of these conditions to blend in when conducting their illegal activities.

In the hours and days immediately following the terrorist events of September 11, 2001, attention was focused on South Florida, in particular, Broward County, where it was suspected at least one of the suicide hijackers, Mohammed Atta, had made his residence in the months prior to that fateful day. Subsequent investigations revealed that at least 7 of the 19 men who crashed hijacked planes on September 11 had spent time in the county.

The location and extent of the various types of terrorist attacks is briefly and generally described below in terms of their effect on the physical environment.

Armed Attack
This will vary based upon the perpetrators' intent and capabilities.

Arson/Incendiary Attack
The extent of damage is determined by the type and quantity of the device or accelerant used and the materials present at or near the target. Cascading consequences may also occur, such as incremental structural failure, etc.

Agriterrorism
Generally there are no direct effects on the built environment. Food contamination may be limited to discrete distribution sites. Pests and diseases may be spread widely.

Biological Agent
Depending on the agent used and the effectiveness with which it is deployed, contamination can be spread via wind and water. In the case of infection, infection can be spread via both human and animal vectors.

Chemical Agent
Chemicals may be corrosive or otherwise damaging over time if not remediated. Contamination can be carried outside of the initial target area by persons, vehicles, water, and wind.

Conventional Bomb/Improvised Explosive Device
The extent of damage is determined by the type and quantity of explosive. Effects are generally static with other cascading consequences, such as incremental structural failure, etc.

Cyber-terrorism
Generally there are no direct effects on the built environment; however, concern is increasing for the potential of networked infrastructure control system failures that may have a direct nexus to

environmental impacts (i.e. lift Stations, storm water pumps, generators, electrical grid, nuclear facilities)

Intentional Hazardous Material Release
Chemicals may be corrosive or otherwise damaging over time. Explosion and/or fire may be subsequent. Contamination can be carried outside of the initial target area by persons, vehicles, water, and wind.

Nuclear Bomb
Initial light, heat, and blast effects of a subsurface, ground or air burst are static and are determined by the device's characteristics and employment. Fallout or radioactive contaminants may be dynamic, depending upon meteorological conditions.

Radiological Agent
Initial effects will be localized to the site of attack. Depending on meteorological conditions, subsequent behavior of radioactive contaminants may be dynamic.

Historical Occurrences

To date, there have been no acts of terrorism in Broward County. However, Broward County did experience effects from a 2001 Anthrax incident in Palm Beach County. A 300% increase in hazardous materials calls severely strained county resources.

Probability of Future Events

The probability of a future terrorist attack is "possible" due to the number of potential targets and the current law enforcement efforts underway. The probability of future terrorist attacks is partially monitored by the Department of Homeland Security through the Homeland Security Advisory System. For more information on this system, visit http://www.whitehouse.gov/homeland/.

Vulnerability Assessment

The U.S. Department of Justice and the Federal Bureau of Investigation have identified Broward County as a highly volatile area for terrorism activity. There are areas in Broward that are more likely to be targets for terrorism such as critical facilities, communication systems, water and utilities, monuments, and areas where large groups congregate (e.g., stadiums, conventions, worship areas).

Technological Hazards

Hazardous Material Incident

Background

Hazardous material (HAZMAT) incidents can apply to fixed facilities as well as mobile, transportation-related accidents in the air, by rail, on the Nation's highways, and on the water. Approximately 6,774 HAZMAT events occur each year, 5,517 of which are highway incidents, 991 are railroad incidents, and 266 are due to other causes (FEMA, 1997). In essence, HAZMAT incidents consist of solid, liquid, and/or gaseous contaminants that are released from fixed or mobile containers, whether by accident or by design as with an intentional terrorist attack. A HAZMAT incident can last hours to days, while some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and contaminants can be extended beyond the initial area by persons, vehicles, water, wind, and possibly wildlife as well.

Hazardous material incidents can include the spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment of a hazardous material, but exclude: (1) any release which results in exposure to poisons solely within the workplace with respect to claims which such persons may assert against the employer of such persons; (2) emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel, or pipeline pumping station engine; (3) release of source, byproduct, or special nuclear material from a nuclear incident; and (4) the normal application of fertilizer.

Location and Spatial Extent

A hazardous material incident can occur in a variety of locations and spatial extents. Some incidents (such as a fuel spill) can occur in a small location and impact a small spatial extent. Others, such as the release of toxic chemicals may occur from a small location or source but can spread over large areas.

The Emergency Planning & Community Right-to-Know Act of 1986 (EPCRA) requires facilities storing hazardous materials to report those substances annually to the State Emergency Response Commission (SERC), the Local Emergency Planning Committee (LEPC), and local fire departments. There are hundreds of such facilities located throughout Broward County, though many do not store substances or quantities of such that are considered extremely hazardous. Of greater concern to the emergency management community are those facilities that use or produce toxic chemicals above specific thresholds that pose major threats to human life and safety. These include Toxics Release Inventory (TRI) facilities as discussed further under *Vulnerability Assessment*. In Broward County there are a total of 35 TRI facilities, most of which are shown on **Map 4.18**.

Broward County is not only vulnerable to hazardous materials at fixed hazardous material sites but also along key transportation corridors such as Interstate 95, the Florida Turnpike, and the 2 major rail lines that transverse the County. According to the CSX Transportation's report, *Hazardous Materials Density Study for Broward County*, 2006, the top most transported products via rail system are Sodium Hydroxide Solution, Chorine, Liquefied Petroleum Gases, and Petroleum Distillates. There are also 3 underground petroleum pipelines that service Miami International, Homestead, and Ft. Lauderdale International Airports.

One of the most vulnerable locations for hazardous materials incidents is Port Everglades. The port is the largest import, storage, and distribution center for petroleum in the state, and second largest in the U.S. Port Everglades had an annual operating revenue of more than $162.6 million in Fiscal Year 2016.

According to the Port Everglades Commerce Report, 2016 is the third consecutive year, Port Everglades saw a rise in petroleum volumes coming into the Port via ship, truck and rail. Total petroleum volumes increased by 4 percent from more than 116,856,258 barrels in FY2015 to 121,068,561 barrels in FY2016. The continued upswing is attributed to lower consumer prices and a higher demand for jet fuel during FY2016. As with the prior fiscal year, jet fuel, diesel fuel and gasoline had the most significant increases. Revenue from petroleum products accounts for 21.4 percent of the Port's total revenue, and increased 12 percent from $32,749,162 in FY2015

to $34,868,376 in FY2016. Some 18 counties in Florida are directly reliant on this source of petroleum.

Map 4.17: Toxics Release Inventory (TRI) Sites

Source: US Environmental Protection Agency 2015 TRI Basic Data Files

Historical Occurrences

Broward County averages about 1 reported hazardous material incident every 3 weeks. These incidents may be a tanker rollover or other accidental releases of substances during transport.

It was reported that in a 20-year period approximately 1,171 hazardous materials releases were reported to the Florida State Warning Point which resulted in 150 injuries, 12 deaths, and 21,300 evacuees. Most of the deaths were attributed to traffic accidents, and were not directly caused by hazardous materials release. Slightly more than 70% of the hazardous material releases involved petroleum. The most frequently released non-petroleum based chemicals were ammonia and chlorine. The incident type breakdown was approximately 44% fixed, 48%, mobile, 5% other, and 2% unknown. According to the National Response Center, the number of hazardous material releases during this time period was actually 2,442. The discrepancy could be due to the fact that many of the reports are not being sent through the State Warning Point if it is Port Everglades related.

Probability of Future Events

Due to the continuous presence of hazardous materials being transported or stored in and around Broward County, hazardous materials incidents of varying magnitudes are considered “highly likely” future events.

Vulnerability Analysis

The Toxics Release Inventory (TRI) is a publicly available database from the U.S. Environmental Protection Agency (EPA) that contains information on toxic chemical releases and other waste management activities reported annually by certain covered industry groups as well as federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and expanded by the Pollution Prevention Act of 1990. Each year, facilities that meet certain activity thresholds must report their releases and other waste management activities for listed toxic chemicals to EPA and to their state or tribal entity. A facility must report if it meets the following three criteria:

- The facility falls within one of the following industrial categories: manufacturing; metal mining; coal mining; electric generating facilities that combust coal and/or oil; chemical wholesale distributors; petroleum terminals and bulk storage facilities; RCRA Subtitle C treatment, storage, and disposal (TSD) facilities; and solvent recovery services
- Has 10 or more full-time employee equivalents
- Manufactures or processes more than 25,000 pounds or otherwise uses more than 10,000 pounds of any listed chemical during the calendar year. Persistent, bioaccumulative and toxic (PBT) chemicals are subject to different thresholds of 10 pounds, 100 pounds, or 0.1 grams depending on the chemical

For fixed site analysis, only toxic sites that have georeferenced data available were analyzed and the circle buffers are drawn around each hazardous material site. 2 sizes of buffers, 500 and 2,500 meters are assumed in respect to the different levels of effect-- immediate (primary) and secondary. For mobile analysis, the major roads (Interstate highway, US highway, State highway) and railroads are chosen to be the routes where hazardous material is allowed. The buffer along the roads is drawn with the same size as fixed site analysis. Census block data was used to estimate exposure.

Table 4.40 shows estimated toxic release exposure of people and buildings by jurisdiction for fixed sites using census block data, while **Table 4.41** shows the result for mobile site toxic release. Primary and secondary impact sites were selected based on guidance from FEMA Publication #426 (*Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings*) and professional engineering judgment. Because many sites containing hazardous materials are located in densely populated areas, there are population and structures that could be susceptible to a release from more than 1 site. In some jurisdictions, the number of people and property has been counted more than once to account for their susceptibility to multiple potential toxic releases. Therefore, the number of people and structures that could potentially be impacted may appear to exceed the total number or value of structural units and total population by jurisdiction.

Table 4.40: Estimated Exposure of People and Buildings by Jurisdiction (Fixed Site Toxic Release)

Jurisdiction	Immediate (Primary) Impact			Secondary Impact		
	Number People at Risk	Number of Buildings at Risk	Value of Buildings at Risk	Number People at Risk	Number of Buildings at Risk	Value of Buildings at Risk
Coconut Creek	0	0	$0	15,287	3,952	$1,093,314,447
Cooper City	0	0	$0	0	0	$0
Coral Springs	4,222	1,018	$301,346,504	35,606	11,649	$2,742,053,616
Dania Beach	1,113	668	$204,351,779	21,178	9,393	$2,134,792,947
Davie	0	0	$0	4,573	2,440	$701,481,325
Deerfield Beach	9,353	1,961	$1,120,009,400	51,911	15,824	$4,448,959,176
Fort Lauderdale	11,212	4,759	$2,652,504,621	123,450	45,566	$18,762,613,213
Hallandale Beach	0	0	$0	0	0	$0
Hillsboro Beach	0	0	$0	0	0	$0
Hollywood	4,615	2,177	$542,352,933	72,447	27,436	$6,384,248,787
Lauderdale-By-The-Sea	0	0	$0	0	0	$0
Lauderdale Lakes	154	63	$23,765,544	3,945	1,311	$213,447,602
Lauderhill	0	0	$0	382	214	$19,833,531
Lazy Lake	0	0	$0	75	31	$2,867,225
Lighthouse Point	0	0	$0	2,212	821	$270,046,908
Margate	0	0	$0	56	20	$2,695,446
Miramar	2,455	826	$450,554,441	38,698	13,289	$3,924,123,469
North Lauderdale	99	54	$23,126,107	511	176	$49,384,601
Oakland Park	3,719	1,252	$283,831,547	37,782	13,164	$2,474,434,020
Parkland	0	0	$0	422	332	$174,843,394
Pembroke Park	0	0	$0	318	140	$31,266,729
Pembroke Pines	1,797	670	$127,936,540	16,978	4,931	$1,231,619,120
Plantation	0	0	$0	247	110	$29,185,980
Pompano Beach	5,075	1,450	$1,371,996,575	52,807	13,734	$5,819,120,030
Sea Ranch Lakes	0	0	$0	0	0	$0
Southwest Ranches	0	0	$0	0	0	$0
Sunrise	0	0	$0	0	0	$0
Tamarac	710	290	$121,555,644	2,102	731	$307,341,280
Broward Municipal Services Districts	807	330	$43,529,894	10,052	3,789	$296,934,041
West Park	0	0	$0	1,316	643	$82,046,605
Weston	0	0	$0	0	0	$398,199
Wilton Manors	0	0	$0	10,437	3,832	$890,702,030
TOTAL	**45,330**	**15,520**	**$7,266,861,530**	**502,790**	**173,527**	**$52,087,753,720**

Source: Broward County Property Appraiser and Hazus-MH MR3

Table 4.41: Estimated Exposure of People and Buildings by Jurisdiction (Mobile Site Toxic Release)

County	Immediate (Primary) Impact			Secondary Impact		
	Number People at Risk	Number of Buildings at Risk	Value of Buildings at Risk	Number People at Risk	Number of Buildings at Risk	Value of Buildings at Risk
Coconut Creek	33,417	10,859	$2,681,134,650	45,753	11,701	$3,061,603,270
Cooper City	11,944	4,759	$827,267,090	30,324	11,860	$1,943,657,150
Coral Springs	53,193	18,016	$4,829,695,700	118,703	31,655	$8,134,798,700
Dania Beach	21,041	9,157	$2,146,967,360	22,493	7,704	$1,878,435,580
Davie	43,128	17,434	$4,911,733,240	72,125	25,955	$6,711,031,880
Deerfield Beach	65,918	21,755	$5,746,695,970	71,708	18,500	$5,161,599,440
Fort Lauderdale	145,839	52,081	$24,307,175,720	174,407	46,963	$22,130,694,710
Hallandale Beach	27,471	6,629	$3,809,116,360	32,437	5,574	$3,836,691,130
Hillsboro Beach	1,947	337	$874,503,810	1,947	283	$810,574,300
Hollywood	106,966	38,547	$9,785,340,920	137,407	39,957	$10,029,588,340
Lauderdale-By-The-Sea	6,427	2,192	$2,102,941,510	6,427	1,575	$1,739,928,950
Lauderdale Lakes	22,813	3,868	$1,158,439,200	27,809	4,232	$1,152,461,750
Lauderhill	49,604	10,116	$2,197,719,300	66,051	11,554	$2,492,601,430
Lazy Lake	102	47	$4,145,050	118	38	$4,107,550
Lighthouse Point	9,733	4,647	$1,362,148,460	11,028	4,489	$1,261,700,120
Margate	22,943	7,520	$1,277,732,100	50,439	13,866	$2,296,212,030
Miramar	47,227	17,475	$5,235,872,030	76,220	26,478	$7,475,638,380
North Lauderdale	8,644	2,797	$403,375,520	36,656	9,432	$1,260,435,790
Oakland Park	34,108	12,609	$2,494,719,440	42,547	11,631	$2,473,754,560
Parkland	6,961	3,167	$1,695,072,100	13,254	5,261	$2,682,321,260
Pembroke Park	2,055	566	$118,884,600	6,527	2,906	$404,154,300
Pembroke Pines	80,205	27,794	$7,451,109,490	130,899	40,848	$10,247,846,250
Plantation	43,468	15,451	$4,271,908,620	83,575	26,821	$6,803,128,100
Pompano Beach	86,547	26,114	$9,808,804,590	96,834	22,747	$8,981,181,420
Sea Ranch Lakes	805	360	$142,788,670	805	258	$110,763,020
Southwest Ranches	934	325	$747,880,580	1,266	358	$890,133,450
Sunrise	25,072	7,805	$1,899,288,370	86,466	22,356	$5,308,400,300
Tamarac	25,873	8,432	$1,981,329,900	52,060	15,087	$3,283,696,510
Broward Municipal Services Districts	35,913	14,135	$759,483,820	57,590	20,754	$1,106,396,610
West Park	11,074	3,992	$351,459,380	14,328	4,196	$331,537,990
Weston	15,794	6,191	$3,059,188,670	39,508	14,589	$6,490,572,820
Wilton Manors	11,370	4,410	$1,017,041,510	12,617	3,475	$941,493,080
TOTAL	**1,058,644**	**359,603**	**$109,460,963,730**	**1,620,434**	**463,119**	**$131,437,140,170**

Source: Broward County Property Appraiser and Hazus-MH MR3

Conclusions on Hazard Risk

The findings presented in this section were developed using best available data, and the methods applied have resulted in an *approximation* of hazard risk. These approximations should be used to understand relative hazard risk and the potential losses that may be incurred. However, uncertainties are inherent in risk assessment methodology, arising in part from incomplete scientific knowledge concerning specific hazards and their effects on the built environment and also from assumptions or generalities that are necessary in order to provide a comprehensive analysis and overview of hazard risk for large planning areas.

The hazard identification and risk assessment completed for Broward County is principally a qualitative assessment as recommended by FEMA in its "How-to" guidance document entitled *Understanding Your Risks: Identifying Hazards and Estimating Losses* (FEMA Publication 386-2). It relies heavily on historical and anecdotal data, stakeholder input, and professional and experienced judgment regarding expected hazard impacts. It also carefully considers the findings in other relevant plans, studies, and technical reports.

However, when possible, conclusions on hazard risk for Broward County are also driven by quantitative loss estimation using best available data and technology, including the use of Hazus-MH and the statistical risk assessment methodology (further described in the "risk assessment methods" section of this chapter). These quantitative risk assessment approaches are useful for estimating the potential future impact of hazard occurrences in Broward County and each of its municipalities. The results of the quantitative assessment are made even more meaningful when combined with other qualitative information made available through the qualitative assessment, as has been done throughout this chapter and in Chapter 5.

In order to draw some meaningful planning conclusions on hazard risk for Broward County, the results of the combined risk assessment process were used to generate hazard profiles according to a "Priority Risk Index" (PRI). The purpose of the PRI, described further below, is to categorize and prioritize all potential hazards for Broward County as high, moderate, or low risk.

Priority Risk Index

The prioritization and categorization of identified hazards for Broward County is based principally on the Priority Risk Index (PRI), a tool used to measure the degree of risk for identified hazards in a particular planning area. The PRI is used to assist the Broward County Mitigation Task Force in gaining consensus on the determination of those hazards that pose the most significant threat to Broward County based on a variety of factors. The PRI is by no means scientific, but is rather meant to be utilized as an objective planning tool for classifying and prioritizing hazard risks in Broward County based on standardized criteria. Combined with the inventory of local assets and critical facilities, the hazard profiles generated through the use of the PRI allows for the prioritization of those high hazard risks for mitigation planning purposes, and more specifically, the identification of hazard mitigation opportunities for the Broward County Mitigation Task Force to consider as part of its proposed mitigation strategy.

The application of the PRI results in numerical values that allow identified hazards to be ranked against one another (the higher the PRI value, the greater the hazard risk). PRI values are obtained by assigning varying degrees of risk to 5 categories for each hazard (probability, impact, spatial extent, warning time, and duration). Each degree of risk has been assigned a value (1 to 4) and an agreed upon weighting factor, as summarized in **Table 4.42**. To calculate the PRI value

for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all 5 categories equals the final PRI value, as demonstrated in the example equation below:

PRI VALUE = [(PROBABILITY x .30) + (IMPACT x .30) + (SPATIAL EXTENT x .20) + (WARNING TIME x .10) + (DURATION x .10)]

Table 4.42: PRI Category

	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	30%
	Possible	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 100% annual probability	3	
	Highly Likely	100% annual probability	4	
Impact	Minor	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of critical facilities.	1	30%
	Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one day.	2	
	Critical	Multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than 1 week.	3	
	Catastrophic	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
Spatial Extent	Negligible	Less than 1% of area affected	1	20%
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	More than 24 hours	Self explanatory	1	10%
	12 to 24 hours	Self explanatory	2	
	6 to 12 hours	Self explanatory	3	
	Less than 6 hours	Self explanatory	4	
Duration	Less than 6 hours	Self explanatory	1	10%
	Less than 24 hours	Self explanatory	2	
	Less than 1 week	Self explanatory	3	
	More than 1 week	Self explanatory	4	

According to the weighting scheme applied for Broward County, the highest possible PRI value is 4.0. Prior to being finalized, PRI values for each identified hazard were reviewed and accepted by the Broward County LMS Working Group.

PRI Results

Table 4.43 summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Broward County Mitigation

Task Force. The results were then used in calculating PRI values and making final determinations for the risk assessment.

Table 4.43: Hazards

	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	*PRI Score*
Atmospheric Hazards						
Extreme Heat	Likely	Minor	Small	More than 24 hours	Less than 1week	**2.0**
Severe Storm	Highly Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.9**
Tornado	Highly Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.7**
Tropical Cyclone	Likely	Catastrophic	Large	More than 24 hours	Less than 1 week	**3.3**
Hydrologic Hazards						
Coastal Erosion	Likely	Minor	Small	More than 24 hours	More than 1 week	**2.1**
Drought	Possible	Minor	Large	More than 24 hours	More than 1 week	**2.2**
Flood	Highly Likely	Critical	Moderate	More than 24 hours	Less than 1 week	**3.1**
Sea Level Rise/Climate Change	Likely	Critical	Large	More than 24 hours	More than 1 week	**3.1**
Other Natural Hazards						
Wildfire	Likely	Limited	Moderate	6 to 12 hours	Less than 1 week	**2.7**
Biological Hazards						
Pandemic/Infectious Disease	Possible	Critical	Moderate	More than 24 hours	More than 1 week	**2.6**
Societal Hazards						
Mass Migration	Possible	Minor	Small	More than 24 hours	More than 1 week	**1.8**
Terrorism	Possible	Critical	Small	Less than 6 hours	Less than 24 hours	**2.5**
Technological Hazards						
Hazardous Material Incident	Highly Likely	Limited	Small	Less than 6 hours	Less than 24 hours	**2.8**

Final Determinations

The conclusions drawn from the risk assessment process for Broward County, including the PRI results and input from the Broward County LMS, resulted in the classification of risk for each identified hazard according to three categories: *High Risk*, *Moderate Risk, and Low Risk* (**Table 4.44**). It should be noted that although some hazards are classified as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and will continue to be reevaluated during future plan updates. This table was reviewed during the 2017 ELMS revision and the results were confirmed.

Table 4.44: Conclusions on Hazard Risk for Broward County

HIGH RISK	Tropical Cyclone Flood Severe Storm Tornado	Hazardous Material Incident Sea Level Rise / Climate Change
MODERATE RISK	Wildfire Pandemic/Infectious Disease Terrorism	Drought Coastal Erosion
LOW RISK	Extreme Heat Mass Migration	

*

Chapter 5 – Economic Vulnerability

Background

Understanding an area's economic exposure to natural hazards is an advanced risk and vulnerability analysis that probes deeper into the County's key economic assets and how a disaster event may alter the County's pre-disaster economic condition, for better or worse. The sophisticated analysis in this Chapter, which goes beyond both the LMS and FEMA DMA 2000 planning requirements, demonstrates a commitment from the County to identify the key economic drivers in the county and working in a collaborative fashion to determine how to better protect them. This in turn will help protect the smaller support businesses that service them and residents employed by both types of businesses. The methodology used in this chapter to measure economic vulnerability is a combination of using established FEMA tools like Hazards US (Hazus) GIS-based loss projection software to project potential losses, other publicly available non-computer based analytical methodologies including the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center's Risk and Vulnerability Assessment Tool, as well as County-driven innovations and modifications to these methodologies.

One purpose of this chapter is to better understand the economic implications of effects from hazards of most significant concerns to Broward County which can provide the necessary background information to help the County, its municipalities and its constituent private sector chart a course for a more orderly recovery. This type of information also sets the stage for identifying opportunities to drive down risk to minimize damages, shorten business interruption, and retain businesses in the aftermath of a disaster event. These combined efforts would have the positive effect of keeping more of the County residents continuously employed resulting in a healthy flow of healthy tax revenues. Maintaining sufficient tax revenue is needed to maintain the County and municipal services necessary for basic functionality and a high quality of life.

In the past, where vulnerable areas across the nation have suffered major damage from a disaster, many businesses closed leaving reduced overall tax revenues which led to an inability or dependency on the federal government to provide basic services like trash collection. In addition, these damaged areas created the perception, accurately or inaccurately, that they were not open for business which is particularly devastating for tourism-dependent economies.

Another purpose of this chapter is to provide a platform to engage the private sector in a collaborative effort to reduce the risk to disasters and events and use their collective knowledge, expertise, and resources in managing a recovery. Not only will this public-private partnership benefit existing businesses and the residents that depend on them for employment and services, but it will demonstrate the County's sound governance in addressing its risk which can help the County's effort to attract future businesses. The information from the enhanced LMS and this Economic Vulnerability chapter will be used in workshops and meetings with the private sector Broward Private Sector Committee. It will also be used in the County's revision of the County-wide Recovery Process.

This chapter is organized in the following format:

- Existing Economic Climate
- Major Employers and Economic Areas
- Future Economic Development
- Economic Vulnerability Methodology

- Data Sources, Assumptions, and Limiting Factors
- Preliminary Results – County-wide Hazards Analysis and Commercial Businesses
- Preliminary Results Analysis and Economic Hot Spot Profiles
- Summary of Potential Impacts and Potential Areas for Redevelopment
- Major Government Facilities/Infrastructure Qualitative Analysis
- Conclusions/Recommendations

Existing Economic Climate

Broward County has a diverse economy that is influenced by its year-round warm weather, access to major transportation networks including the Atlantic Ocean, and its proximity to Latin America and the Caribbean. The County is a major tourism draw, both nationally and internationally, and is also a major transportation/distribution hub, especially for the heavily populated South Florida area. The County has major transportation infrastructure for the mass delivery of goods including a major seaport (Port Everglades), major airport (Fort Lauderdale-Hollywood International), 4 major highways (I-95, I-595, I-75, and the Florida Turnpike), and a major north-south rail line (the Florida East Coast Railway). These transportation networks move many types of goods needed for everyday living in the South Florida area as well as high-grade limestone and intermodal shipping containers from Port Everglades. Broward County is also close to major international airports in neighboring counties (Miami International (MIA) and West Palm Beach International (WPB)) which strengthens its ties to the Caribbean, Central, and South America.

The County attracts businesses operating in multiple states and internationally that primarily choose their location based on a higher quality of life for its employees including warm climate, presence of urban amenities, access to recreational assets like beaches and perception of an enjoyable lifestyle. The 2004 Vision Broward document, a multi-year endeavor to 'chart the future course of Broward County' stated then what remains true today: "The population growth of South Florida has been fueled by favorable weather, high quality of life, and great concern to maintain a pristine environment, low-tax climate for business and citizens, and openness to multi-cultural and ethnic diversity." But 13 years later, the County continues to be challenged by its very success in attracting business and new population from becoming a detractor (e.g. clogged roads, lack of undeveloped land).

Broward County's growing population numbered 1.92 million residents in 2017, up from 1.76 million in 2012. By 2022, the population is estimated to be 2.08 million. Transportation infrastructure and mobility remain challenges. With 300 miles of inland waters, Broward is a county of bridges, yet nearly 1 in every 5 bridges is deemed Structurally Deficient or Functionally Obsolete as defined by FDOT. A 2016 ballot initiative to increase the county's sales tax by a penny to be split between county and municipal transportation improvement projects, including reducing east-west gridlock, failed to pass. Improvement in north-south movement is expected in 2018, when the Brightline higher-speed passenger rail system begins operation from Miami to West Palm Beach with a stop in Ft. Lauderdale.

At the 2017 State of the County Forum, County officials noted recent achievements as well as challenges that remain in providing an economic climate that is as competitive and vibrant as possible. Broward County continues its focus on reducing the size of its own operations, maintaining a healthy financial reserve, and expanding airport and port operations. Deepening and widening of Port Everglades in Ft. Lauderdale to accommodate the newest Panamax ships is proceeding after a three-year delay. Compared to statewide Florida economic indicators,

Broward leads – and is improving – on key indicators such as high-school graduation rate, unemployment rate, poverty rate, voter participation and visitor revenue. The County currently lags on job creation, housing sales, and consumer sentiment.

Southeastern Florida, which includes Broward County, has the highest frequency of hurricanes in the United States. Having a sound mitigation and recovery plan involving the community is critical and a likely factor in a larger business's decision to locate to Broward and if the plan is executed well, influence existing businesses that suffered damages and loss to stay in Broward after an event. A 2017 FEMA study noted that the County's mitigation efforts resulted in a return on investment of $4.83 for each dollar spent in a $2.1 million pre- and post-event mitigation project. To date, $10.4 million in total losses have been avoided, as tested by Hurricane Wilma in 2005.

Major Employers and Economic Areas

Broward County is home to a diverse economy composed of the following economic sectors:

Table 5.1: Overall Largest Employment Sectors in Broward County

Rank	Sector	Employment*
1	Services	393,804
2	Retail Trade	198,832
3	Finance, Insurance, and Real Estate	88,327
4	Wholesale Trade	46,943
5	Construction	40,446
6	Manufacturing	40,263
7	Transportation and Communications	37,915
8	Public Administration	36,623
9	Agricultural, Forestry, and Fishing	6,855
10	Unclassified	5,340

Source: Greater Fort Lauderdale Alliance Prospector (http://greaterfortlauderdale.zoomprospector.com)

Table 5.2: Largest Broward County Companies Ranked by Revenue

Company Name	Municipality	Revenue	Type of Business
AutoNation	Fort Lauderdale	$17,691,500,000	Car sales and rentals
JM Family Enterprises, Inc.	Deerfield Beach	$12,200,000,000	Diversified automotive corporation
Republic Services	Fort Lauderdale	$3,176,200,000	Waste management and recycling
Spherion, Inc.	Fort Lauderdale	$2,017,100,000	Employment services
Citrix Systems	Fort Lauderdale	$1,391,900,000	Computer network software
Seacor Holdings	Fort Lauderdale	$1,359,200,000	Marine services company
Elizabeth Arden	Miramar	$1,156,100,000	Perfumes, colognes, and skin care products
Interbond Corp of America (Brands Mart USA)	Hollywood	$1,100,000,000	Retail applicant, TV, and electronic sales
Kaplan Higher Education	Fort Lauderdale	$1,022,000,000	Post-Secondary & Secondary education
BFC Financial Corp.	Fort Lauderdale	$953,900,000	Holding company of BankAtlantic Bancorp and Woodbridge Holdings Corp.
Pediatrix Medical Group	Sunrise	$917,600,000	National physician group practice
Ed Morse Automotive	Fort Lauderdale	$897,900,000	Automotive sales and services
Aero Toy Store LLC	Fort Lauderdale	$838,200,000	Corporate aircraft/helicopter sales, yachts, exotic automobiles, interiors
Spirit Airlines	Miramar	$762,000,000	Airline
G.L. Homes of FL	Sunrise	$700,000,000	Homebuilder
Moss & Associates LLC	Fort Lauderdale	$684,300,000	Construction Management
Associated Grocers of FL	Pompano Beach	$650,000,000	Wholesale food distributor for FL, Caribbean, and Latin America
National Beverage Corp.	Fort Lauderdale	$554,400,000	Non-alcoholic beverages
Rick Case Enterprises	Fort Lauderdale	$550,000,000	Automotive sales and service
BankAtlantic Bancorp.	Fort Lauderdale	$524,600,000	Banking
Heico Corp.	Hollywood	$507,900,000	Jet engines and parts
Gold Coast Beverage Dist.	Pompano Beach	$480,000,000	Beer wholesaler
Woodbridge Holdings Corp.	Fort Lauderdale	$415,900,000	Real Estate Developer
Stiles Corp.	Fort Lauderdale	$398,100,000	Real Estate Developer
James A. Cummings	Fort Lauderdale	$338,700,000	Miscellaneous retailer

Source: Greater Fort Lauderdale Alliance

Table 5.3: Largest Broward County Companies Ranked by Number of South Florida Employees

Company Name	Municipality	South Florida Employees	Type of Business
Nova Southeastern Univ.	Davie	7,462	University – Bachelor, Masters, and Doctoral degrees
AutoNation	Fort Lauderdale	4,000	Automotive retailer – corporate headquarters
American Express	Plantation	3,500	Commercial/consumer financial services
Spirit Airlines	Miramar	1,800	Airline
Citrix Systems	Fort Lauderdale	1,700	Computer network software
JM Family Enterprises	Deerfield Beach	1,685	Diversified automotive corporation
Kaplan	Fort Lauderdale	1,665	Online educational provider
Actavis	Davie	1,620	Pharmaceutical Developer/Manufacturer/Distributor
DHL Express	Plantation	1,400	Air courier services
Rick Case Automotive Group	Fort Lauderdale	1,379	Automotive sales and services
Ultimate Software	Weston	1,327	Professional and financial software
City Furniture	Tamarac	1,266	Home furniture retailer
The Castle Group	Plantation	1,100	Community association management
Sitel	Pompano Beach	1,000	Customer service center
Patriot National	Fort Lauderdale	988	Insurance
Point Blank Enterprises	Pompano Beach	974	Manufacturer/Distributor of bullet proof vests
Centene	Sunrise	877	Healthcare programs service provider
Sun-Sentinel Co.	Fort Lauderdale	800	Newspapers, commercial lithographic printing
Zimmerman	Fort Lauderdale	650	Advertising agency
Weatherby Healthcare	Fort Lauderdale	457	Staffing and recruiting

Source: South Florida Business Journal and Greater Fort Lauderdale Alliance. Note: Excludes retail and hospitality companies unless headquarters is in Greater Fort Lauderdale

Overall, these tables illustrate the importance of a diverse economy but one that can generally point to the following 'anchor industries':

Table 5.4: Broward County's Diverse Economy

General Anchor Industries	Amenities/Attractors	Challenges
Major Transportation Infrastructure / Commercial Distribution Hub	Major seaport, rail line, airport; Major roadway network including 3 interstates and turnpike	Central location in South Florida, the largest state population concentration
Business Headquarters	Climate, Beaches, Water; Quality of Life; No state income tax; Access to Latin America	Influenced by

General Anchor Industries	Amenities/Attractors	Challenges
High Tech Industry	Synergy with similar innovative, creative, and entrepreneurial firms	Sufficient educated workforce
Tourism	Beaches, Ocean, Tourist districts like Las Olas, unique attractions like Tradewinds Butterfly World, Everglades, Museum of Art	Influenced by market forces (recession) and after a hurricane, perception if it has recovered (condition of beaches, transportation network, service workers)
Seasonal Living/Retirement Area	Beaches, Climate, No state income tax, congregation of other similar people	Cost of insurance, perception of how well prepared area is

Additional metrics to evaluate Broward County's economy:

Key economic and employment data from The Florida Scorecard (www.thefloridascorecard.com and http://greaterfortlauderdale.zoomprospector.com/):

- Unemployment Rate is 3.8%
- College Attainment is 30.2 %
- Average Annual Wage is $46.1609
- Per Capita Income is $43,2830
- Home ownership rate is 65.3% with 34.7% Broward County residents renting their homes.

Future Economic Development

Broward County and Florida in general, experienced tremendous growth in the past 4 decades. The housing market crash and large-scale recession of the late 2000s slowed this growth both in the county and the state. The Florida Chamber Foundation produced a report that can be found on its website, http://www.flchamber.com/research/six-pillars/that details the 6 key pillars of Florida's future economy (through 2035):

- Talent Supply and Education
- Innovation and Economic Development
- Infrastructure and Growth Leadership
- Business Climate and Competitiveness
- Civic and Governance Systems
- Quality of Life and Quality Places

In 2011, Broward County community leaders and volunteers began the process of developing a strategic visioning plan through the year 2030, using the Six Pillars framework. The plan was developed over the next year and launched in October 2012. The plan consists of 22 goals, 82 strategies and nearly 400 tactics. The Broward County Six Pillars Community Plan 2017 Report to the Community can be found here: http://www.gflalliance.org/clientuploads/Six%20Pillars/2017%20Annual%20Report/Six%20Pillars%202017%20Report%20Book.pdf The report compares key metrics with the other six urban counties in the state and with Florida as a whole.

In terms of economic climate and development, Broward County faces an additional challenge the other urban counties of the state largely do not, because it is primarily built-out and now focuses on attracting businesses that require less acreage/square footage. In fact, growing the number of targeted industries by transitioning the County to more of a knowledge-based economy is a key goal of the County's 2012 Six Pillars Community Strategic Plan currently under execution. The Plan can be found here: http://www.gflalliance.org/clientuploads/Six%20Pillars/Final%20Plan%20October%202012/Six%20Pillars%20Broward%20Final%20Plan%20October%202012%20-%20Business%20Climate.pdf

The Broward County Board of County Commissioners has assessed different types of industries for ones that were new, emerging, and high growth industries to create high-skill and high-wage jobs. The following are the ten targeted industries of the County and the list was modified based on multiple factors including existing businesses, workforce availability, environmental concerns and industry trends.

- *Advanced Materials and High-Tech Manufacturing*
  - Includes plastics material and resin manufacturing, secondary aluminum alloying (for aerospace, biomedical, and information technology), nanotechnology, cement/concrete, chemicals, rubber
- *Alternative Energy and Renewable Resources*
  - Includes biomass electric power generation, miscellaneous electrical equipment manufacturing including photovoltaic fuel cells, turbine/turbine generator units manufacturing equipment, water utility systems, environmental services, and architectural/engineering services
- *Aviation / Aerospace*
  - Includes aerospace products/parts, avionics, and air transportation support
- *Global Business Services*
  - Includes banking, computer systems design, insurance carriers, and commercial credit
- *Global Media and Production*
  - Includes radio and television broadcasting, video industries, advertising and related services, internet, and cable
- *Headquarters and Management Operations*
  - Includes corporate headquarters, business/professional/labor/political organizations, management/consulting services, and commercial equipment leasing primarily focused on Caribbean, and Central and South America financial services companies
- *Human Resources and Higher Education*
  - Includes colleges/universities/professional schools, business schools, management training, and computer training
- *International Trade and Logistics*

- Includes wholesalers of professional/commercial equipment, durable goods, electrical goods, grocery and related products, metal and minerals; also includes logistics consulting services

- *Life Sciences*
  - Includes biotechnology research/development, and pharmaceutical preparation manufacturing

- *Marine Industries*
  - Includes ship/boat building, nautical instruments manufacturing, and electronics repair and maintenance

To continually draw and support these industries, a higher educated workforce is needed. Grooming and attracting this type of workforce is a challenge in South Florida due to the lack of a critical mass of powerful and nationally recognized universities.

While the County targets the above industries, a projection of what are actually expected to be the County's fastest growing industries by employment over the next five years (through 2022) is available in this list from the Florida Department of Economic Opportunity: http://www.gflalliance.org/clientuploads/Data%20Center%20files%20(Facts%20and%20Figures)/Fastest-Growing%20Industries.pdf . The industries include Construction of Buildings, Specialty Trade Contractors, Heavy and Civil Engineering Construction, Warehousing and Storage, and Nonmetallic Mineral Product Manufacturing.

Economic Vulnerability Methodology

To analyze the economic vulnerability of an area, it is first necessary to understand the basic geographic distribution of business and which sectors are the primary economic bases for the area. Once this is established, how the hazards of most significant concern directly impact the facilities of the businesses must be understood. The subsection entitled "Preliminary Results – County-wide Hazards Analysis and Commercial Businesses" will provide detailed maps and the subsection entitled "Preliminary Results Analysis and Economic Hot Spot Profiles" will include loss projection scenarios. The Economic Vulnerability chapter will help prepare a road map to better understand areas where mitigation efforts should be targeted.

Although economic vulnerability for all the hazards of most significant concern were considered, tropical cyclones were identified as the most likely economically damaging. The central focus of this study is to look at the businesses projected to be damaged in a direct Category 3 hurricane strike that includes high winds, storm surge (using SLOSH) and inland flooding. A Category 3 storm was selected because the impacts from wind and flooding are likely to be significant and it is a higher probability storm than the Category 4 and 5 storms. The study also examines the future risk of storm surge by incorporating the projected impacts of sea level rise as determined by the Southeast Florida Climate Change Regional Compact's *Analysis of the Vulnerability of Southeast Florida to Sea Level Rise* and the *Broward County Climate Change Action Plan* (actual data provided courtesy of the South Florida Water Management District).

The maps of hazards will be superimposed on the distribution of the businesses to determine the areas where the hazards may affect the businesses. This intersection of the businesses and the

wind and flood hazard is mapped and analyzed in the "Preliminary Results" section. Based on these preliminary results, areas of major business concentration at higher risk (called 'hot spots' in this plan) will be analyzed in more detail in the "Economic Hot Spot Profiles" section. This chapter will also look at potential damage to major infrastructure on which the businesses are dependent and any major government facilities in the "Major Government Facilities/Infrastructure Qualitative Analysis" section.

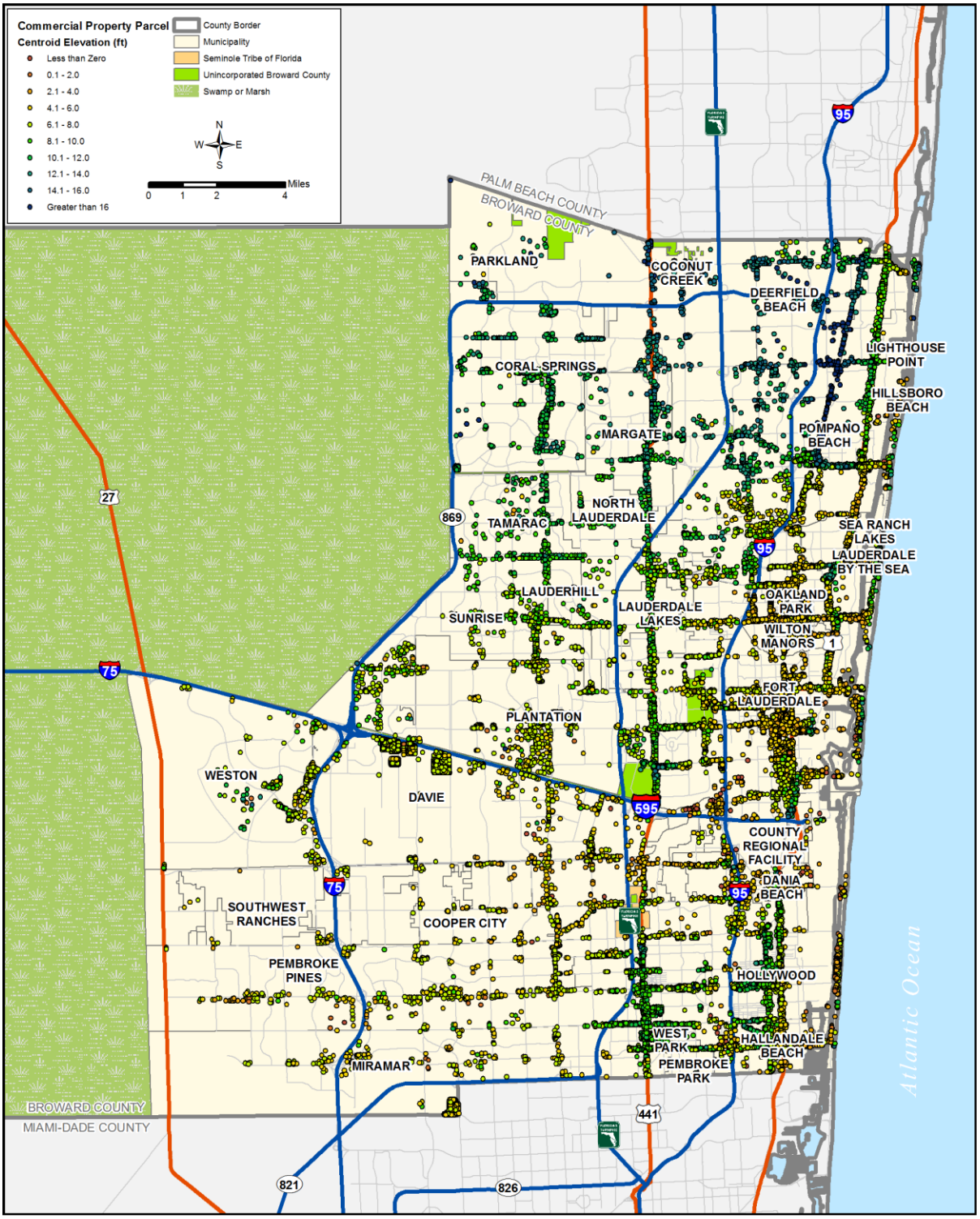
To determine quantitative data on direct losses, business interruption costs, and lost income, the study will use FEMA's Hazus MR-5 (wind) and Hazus 4.0 (flood) software to estimate losses in the hot spots. Hazus provides information down to the census block level for direct damages which will be captured for each hot spot. To estimate business interruption costs, which are only calculated at the county level, a 'damage percentage multiplier', which is based on each individual hot spots proportion of the county direct damage to businesses, will be applied to the county level business interruption figures. This same methodology will be used to calculate estimated property tax losses: the annual commercial property tax level for each hot spot will be multiplied by a coefficient that is derived by dividing the direct damages in the hotspot by the commercial exposure of the hotspot (both numbers from Hazus). This damage coefficient would provide a basic estimate of the level of damage in the hotspot which is used to estimate the level of loss of commercial property taxes. It is beyond the scope of Hazus to provide direct damages to each business and this level of detail would not be permitted in a public plan by the Federal Privacy Act.

Once the overall impact to the County and the impact to the hot spots are described, the next step of the analysis is to describe how the damages may ripple through the general economy in "Summary of Potential Impacts and Potential Areas for Redevelopment". The ripple effects will result in some degree of economic harm to smaller, dependent, and supporting businesses. The effects will also impact residents who rely on the business for employment, a service or a product.

It is hoped that these analyses will provide the level of information to allow the private sector to scrutinize their individual and collective vulnerability, conduct a detailed analysis of their own facilities, participate in the County level public-private risk reduction partnership established through the LMS Working Group called the Broward Private Sector Subcommittee, and follow through on implementing appropriate risk reduction measures.

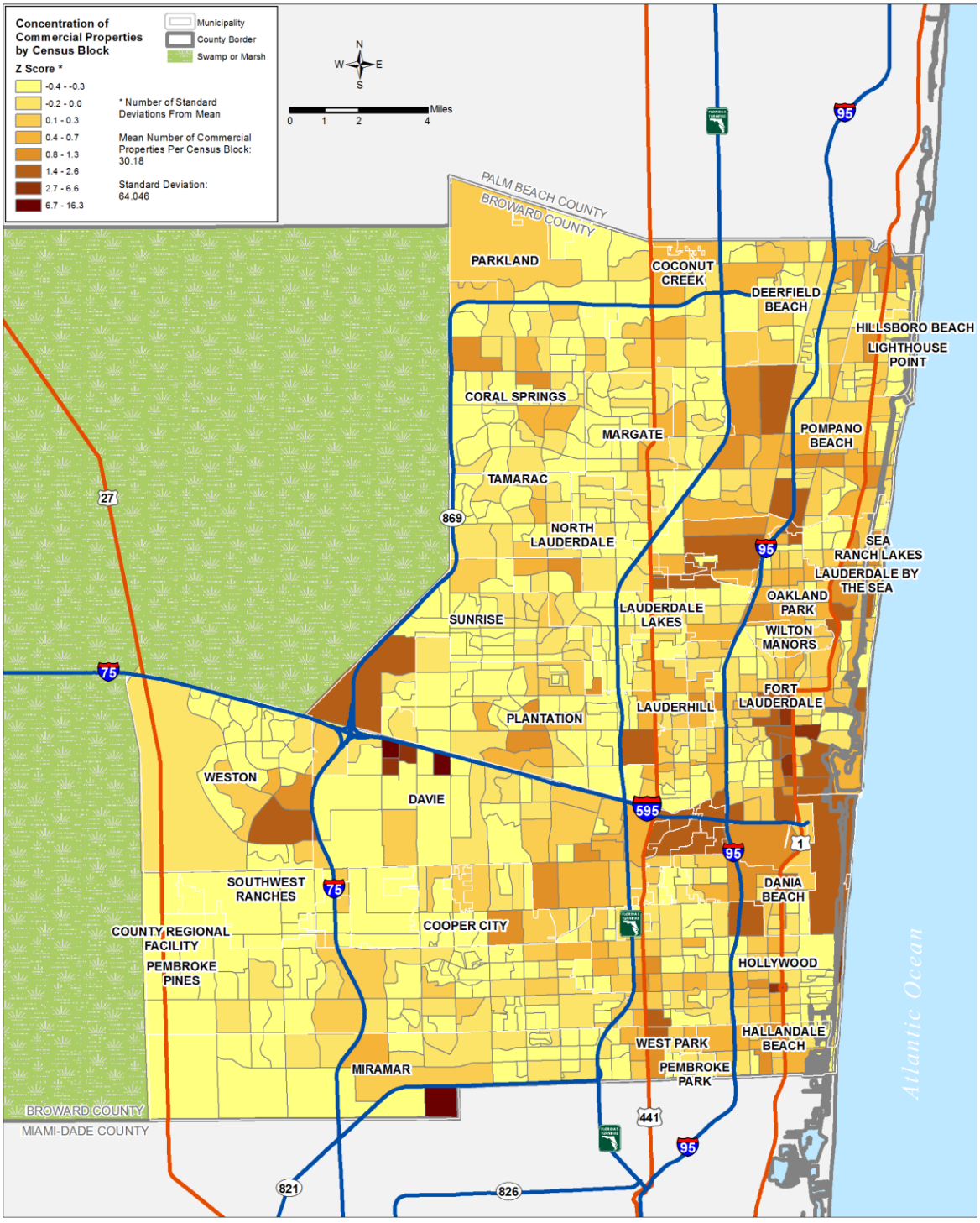
The maps on the following two pages display some of the basic analysis information including the location of commercial businesses in the County (**Map 5.1** - with their elevations of the ground at the base of the building) and the concentration of businesses by census block group (**Map 5.2** – darker areas indicate higher concentration).

Map 5.1: Broward County Commercial Buildings Elevation



Source: Broward County Property Appraiser GIS

Map 5.2: Broward County Concentration of Businesses by Census Block Group



Source: Broward County Property Appraiser GIS, US Census Bureau 2015 Census Block Group Boundaries

Data Sources, Assumptions, and Limiting Factors

- **Commercial Property Location information** - Broward County Property Appraiser GIS parcel data
- **Property Tax Revenue** – 2010 Millage Rates and Last Year Taxable Value from Parcel data
- **Population Data** – 2010 US Census data
- **SLOSH storm surge** - FL Division of Emergency Management (FDEM) & NOAA
- **Wind Speed zones** - FDEM Hazard grid
- **Terrain Data** - South Florida Water Management District (SFWMD) GIS Data Catalog
- **Infrastructure (major roads, etc.)** - Broward County GIS website
- **Flood zone information** - FEMA 1996 Q3 data
- **Sea level rise data** - SFWMD
- **Hazus Wind Loss Estimation (Probabilistic 100-year Return Period)** - Hazus-MH MR-5
- **Hazus Flood Loss Estimation (100-year Return Period, No What-Ifs)** - Hazus 4.0
- **Commercial Exposure Info by County level and by Census Block Group** - Hazus 4.0 Flood module

One limiting factor is that some Hazus information is only available at county level. The work around for this is a 'damage multiplier' for each census block. In addition, many of the researched economic statistics are only available at municipal level and not a Census Block Group level which is the basis for the Hot Spots.

Preliminary Results – County-wide Hazards Analysis and Commercial Businesses

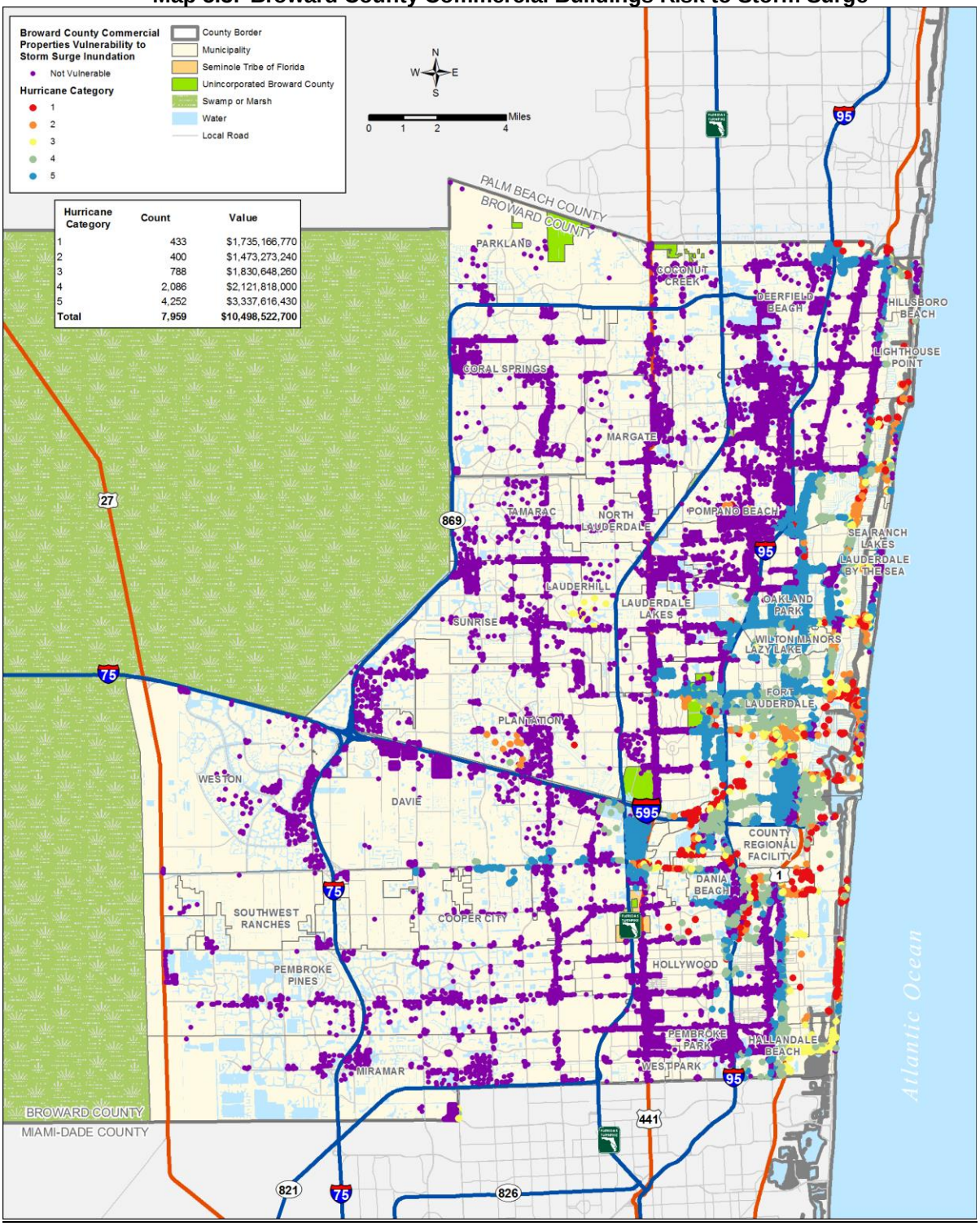
As discussed earlier, the Category 3 hurricane event is the designated scenario in this study because it is much more probable than a Category 4 and 5 event and mitigation efforts to the impacts of this level storm would probably be more cost-effective.

Storm Surge Risk

Map 5.3 on the following page examines the overall risk of commercial buildings to storm surge flooding. The different color dots show commercial buildings and vulnerability to the different categories of hurricane storm surge event and lower based on geographic vulnerability and

building elevation. Purple dots show buildings unaffected by any level storm. **Table 5.5** is a table which summarizes the number and value of businesses in the various storm surge zones.

Map 5.3: Broward County Commercial Buildings Risk to Storm Surge



Source: Broward County Property Appraiser GIS, Broward County GIS, NOAA SLOSH Data

Table 5.5: Value of Commercial Businesses in Storm Surge Zones

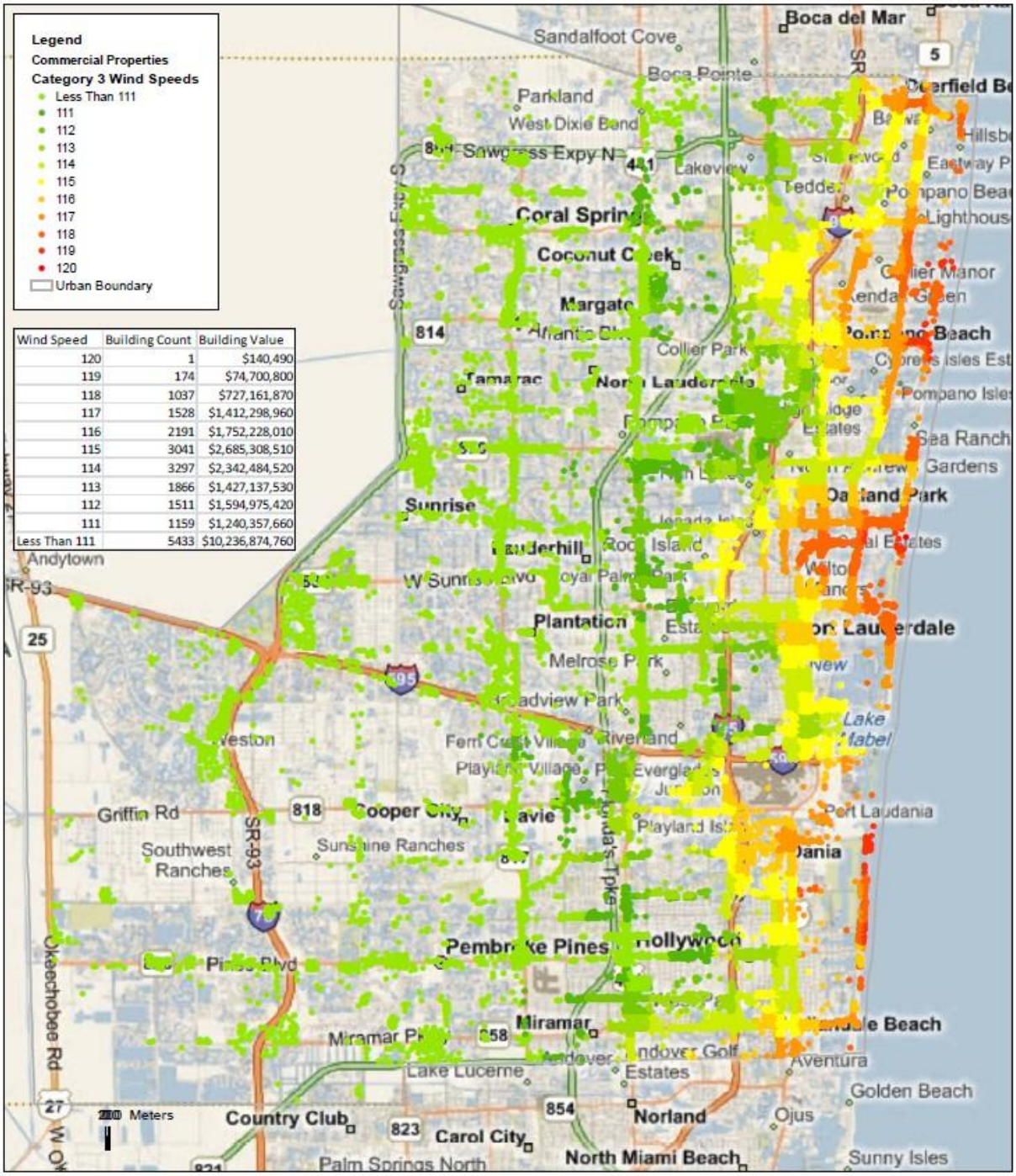
Hurricane Category	Building Count	Building Value	Cumulative Value	Cumulative Count
1	433	$1,735,166,770	$1,735,166,770	433
2	400	$1,473,273,240	$3,208,440,010	833
3	788	$1,830,648,260	$5,039,088,270	1,621
4	2,086	$2,121,818,000	$7,160,906,270	3,707
5	4,252	$3,337,616,430	$10,498,522,700	7,959
Total	7,959	$10,498,522,700		

Source: Broward County Property Appraiser GIS, Florida Regional Planning Councils and Florida Division of Emergency Management, Broward County GIS

Wind Risk

Map 5.4 on the following page shows the overall risk of commercial buildings to Category 3 High Winds. The different color dots show commercial buildings and vulnerability to the different wind speed of this level event. **Table 5.6** is a table which summarizes the number and value of businesses to the various wind speeds of a Category 3 Hurricane.

Map 5.4: Broward County Commercial Buildings Risk to Category 3 High Winds



Source: Broward County Property Appraiser GIS

Table 5.6: Value of Commercial Businesses in Category 3 Hurricane Wind Speed Zones

Wind Speed	Building Count	Building Value
128.9 – 130.6	2926	$6,146,877,270.00
130.7 – 131.5	2902	$6,285,960,310.00
131.6 – 132.4	8063	$8,271,549,010.00
132.5 – 133.4	6990	$6,655,795,190.00
133.5 – 135.3	2128	$3,369,890,460.00
135.4 – 138.2	579	$1,731,614,050.00

Source: Broward County Property Appraiser GIS, HAZUS 4.0

Future Storm Surge Risk Conditions Considering Sea Level Rise

See Chapter 4 for a comprehensive discussion of the impact of sea level rise and climate change on Broward County. The Economic Vulnerability section will focus on the impacts of a 1 foot sea level rise, the most probable and most immediate impact, on the hot spots. Some of the hot spots may not be impacted at all by the 1 foot rise. No map of sea level rise will be included in the hot spot section if there is no impact.

Preliminary Results Analysis and Economic Hot Spot Profiles

The preliminary results depicted areas where the concentrations of commercial buildings were shown in relation to the impacts of hurricane high winds and hurricane storm surge. Where the highest concentrations of commercial developed intersected with the higher levels of wind and flood risk, 'hot spots', were identified. Major impacts to any of these hot spots are expected to have a negative economic ripple effect to other businesses in that geographic area, other county geographic areas, and other business sectors in the County and beyond.

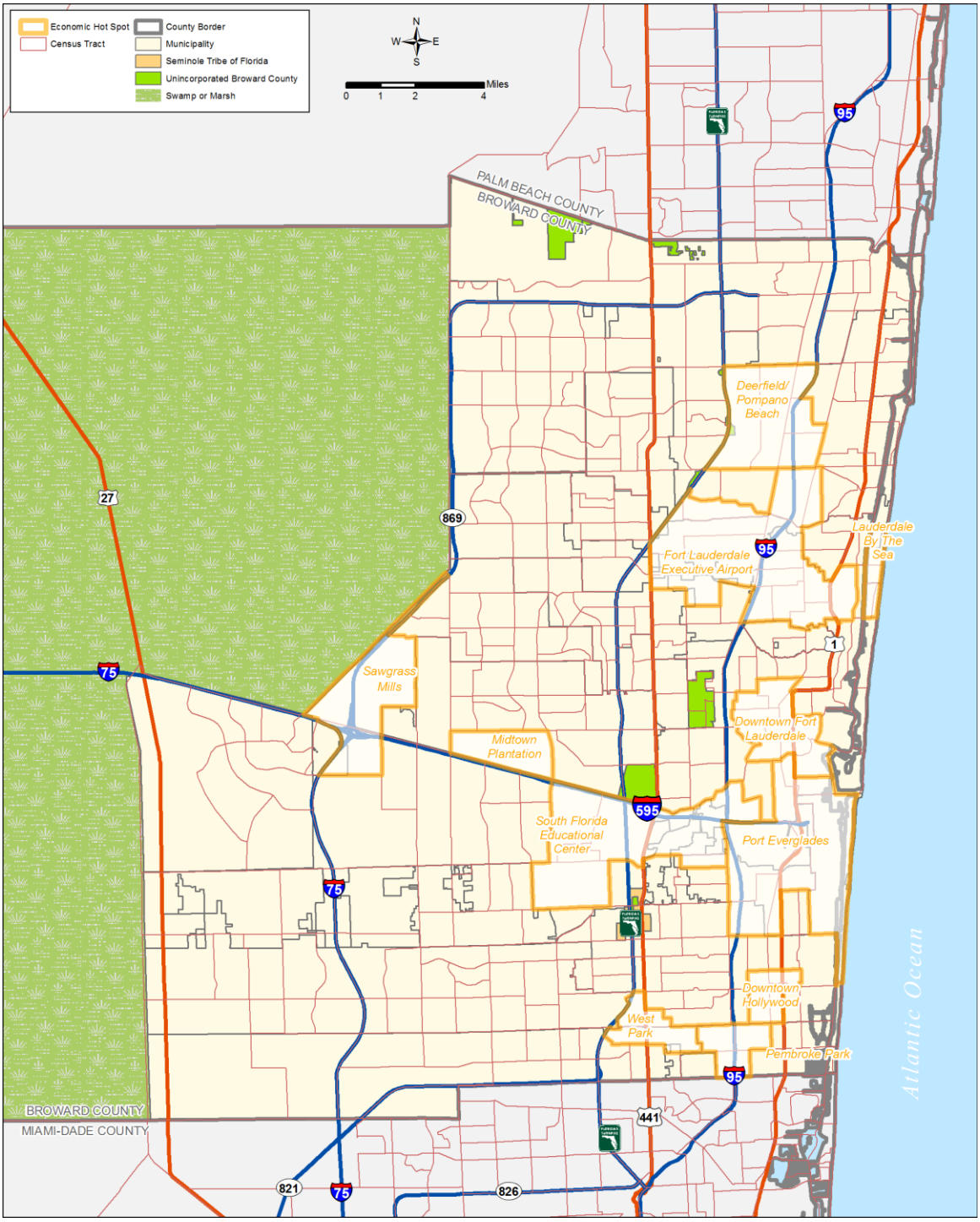
The hot spots identified by the County include the following:

- Davie College/University Area
- Deerfield Beach/Pompano Beach Rail/Interstate 95 Corridor
- Downtown Fort Lauderdale
- Fort Lauderdale Executive Airport/Commercial Boulevard
- Downtown Hollywood
- Lauderdale-By-The-Sea
- Pembroke Park/West Park
- Plantation Midtown Area
- Port Everglades/International Airport

- Sawgrass Mills/Sunrise
- South Florida Educational Center in Davie

The hot spots subsection includes important economic information for each hot spot, including a list of key infrastructure and/or key facilities, large businesses, any agglomeration of certain business sector types, and other significant economic information. It also includes maps of the businesses in relation to the storm surge (if impacted), high wind, and inland flood hazards**.** At then of each hot spot subsection, there is a table that lists the Hazus loss estimation for direct impacts, Hazus business interruption costs, and approximate property tax losses from flooding and wind. **Map 5.5** on the following page shows the boundaries of the hot spots (based on the census block groups). **Table 5.7** below provides FEMA's estimated Average Annualized Losses from flooding for each hot spot. The overall annual commercial property tax for Broward County is $837,409,658 (Source – Broward County Property Appraisers' Office).

Map 5.5: Grouped Hot Spots



Source: Broward County GIS and US Census 2015

Table 5.7: FEMA Average Annualized Loss for 100-Year Flood Event Hazard in Hot Spots (2017)

Hot Spot	Total Loss	Building Loss	Contents Loss
Fort Lauderdale	$158,480,000	$66,900,000	$90,680,000
South Florida Education Center/ Davie	$81,970,000	$32,990,000	$46,670,000
Commercial Blvd /Executive Airport	$218,780,000	$82,060,000	$130,050,000
Port Everglades/Airport	$48,620,000	$17,970,000	$29,510,000
Sawgrass Mills /Sunrise	$15,200,000	$5,000,000	$9,740,000
Deerfield/Pompano Beach Distribution Corridor	$72,010,000	$22,770,000	$46,320,000
Lauderdale-By-The-Sea	$120,000	$80,000	$40,000
Plantation	$26..660,000	$14,640,000	$11,980,000
Pembroke Park	$13,530,000	$7,430,000	$5,970,000
Hollywood	$5,420,000	$3,060,,000	$2,360,000
West Park	$4,570,000	$2,550,000	$1,980,000
TOTAL (entire county)	**$645,360,000**	**$255,450,000**	**$375,300,000**

Source: FEMA Headquarters Risk MAP Program which used Hazus MR4

Deerfield Beach/Pompano Beach Rail/Interstate-95 Corridor:

General Information

The Deerfield / Pompano Beach Rail/Interstate-95 Corridor is a major transportation, distribution, and commercial hub for the entire South Florida area. Many larger distribution hubs, like Publix and Gold Coast Beverage, take advantage of its proximity to rail (Florida East Coast Railway) and 2 major interstates (I-95 and the Florida Turnpike). The approximate boundaries of this hot spot are in Maps 5.6 to 5.8. This analysis will focus on the East to West area of I-95 to Powerline Road.

Pompano Beach (http://pompanobeachfl.gov/index.php/pages/dev_scv_economic_development/economic_development)

- The city provides access to both the Florida Turnpike and Interstate 95 and also provides access to both the CSX and FEC railroads

Key Infrastructure, Facilities, and Businesses

2016 Passenger Vehicle Information (from http://flto.dot.state.fl.us/website/FloridaTrafficOnline/)

- I-95: Main interstate Highway on East Coast of US; serves Atlantic Coast of FL
  - Annual Average Daily Traffic (AADT): two-ways, between Route 810 – Route 869= **205,000** (2016)
  - AADT: two-ways, I-95 - NB ON RAMP FROM EB SR 810/HILLSBORO BLVD. = **6,200**
  - AADT: two-ways, I-95 - SB ON RAMP FROM EB SR-810 HILLSBORO BLVD = **9,000**
  - AADT: two-ways, I-95 NB ON RAMP FROM WB SR 810/HILLSBORO BLVD. = **7,200**
  - AADT: two-ways, I-95 SB ON RAMP FROM WB SR-810/HILLSBORO BLVD = **9,200**
  - AADT: two-ways, I-95 NB ON RAMP FROM 1OTH ST/SR-869 = **18,500**
  - AADT: two-ways, I-95 SB ON RAMP FROM 10TH ST/SR-869 = **14,000**
- Florida State Road 810
  - Main exit to Deerfield Beach
  - AADT: two-ways, I-95 - NB OFF RAMP TO EB SR 810/HILLSBORO BLVD. = 8,800
  - AADT: two-ways, I-95 NB OFF RAMP TO WB SR 810/HILLSBORO BLVD. = 7,600
  - AADT: two-ways, I-95 - SB OFF RAMP TO SR-810/HILLSBORO BLVD = **13,500**
  - AADT: SR 810 / HILLSBORO BLVD - E OF SR 9/I-95: E 26000 W26000, two-way 52,000
- Florida State Road 869:
  - Bypass of Ft Lauderdale; terminates in Deerfield Beach; connects to I-75 and becomes a toll road (Sawgrass Expressway)
  - AADT: two-ways, I-95 NB. OFF RAMP TO 10TH ST/SR-869 = **15,500**
  - AADT: two-ways, I-95 SB OFF RAMP TO 10TH ST/SR-869 = **13,500**
  - AADT: SR 869 / SW 10 ST - W OF SR 9/I-95 E 25500 W 23500 two-ways 49,000
  - AADT: SR 869 / SW 10 ST - E OF SR 845/POWERLINE RD E 21000 W21500, two-ways **42,500**

Rail Information

- South Florida Regional Transit Authority
- Pompano Beach Station
    - Tri-Rail commuter station
- Deerfield Beach station (Old Seaboard Air Line Railway Station):
    - Amtrak (Silver Meteor and Silver Star – both NY to Miami)
        - 24,150 Boardings and Alightings (FY2010)
    - Tri-Rail commuter station
    - US National Register of Historic Places
    - HQ of South Florida Railway Museum

Pompano Beach Air Park

- Good Year leases approximately 32.5 acres (largest tenant) as a blimp base and whose hanger (45,000 square feet) is the largest building at the Air Park. (http://pompanobeachfl.gov/index.php/pages/pw_airpark/airpark)

Key Businesses

- Home to over 28 million square feet of industrial/warehouse/distribution space; which includes regional headquarters for companies such as (http://pompanobeachfl.gov/index.php/pages/dev_scv_economic_development/economic_development):
    - Aetna
    - Aquathin
    - Associated Grocers
    - FedEx Ground
    - Stimpson Co
- JM Family Enterprises
    - $14.46 billion Revenue (2015); 1,685 Employees (2015)
- Publix Supermarket District Center (distribution to South Florida)
- People's Trust Insurance Company
- Latite Roofing & Sheet Metal
- Airline Spares America
- Deerfield Country Club
- Medics Ambulance Service
- BrandsMart USA
- Gold Coast Beverage Distribution Center (I-95/Sample)
    - Largest Distribution Center in FL; one of largest in country
    - http://goldcoastbeverage.com/
- Associated Grocers
- Pompano Park and Poker (Racetrack and Casino)
    - 1,100 Employees (2017)
    - http://pompano-park.isleofcapricasinos.com/index.aspx

Key Facilities

- North Broward Medical Center (201 E Sample Rd, Pompano Beach)
- Large County Landfill/Wastewater Facility (Turnpike/Sample Road)
- Broward County Correctional Institution (15550 Bount Rd, Pompano Beach)

Key Economic Sectors

Table 5.8: Selected Economic Statistics for Deerfield Beach - 2017 –by Annual Payroll [larger than hot spot area]

Industry	Number of Establish-ments	Sales, Shipments, Receipts	Annual Payroll	Number of Employees
Health care and social assistance	182	$443,680,000	$171,044,000	4,282
Finance and insurance	142	N/A	$159,148,000	1,861
Wholesale trade	218	$10,619,208,000	$148,068,000	2,314
Professional, scientific, and technical services	338	$400,887,000	$136,652,000	2,736
Administrative and Support and Waste Mang and Remediation Srvs	180	$228,060,000	$110,564,000	4,551
Manufacturing	107	$751,541,000	$109,105,000	2,166
Transportation and warehousing	59	$240,458,000	$104,076,000	2,256
Retail Trade	298	$1,084,737,000	$99,083,000	3,593
Information	54	N/A	$90,604,000	1,316
Accommodation and food services	155	$163,222,000	$44,014,000	2,717

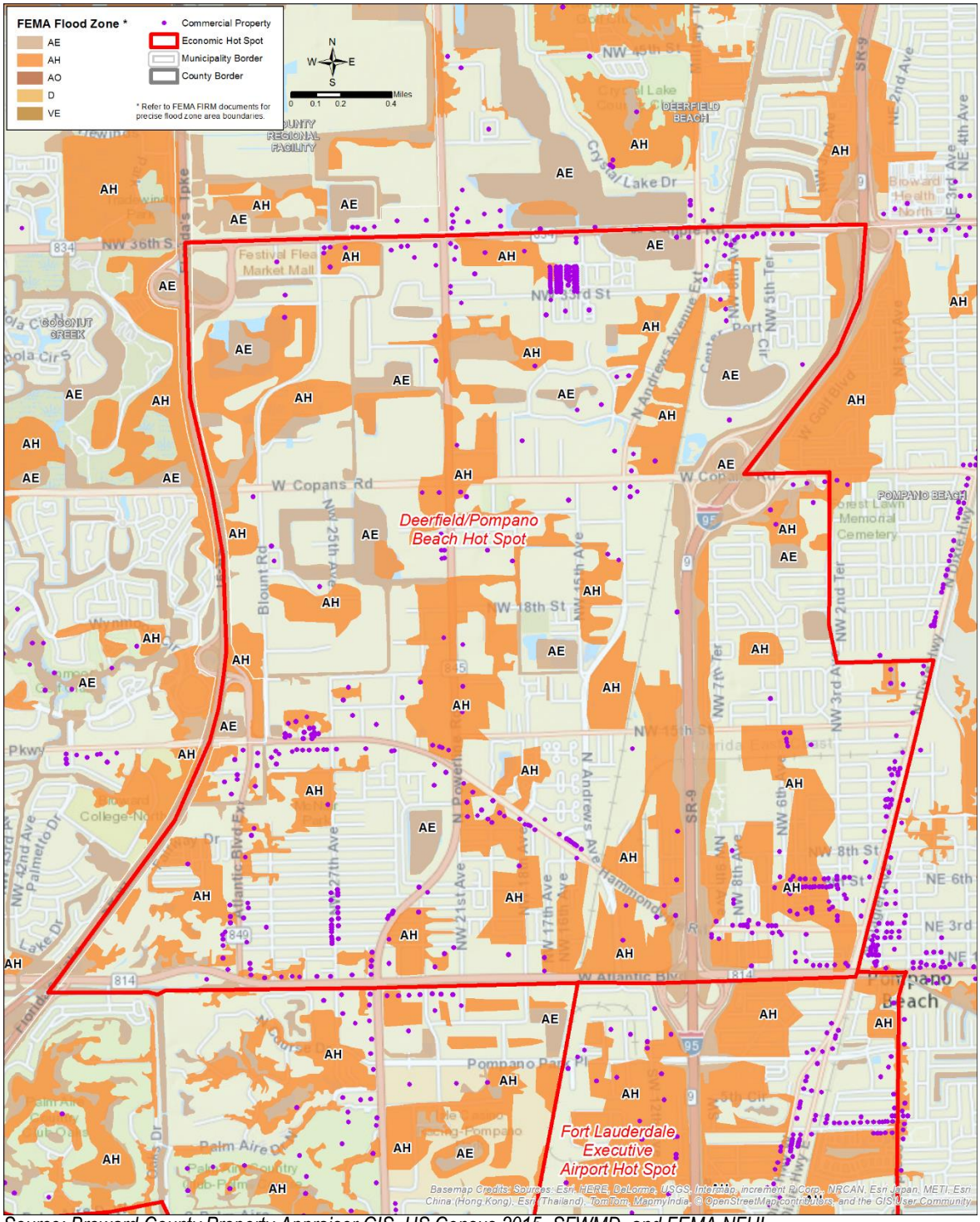
Source: U.S. Census Bureau (http://factfinder.census.gov)

Table 5.9: Selected Economic Statistics for Pompano Beach - 2017 –by Annual Payroll [larger than hot spot area]

Industry	Number of Establish-ments	Sales, Shipments, Receipts	Annual Payroll	Number of Employees
Manufacturing	250	$1,497,250,000	$326,035,000	5,908
Wholesale trade	454	$4,882,201,000	$310,010,000	6,291
Retail trade	624	$4,203,562,000	$257,998,000	8,020
Health care and social assistance	332	$469,550,000	$165,141,000	4,348
Administrative and Support and Waste Mang and Remediation Srvs	247	$248,377,000	$105,451,000	3,459
Professional, scientific, and technical services	471	$287,016,000	$89,897,000	1,768
Transportation and warehousing	139	$315,550,000	$74,485,000	2,207
Accommodation and food services	249	$258,170,000	$69,003,000	3,807
Other services (except public administration)	340	$262,136,000	$59,499,000	2,048
Arts, entertainment, and recreation	50	$129,271,000	$42,365,000	1,455

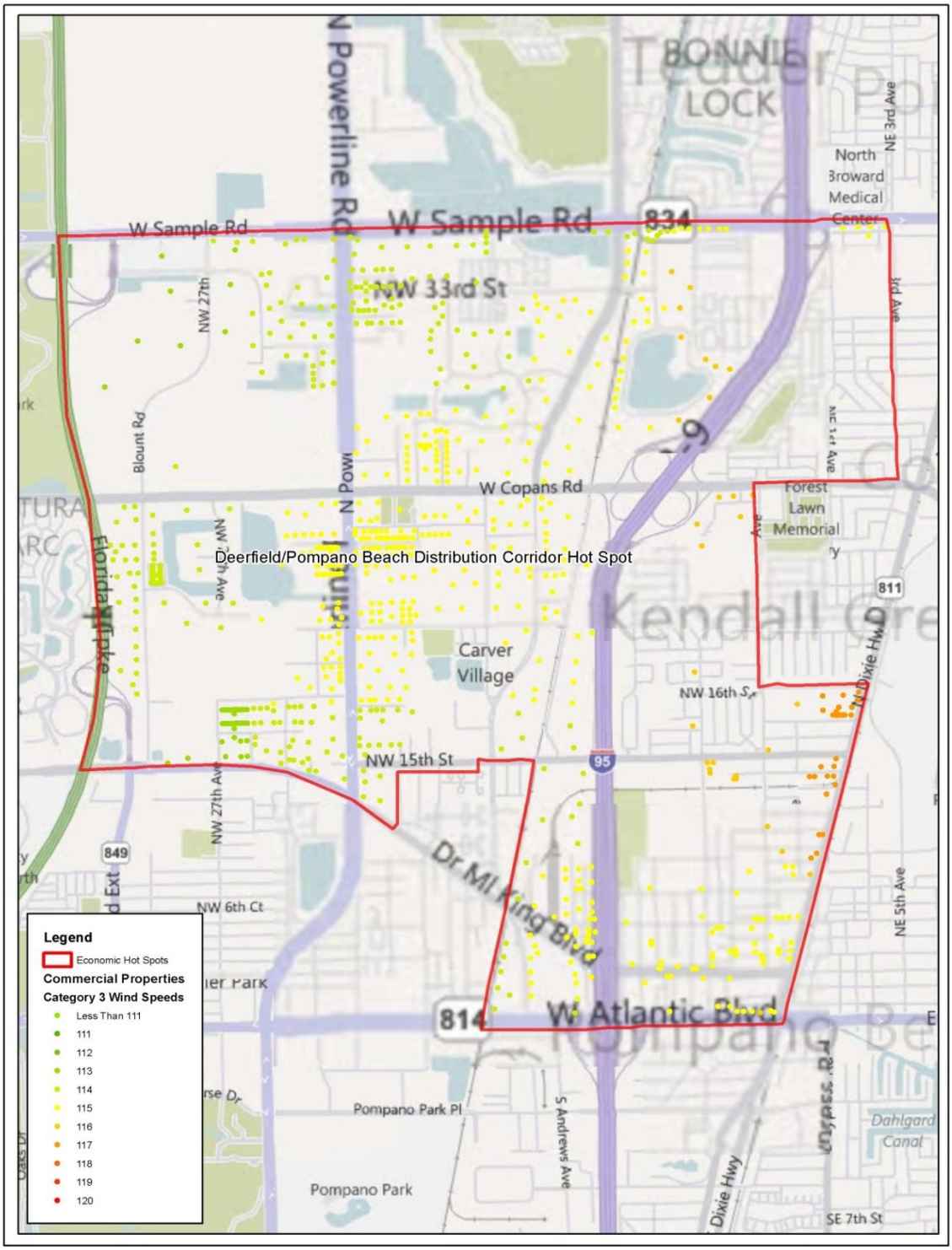
Source: U.S. Census Bureau (http://factfinder.census.gov)

Map 5.6: Deerfield/Pompano Beach Corridor Risk to Inland Flooding



Source: Broward County Property Appraiser GIS, US Census 2015, SFWMD, and FEMA NFHL

Map 5.7: Deerfield/Pompano Beach Corridor Risk to High Winds



Source: Broward County Property Appraiser GIS, US Census 2010, and FDEM Hazard Grid

Hazus Information

Table 5.10: Hazus and Property Tax Data for Deerfield/Pompano Beach Hot Spot

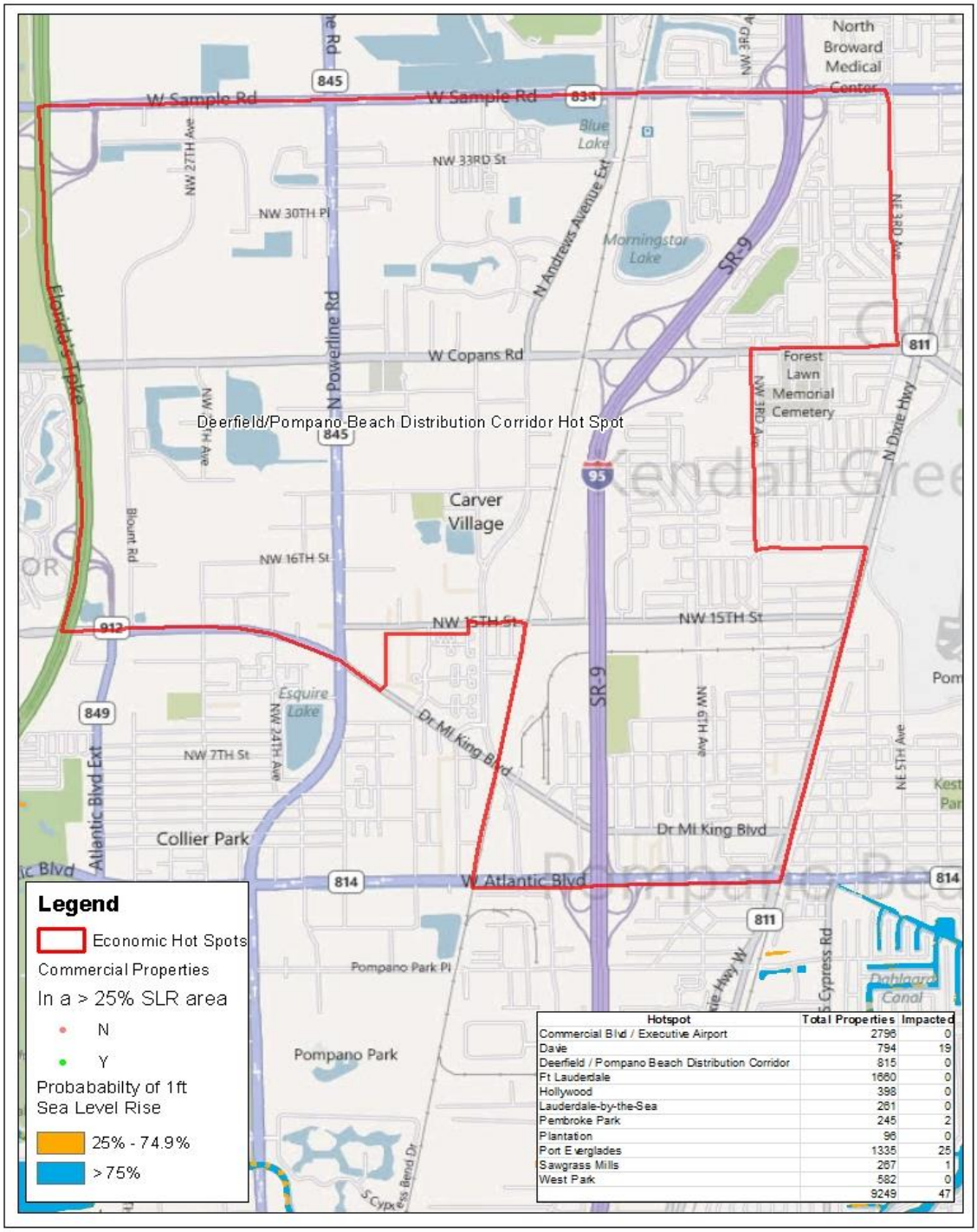
Total Commercial Exposure	Total Economic Loss to Commercial Buildings by Flood*	Business Interruption Costs by Flood**	Property Tax Estimated Loss from Flood	Total Economic Loss to Commercial Buildings by Wind*	Business Interruption Costs by Wind**	Property Tax Estimated Loss from Wind
$1,138,973,000	**$32,950,000**	**$670,000**	**$2,143,518**	**$283,788,210**	**$72,120,870**	**$8,663,725**

Source: Hazus 4.0

* - includes Building, Content, and Inventory
** - Includes Income, Relocation, Rental Income, and Wage

Sea Level Rise 1 foot scenario map

Map 5.8: Deerfield/Pompano Beach Corridor Risk to 1 foot Sea Level Rise



Hotspot	Total Properties	Impacted
Commercial Blvd / Executive Airport	2796	0
Davie	794	19
Deerfield / Pompano Beach Distribution Corridor	815	0
Ft Lauderdale	1660	0
Hollywood	398	0
Lauderdale-by-the-Sea	261	0
Pembroke Park	245	2
Plantation	96	0
Port Everglades	1335	25
Sawgrass Mills	267	1
West Park	582	0
	9249	47

Source: Broward County Property Appraiser GIS, US Census 2010, NOAA, FDEM, SFWMD, and FEMA Q3 Data

Downtown Fort Lauderdale

General Information

Fort Lauderdale is the largest municipality in Broward County, the primary seat of government, and has the densest business cluster in the county. The downtown Fort Lauderdale hotspot is a cluster of census block groups that is approximately bounded by NE 13th Street to the north and SE 17th Street to the south. Of special interest are the areas along both branches of the New River.

Key Infrastructure, Facilities, and Businesses

Fort Lauderdale Business and Economy:
http://www.fortlauderdale.gov/departments/sustainable-development/economic-development
Downtown Development Authority of Fort Lauderdale: http://www.ddaftl.org/

- Las Olas Boulavard and Las Olas Riverfront (Center) and Shops (b/w SW 2nd and River)
- Himmarshee Entertainment Districts
- Broward County Governmental Center (NW corner S Andrews/SW 2nd)
- ANC Plaza (SE corner S Andrews/SW 2nd)
- Broward College-Downtown Center (and FAU campus)
- Museum of Ft Lauderdale (S Andrews/ Las Olas)

Largest companies located in Fort Lauderdale

- AutoNation: Revenue: $20.8 billion
- Citrix Systems: Revenue: $3.2 billion
- Mednax: Revenue: $2.7 billion
- Spirit Airlines: Revenue: $2.1 billion
- Helco Corp.: Revenue: $1.1 billion
- Seacor Holdings: Revenue: $1.05 billion

Public Facilities located in Downtown Fort Lauderdale:

- Riverwalk art & entertainment district of Fort Lauderdale (http://www.riverwalkae.com/press-room/)
- Broward County Library
- Broward College Downtown Center and downtown Florida Atlantic University campus
- Main Broward County Jail along River near SE 3rd Street and Andrews Avenue
- Fort Lauderdale Historical Society
- Museum of Art Fort Lauderdale
    - "The Museum of Art has become one of South Florida's leading cultural attractions; since 2003, it has broken all South Florida museum records by hosting more than 1 million visitors…"
    - "And generated more than $200 million in economic impact to our region." (http://nsuartmuseum.org/)
- Museum of Discovery and Science (www.mods.org)
    - Over 450,000 visitors annually
    - IMAX Theatre (Biggest screen in South Florida)
- Broward Center for the Performing Arts (https://www.browardcenter.org/)
    - 3 Theatres; Combined total capacity = 3,790
    - One of nation's most visited theatres
    - Ranked #4 in World by Venues Today

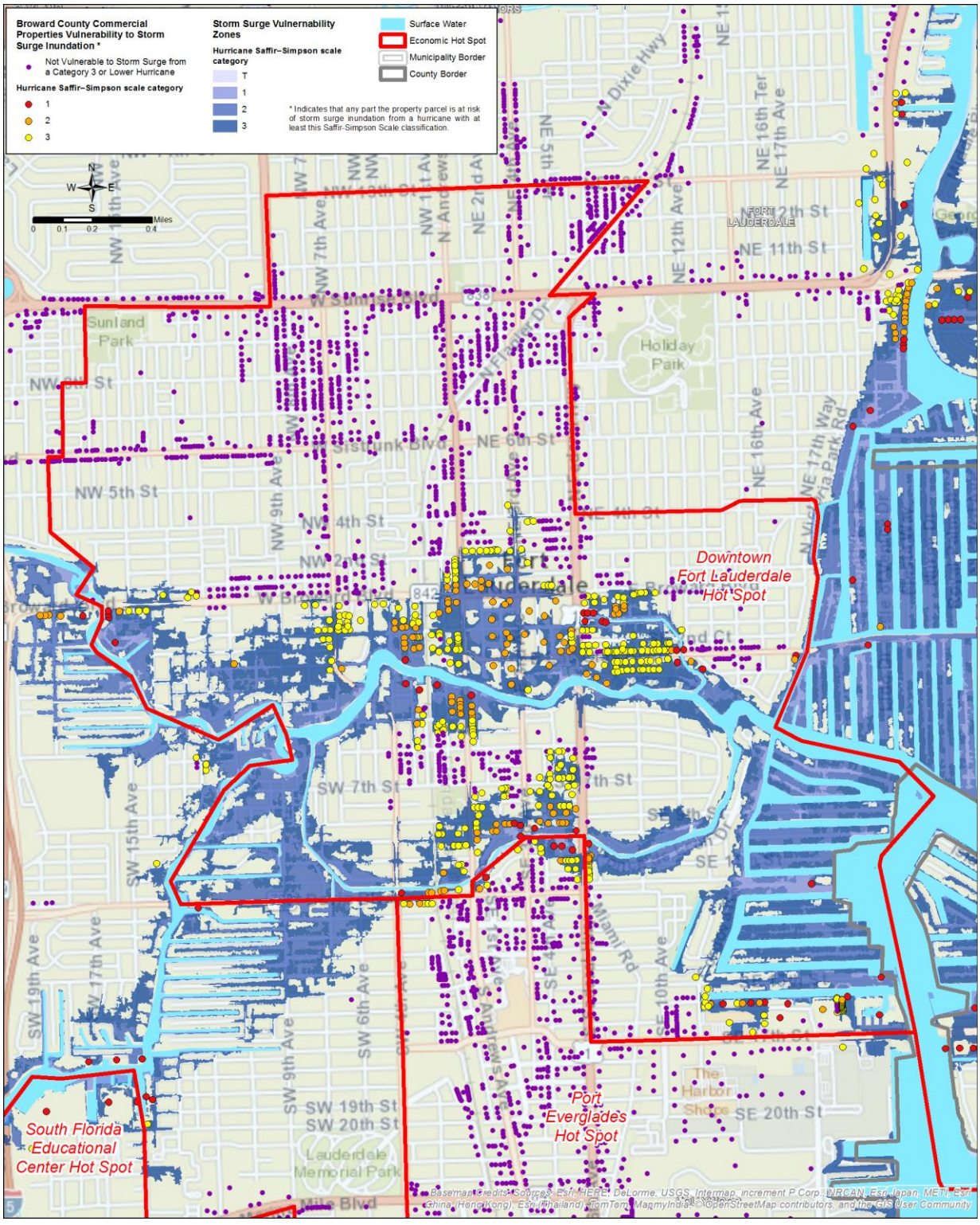
Key Economic Sectors

Table 5.11: Selected Economic Statistics for Fort Lauderdale - 2012 (larger than hot spot area) – by Annual Payroll

Industry	Number of Establish-ments	Sales, Shipments, Receipts	Annual Payroll	Number of Employees
Administrative and Support and Waste Mang and Remediation Srvs	752	2,989,327	1,941,563	46,872
Professional, scientific, and technical services	2,319	2,716,277	1,134,607	14,924
Health care and social assistance	938	2,431,845	972,737	20,654
Information	234	N/A	866,033	6,808
Retail trade	1,161	4,045,258	367,792	12,021
Accommodation and food services	710	1,934,420	464,751	20,279
Real estate and rental and leasing	708	1,279,510	186,423	3,644
Other services (except public administration)	805	609,482	166,015	4,822
Arts, entertainment, and recreation	161	193,657	39,722	1,286

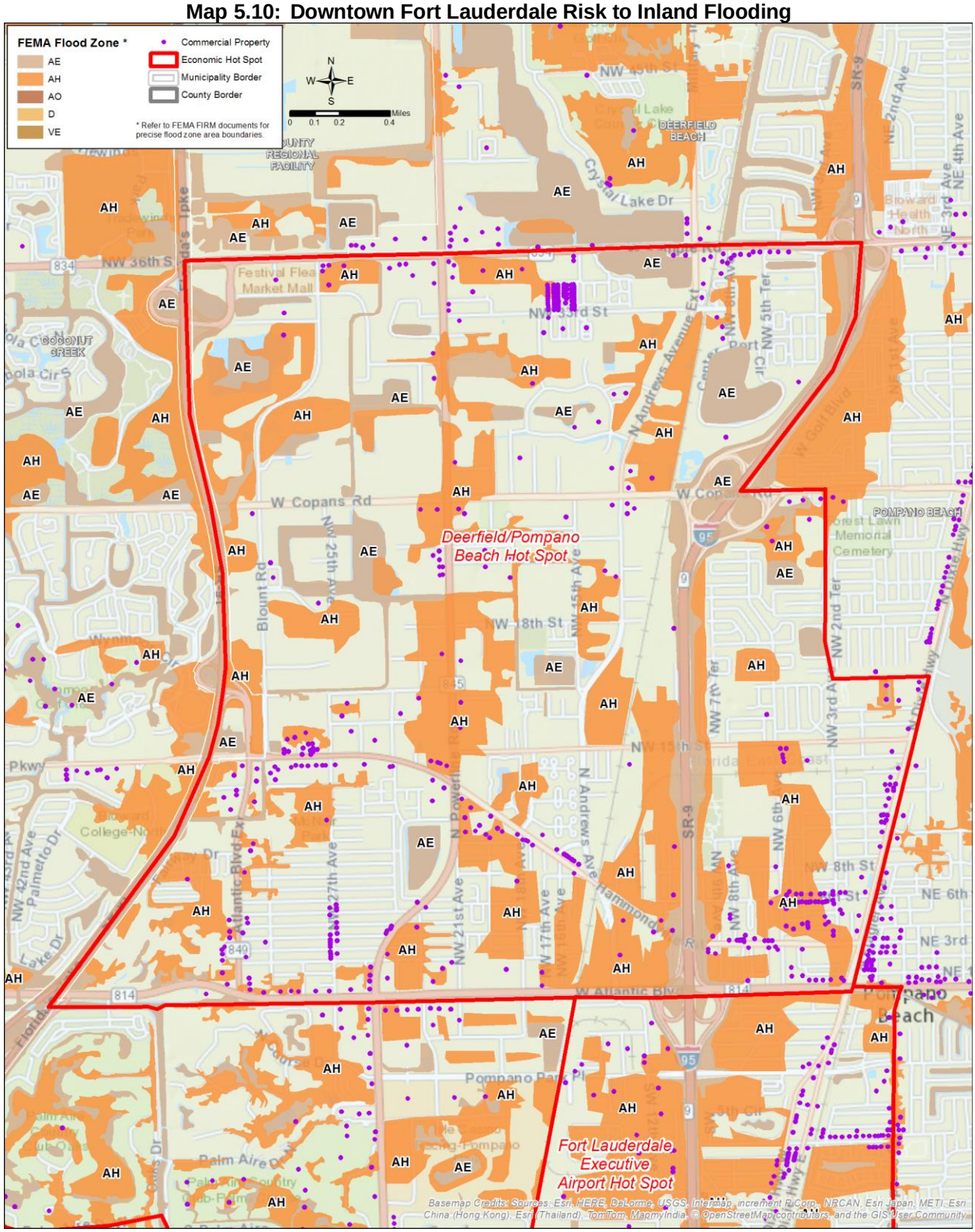
Source: U.S. Census Bureau (http://factfinder.census.gov)

Map 5.9: Downtown Fort Lauderdale Risk to Storm Surge



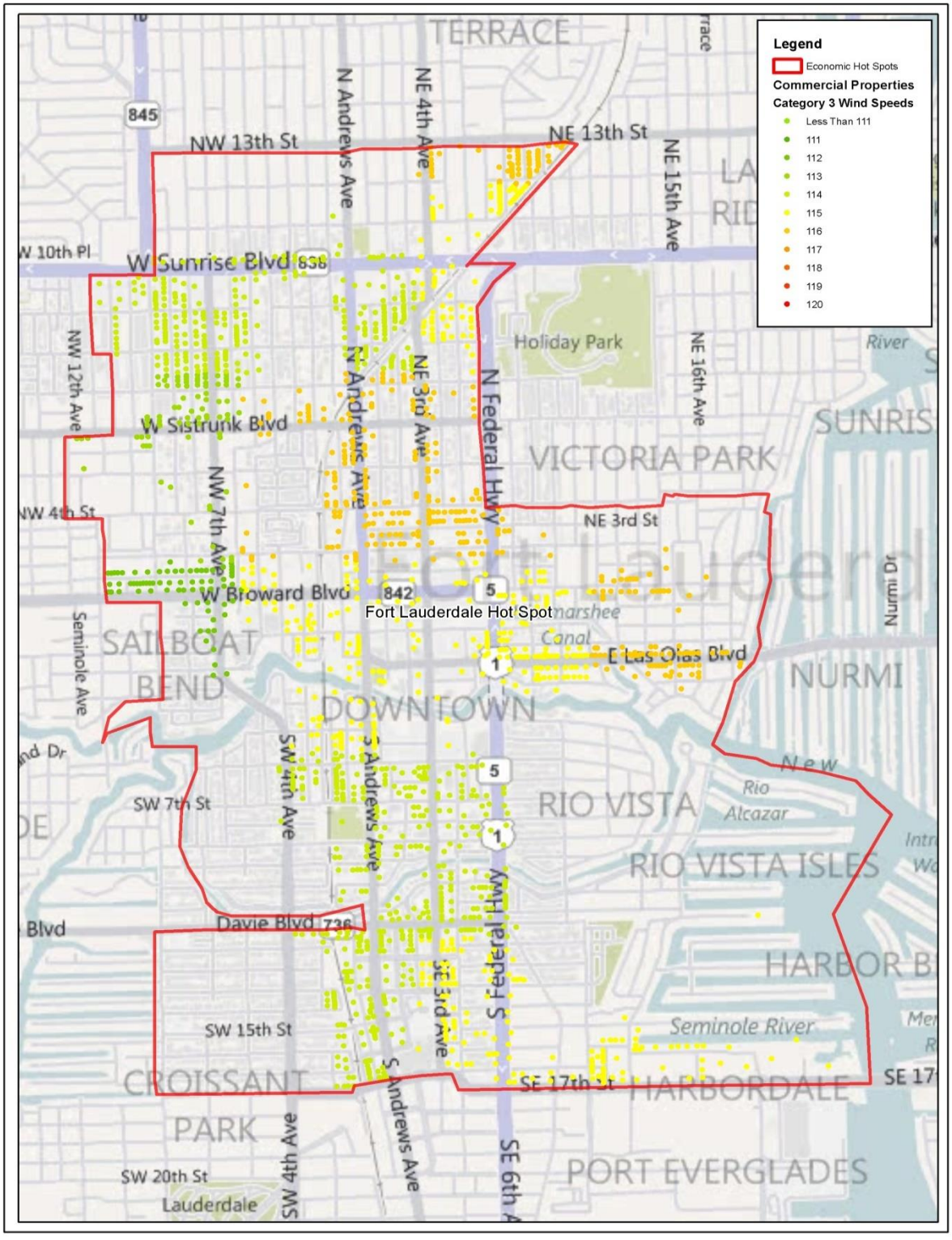
Source: Broward County Property Appraiser GIS, US Census 2010, NOAA, FDEM, SFWMD, and FEMA Q3 Data

Map 5.10: Downtown Fort Lauderdale Risk to Inland Flooding



Source: Broward County Property Appraiser GIS, US Census 2015, SFWMD, and FEMA NFHL

Map 5.11: Downtown Fort Lauderdale Risk to High Winds



Source: Broward County Property Appraiser GIS, US Census 2010, and FDEM Hazard Grid

Hazus Information

Table 5.12: Hazus and Property Tax Data for Downtown Fort Lauderdale Hot Spot

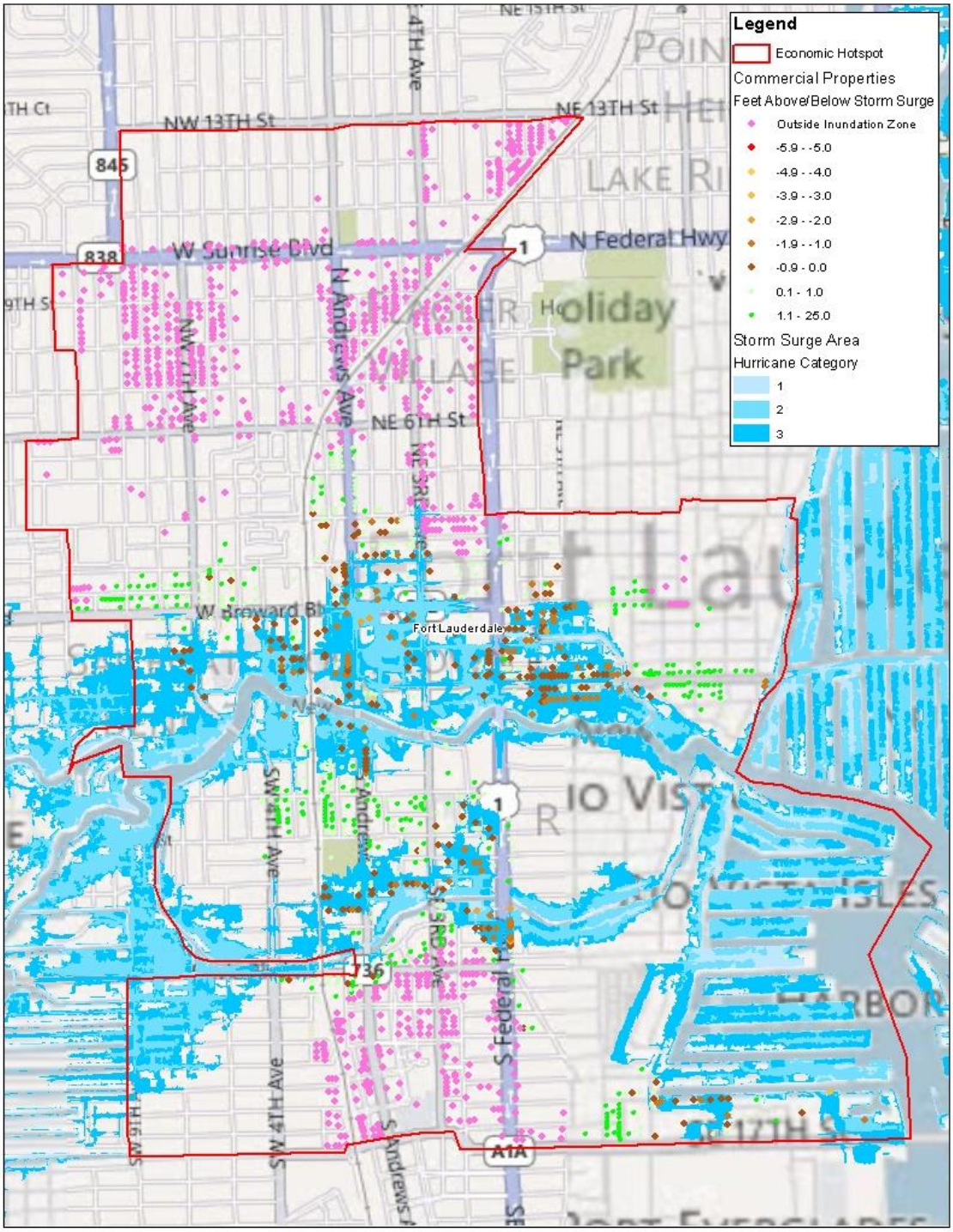
Total Commercial Exposure	Total Economic Loss to Commercial Buildings by Flood*	Business Interruption Costs by Flood**	Property Tax Estimated Loss from Flood	Total Economic Loss to Commercial Buildings by Wind*	Business Interruption Costs by Wind**	Property Tax Estimated Loss from Wind
$1,711,426,000	**$158,480,000**	**$5,370,000**	**$30,888,183**	**$389,904,890**	**$155,516,170**	**$15,296,484**

Source: Hazus 4.0

* - includes Building, Content, and Inventory
** - Includes Income, Relocation, Rental Income, and Wage

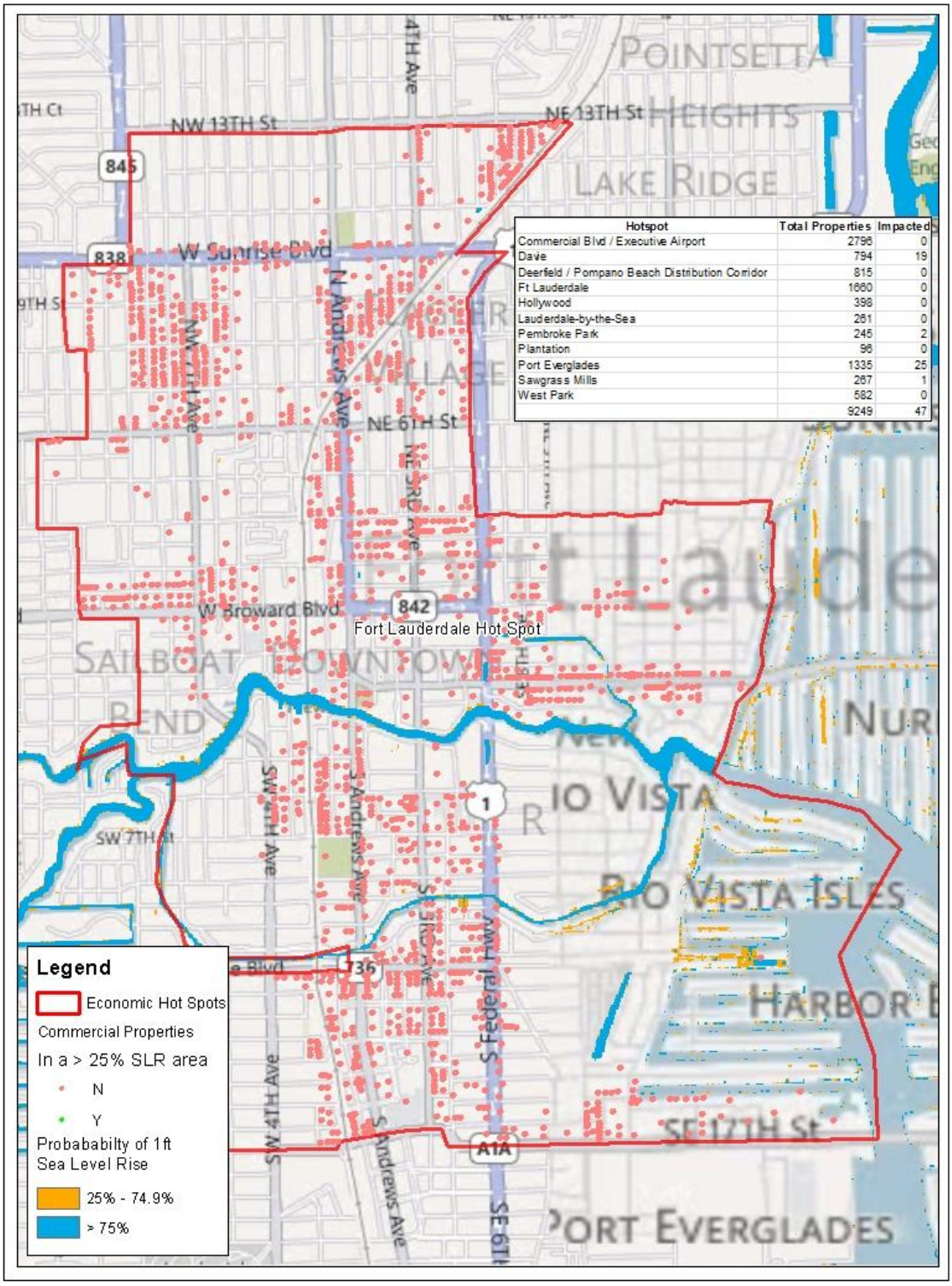
Storm Surge Depth Grid Maps and Sea Level Rise 1-foot scenario

Map 5.12: Downtown Fort Lauderdale Storm Surge Depth Grids



Source: Broward County Property Appraiser GIS, US Census 2010, NOAA, FDEM, SFWMD, and FEMA Q3 Data

Map 5.13: Downtown Fort Lauderdale Risk to 1 foot Sea Level Rise



Hotspot	Total Properties	Impacted
Commercial Blvd / Executive Airport	2796	0
Davie	794	19
Deerfield / Pompano Beach Distribution Corridor	815	0
Ft Lauderdale	1660	0
Hollywood	398	0
Lauderdale-by-the-Sea	261	0
Pembroke Park	245	2
Plantation	96	0
Port Everglades	1335	25
Sawgrass Mills	267	1
West Park	582	0
	9249	47

Source: Broward County Property Appraiser GIS, US Census 2010, NOAA, FDEM, SFWMD, and FEMA Q3 Data

Fort Lauderdale Uptown Business/Executive Airport

General Information

This hot spot is an area of diverse set of businesses centered around the Fort Lauderdale Executive Airport. The approximate boundaries are Oakland Park Boulevard to the south and Atlantic Boulevard to the north (see maps 5.11 – 5.13)

Key Infrastructure, Facilities, and Businesses

Fort Lauderdale Uptown Business/Executive Airport (all info from www.flyfxe.com/about-fxe/general-information)

- Nearly 200,000 visitors arrive into the area through Executive Airport each year.
- Serves over 160,000 aircraft operations per year
- Aviation businesses employ more than 5,100 local residents
- Generate approximately $839 million in economic impact in the community each year.
- Office and manufacturing businesses in the Airport's Industrial Airpark generate $155 million a year in economic activity and employ and additional 2,200 people.
- Approximately 1,200 acres
- Centrally located in Uptown Business District; close to Downtown, I-95, Florida Turnpike
- 61st busiest airport overall
- Over 700 aircraft make Executive Airport their year-round home
- Port of entry airport, with Customs services

Cypress Creek Tri-Rail Station
Fort Lauderdale Stadium
Lockhart Stadium

Key Businesses and Government Facilities

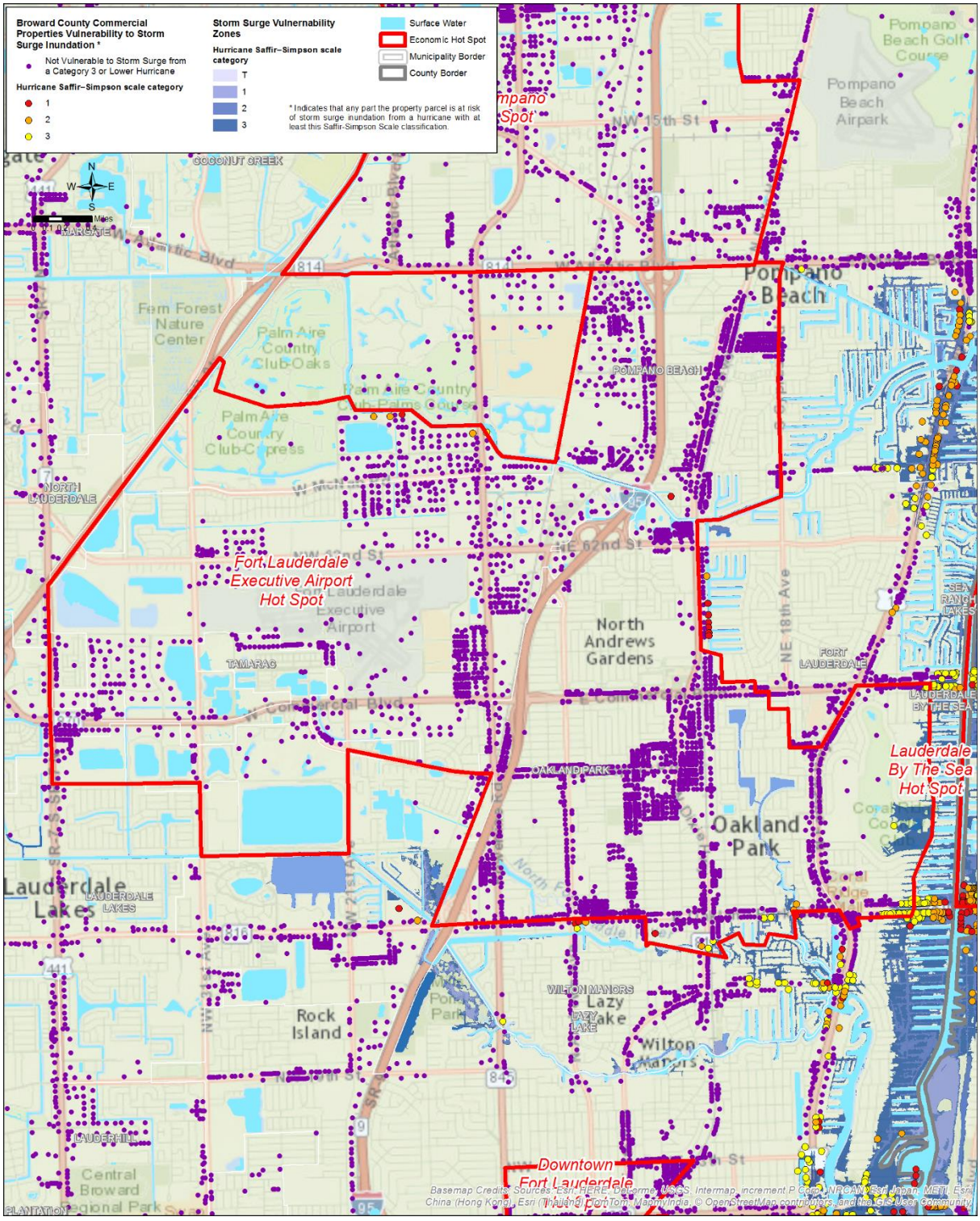
- Citrix (I-95 and Commercial Boulevard)
- Spectrum
- Florida Department of Children and Families
- City College of Fort Lauderdale
- N. Broward Government Center
- Florida Department of Transportation (FDOT)

Key Economic Sectors

See Downtown Fort Lauderdale Hot Spot table for information on Fort Lauderdale.

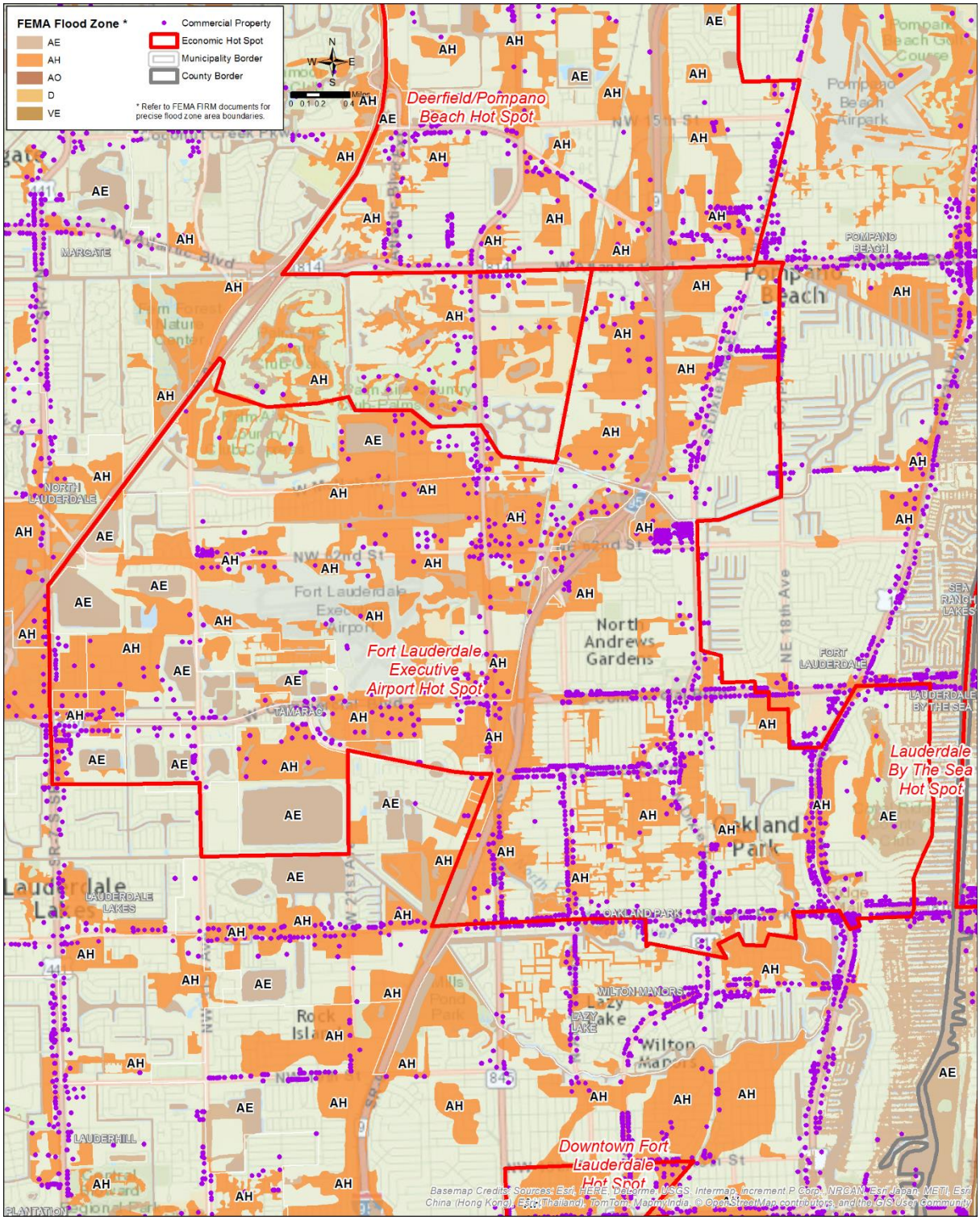
Maps

Map 5.14: Fort Lauderdale Executive Airport Risk to Storm Surge



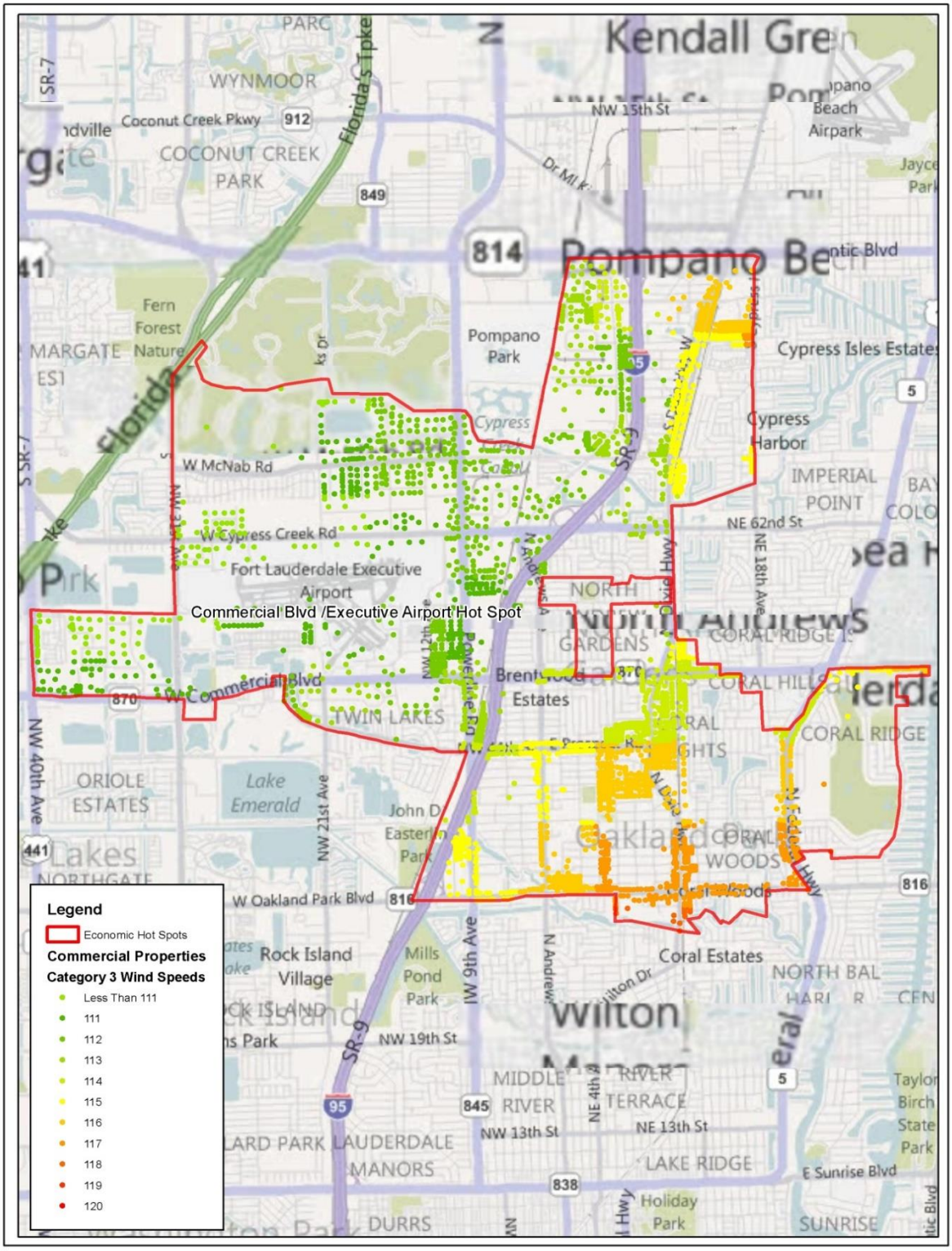
Source: Broward County Property Appraiser GIS, US Census 2010, NOAA, FDEM, SFWMD, and FEMA Q3 Data

Map 5.15: Fort Lauderdale Executive Airport Risk to Inland Flooding



Source: Broward County Property Appraiser GIS, US Census 2015, SFWMD, and FEMA NFHL

Map 5.16: Fort Lauderdale Executive Airport Risk to High Winds



Source: Broward County Property Appraiser GIS, US Census 2010, and FDEM Hazard Grid

Hazus Information

Table 5.13: Hazus and Property Tax Data for Fort Lauderdale Executive Airport Hot Spot

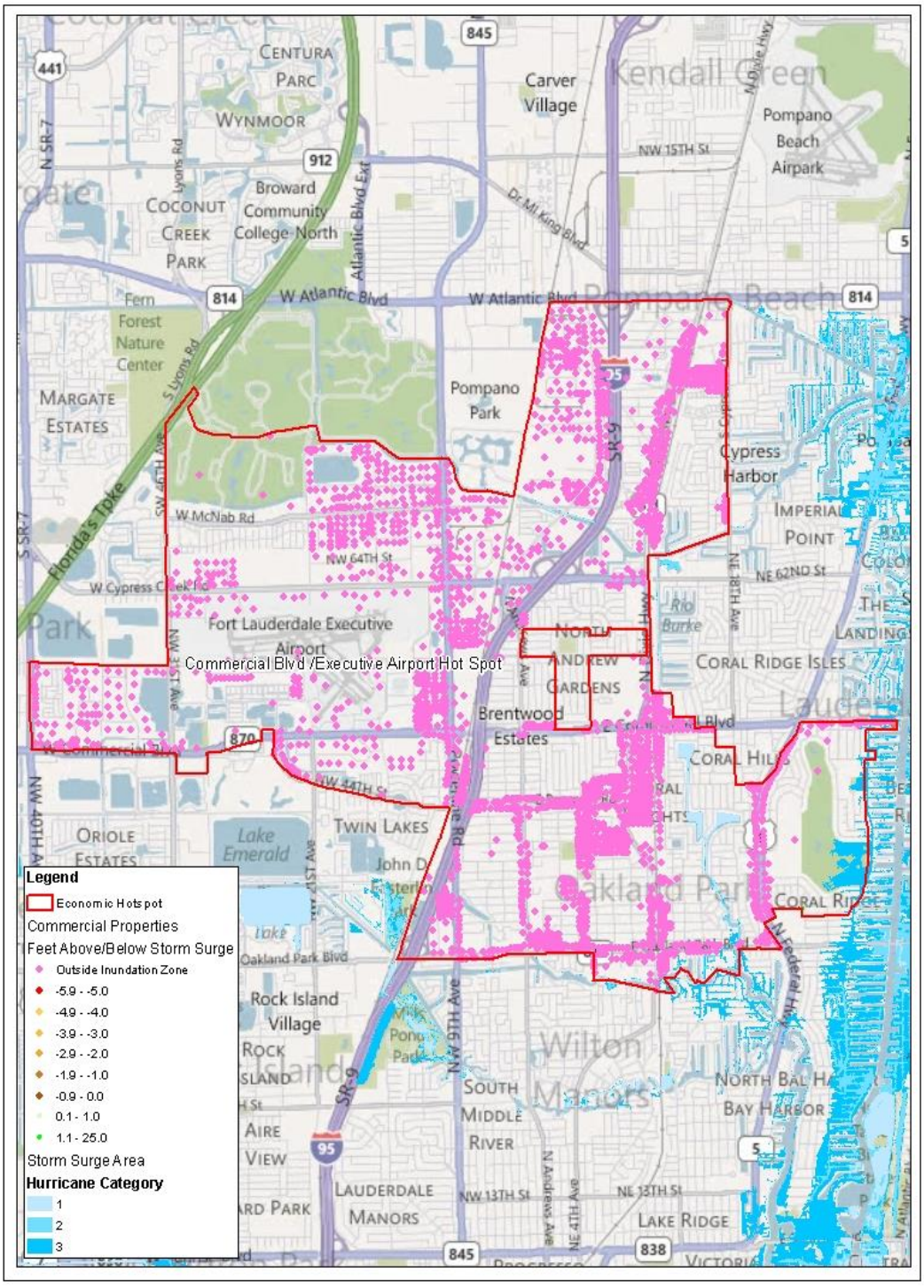
Total Commercial Exposure	Total Economic Loss to Commercial Buildings by Flood*	Business Interruption Costs by Flood**	Property Tax Estimated Loss from Flood	Total Economic Loss to Commercial Buildings by Wind*	Business Interruption Costs by Wind**	Property Tax Estimated Loss from Wind
$3,437,875,000	$83,010,000	$3,030,000	$20,038,205	$806,114,320	$269,054,440	$23,978,175

Source: Hazus 4.0

* - includes Building, Content, and Inventory
** - Includes Income, Relocation, Rental Income, and Wage

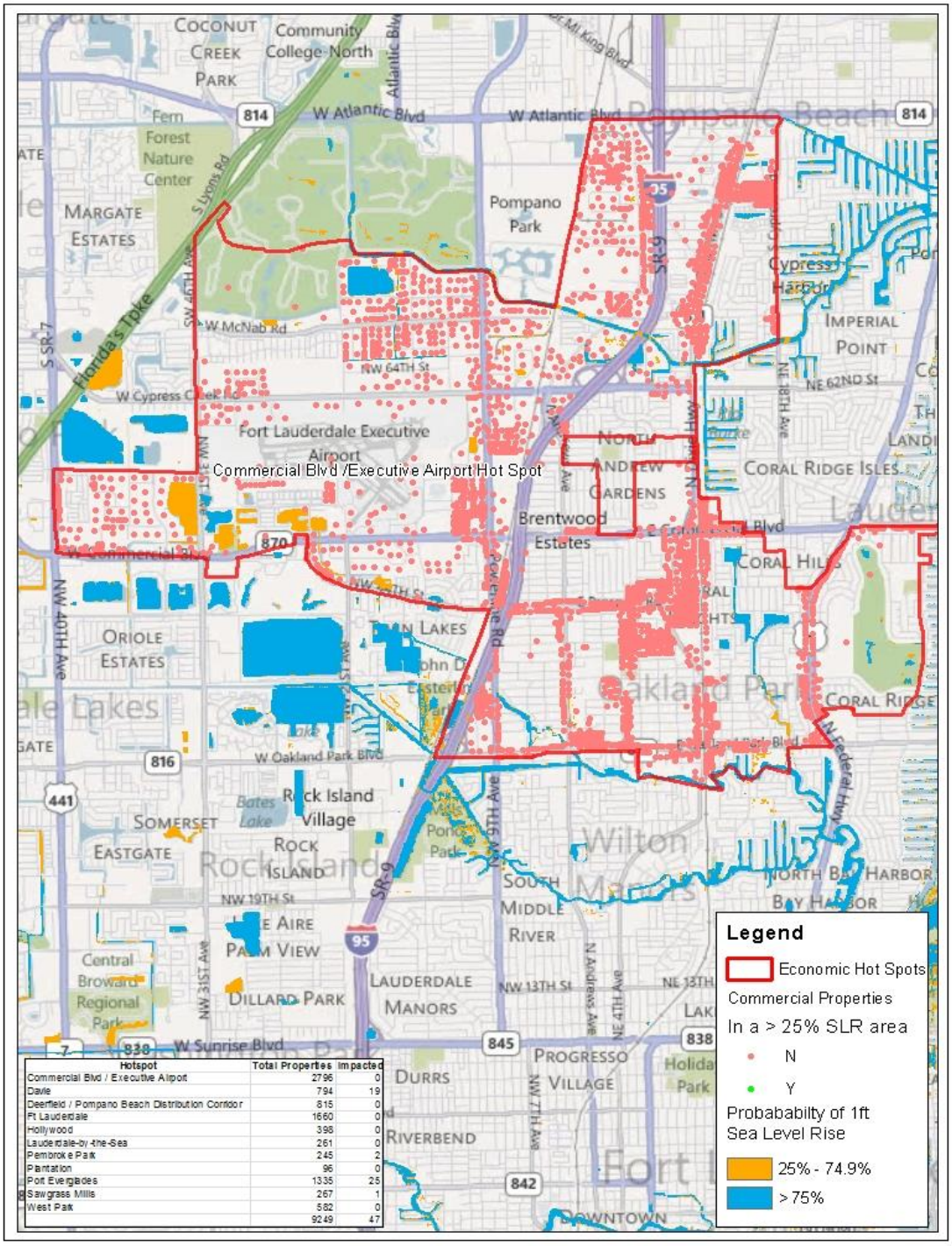
Storm Surge Depth Grid Maps and Sea Level Rise 1-foot scenario

Map 5.17: Fort Lauderdale Executive Airport Storm Surge Depth Grids



Source: Broward County Property Appraiser GIS, US Census 2010, NOAA, FDEM, SFWMD, and FEMA Q3 Data

Map 5.18: Fort Lauderdale Executive Airport Risk to 1 foot Sea Level Rise



Hotspot	Total Properties	Impacted
Commercial Blvd / Executive Airport	2796	0
Davie	794	19
Deerfield / Pompano Beach Distribution Corridor	615	0
Ft Lauderdale	1660	0
Hollywood	398	0
Lauderdale-by-the-Sea	261	0
Pembroke Park	245	2
Plantation	96	0
Port Everglades	1335	25
Sawgrass Mills	267	1
West Park	582	0
	9249	47

Source: Broward County Property Appraiser GIS and US Census 2010

Downtown Hollywood

General Information

While one of Hollywood's largest attractions is its beach area which includes Florida's only oceanfront boardwalk, this hot spot analysis will focus on the downtown area which has the largest concentration of businesses. It is partially dependent on the beach area for business but also serves the local population.

Key Infrastructure, Facilities, and Businesses:

- Kindred Hospital of Hollywood
  - 124 licensed beds, a 9-bed intensive care unit, a 16-bed telemetry unit, and 99 medical-surgical beds
  - http://www.khsfhollywood.com/about-us/
- Jimmy Buffet's Margaritaville resort complex (located in Hollywood Beach which is outside the hot spot but will likely bring more people to downtown)
- Memorial Health Care Systems' Joe DiMaggio's Children's Hospital is now open for business.
  - Memorial Health Care Systems is Hollywood's largest employer

Key Economic Sectors

Table 5.14: Selected Economic Statistics for Hollywood - 2012 –by Annual Payroll [larger than hot spot area]

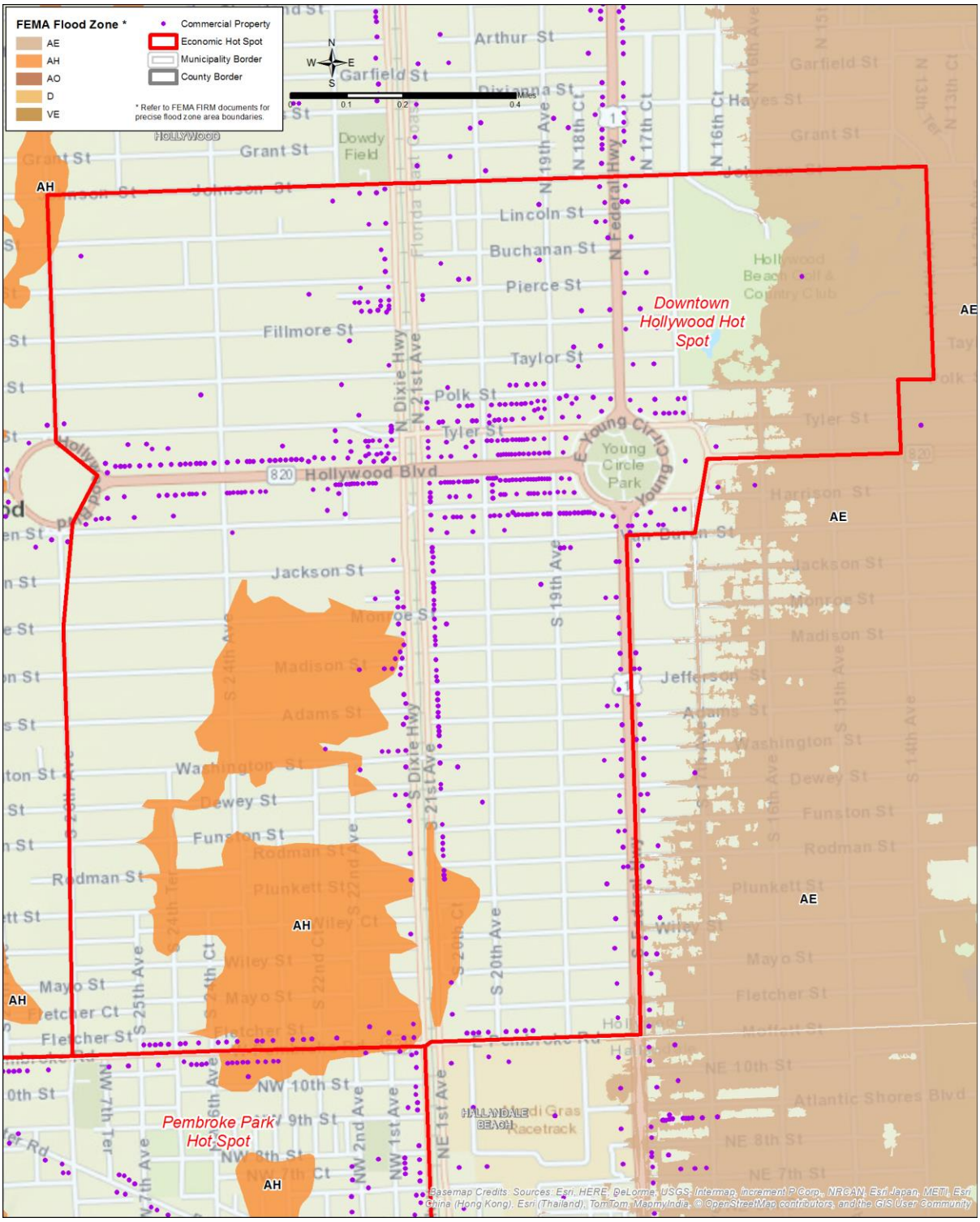
Industry	Number of Establish-ments	Sales, Shipments, Receipts	Annual Payroll	Number of Employees
Health care and social assistance	568	1,500,696	636,589	11,467
Professional, scientific, and technical services	905	541,188	199,979	3,385
Retail trade	573	1,916,113	159,039	6,316
Administrative and Support and Waste Mang and Remediation Srvs	303	308,198	113,043	4,230

Industry	Number of Establish-ments	Sales, Shipments, Receipts	Annual Payroll	Number of Employees
Accommodation and food services	330	427,579	115,833	5,5683
Manufacturing	96	249,098	44,824	1,125
Other services (except public administration)	319	198,461	55,391	1,934
Information	82	N/A	49,949	2,319

Source: U.S. Census Bureau (http://factfinder.census.gov)

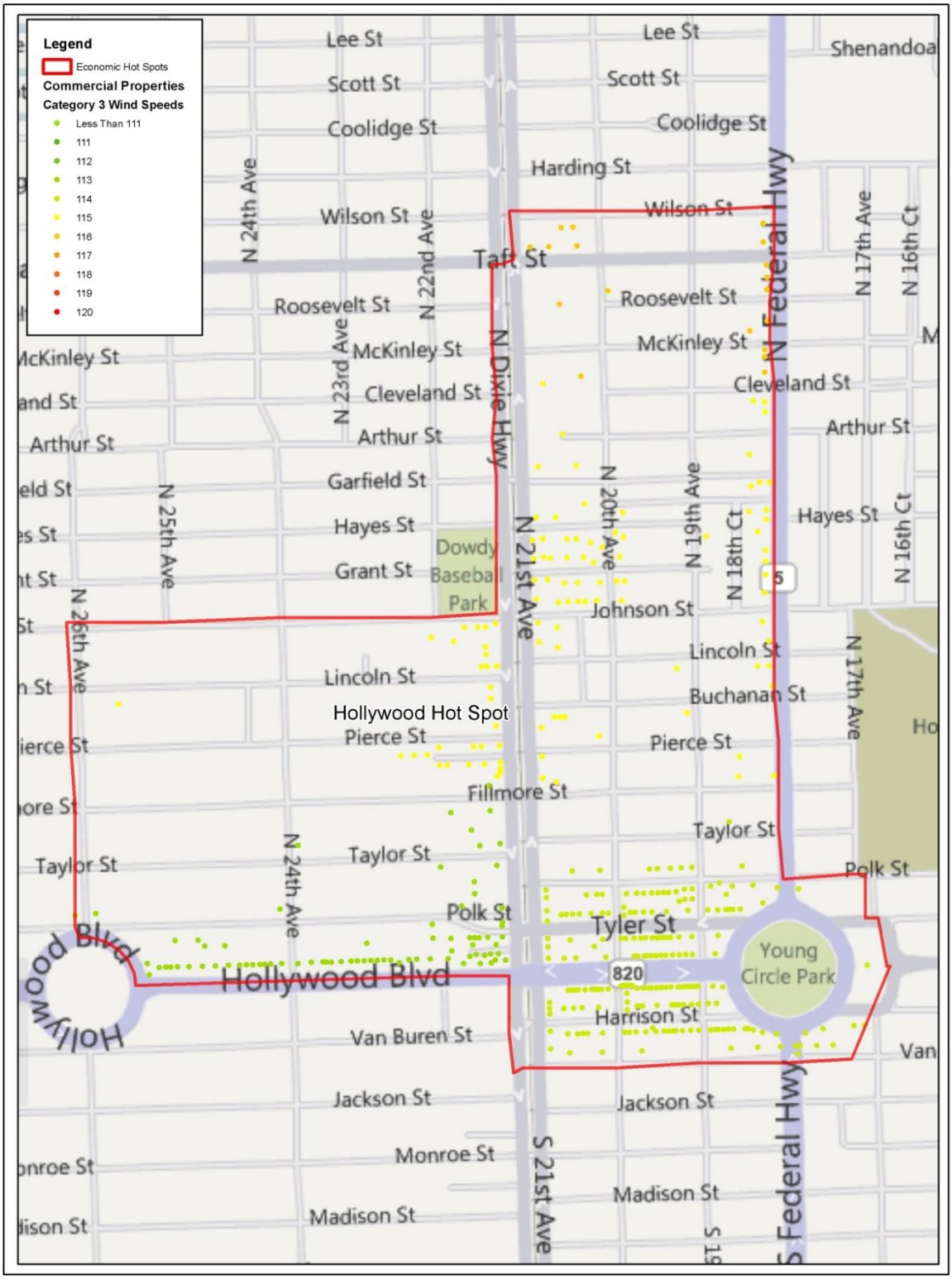
Maps

Map 5.19: Downtown Hollywood Risk to Inland Flooding



Source: Broward County Property Appraiser GIS, US Census 2015, SFWMD, and FEMA NFHL

Map 5.20: Downtown Hollywood Risk to High Winds



Source: Broward County Property Appraiser GIS, US Census 2010, and FDEM Hazard Grid

Hazus Information

Table 5.15: Hazus and Property Tax Data for Downtown Hollywood Hot Spot

Total Commercial Exposure	Total Economic Loss to Commercial Buildings by Flood*	Business Interruption Costs by Flood**	Property Tax Estimated Loss from Flood	Total Economic Loss to Commercial Buildings by Wind*	Business Interruption Costs by Wind**	Property Tax Estimated Loss from Wind
$405,961,000	**$870,000**	**$30,000**	**$372,394**	**$92,460,560**	**$39,926,710**	**$846,417**

Source: Hazus 4.0

* - includes Building, Content, and Inventory
** - Includes Income, Relocation, Rental Income, and Wage

Lauderdale-By-The-Sea

General Information

Lauderdale-By-The-Sea is a small municipality (1.5 square miles) situated between Atlantic Ocean and Intracoastal Waterway. It is located on a barrier island (7 feet above sea level) and 59 % of the town is water. It was declared by Broward County Commission in 1997 as the “Shore Diving Capital of Florida”. Its main economic generators are retail and tourism.

Key Infrastructure, Facilities, and Businesses

- Large wooden pier extends (876 feet) into ocean (off of Commercial Blvd)
- Beach front resorts

Key Economic Sectors

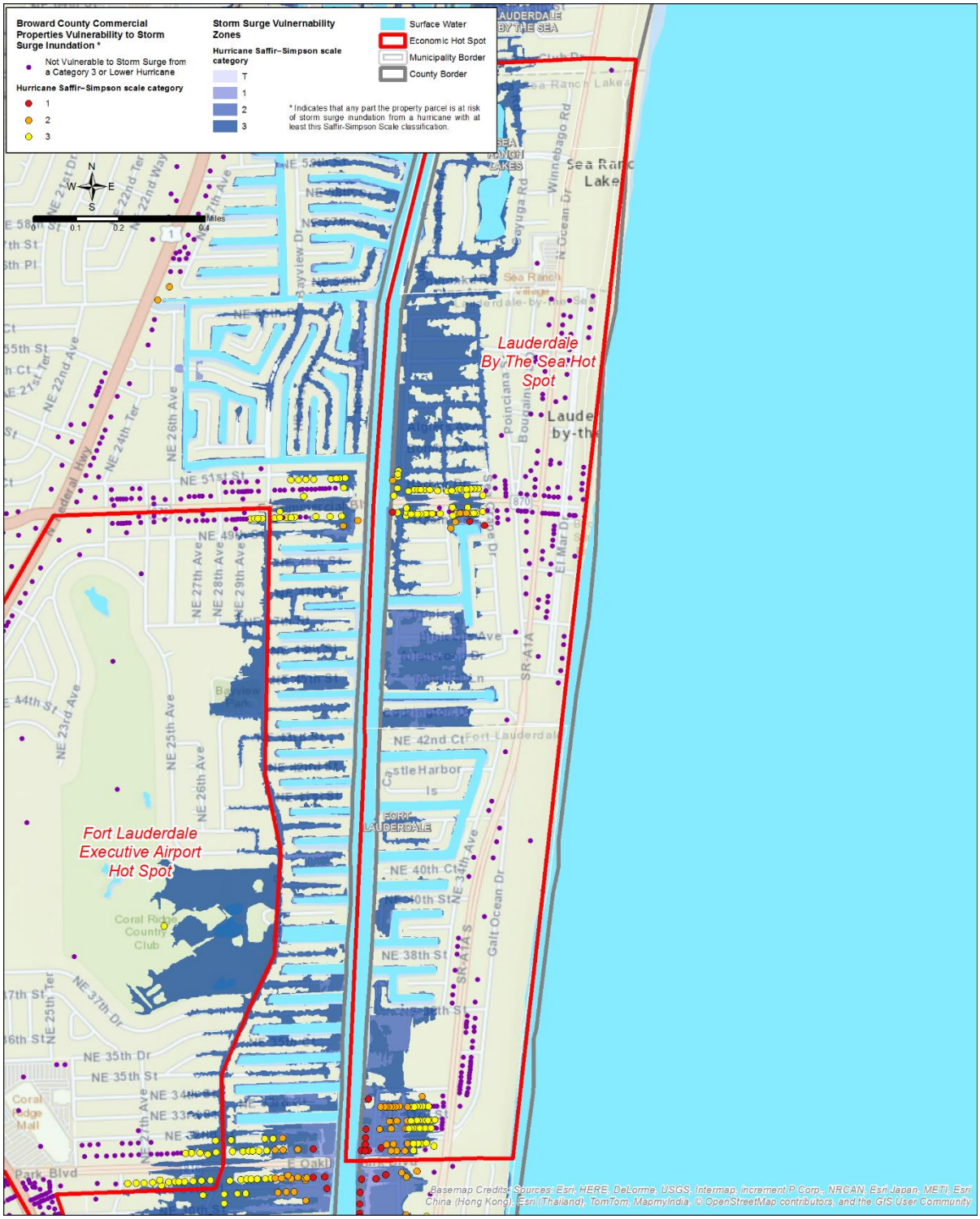
Table 5.16: Selected Economic Statistics for Lauderdale-By-The-Sea - 2012 –by Annual Payroll [larger than hot spot area]

Industry	Number of Establish-ments	Sales, Shipments, Receipts	Annual Payroll	Number of Employees
Accommodation and food services	50	60,903	17,845	862
Other services (except public administration)	39	19,567	4,292	177
Professional, scientific, and technical services	38	19,057	5,338	91
Retail trade	29	23,830	3,435	118
Real estate and rental and leasing	27	11,855	1,457	57
Administrative and Support and Waste Mang and Remediation Srvs	15	N/A	N/A	N/A
Finance and insurance	10		1,277	31
Educational Services	5	3,427	1,155	44

Source: U.S. Census Bureau (http://factfinder.census.gov)

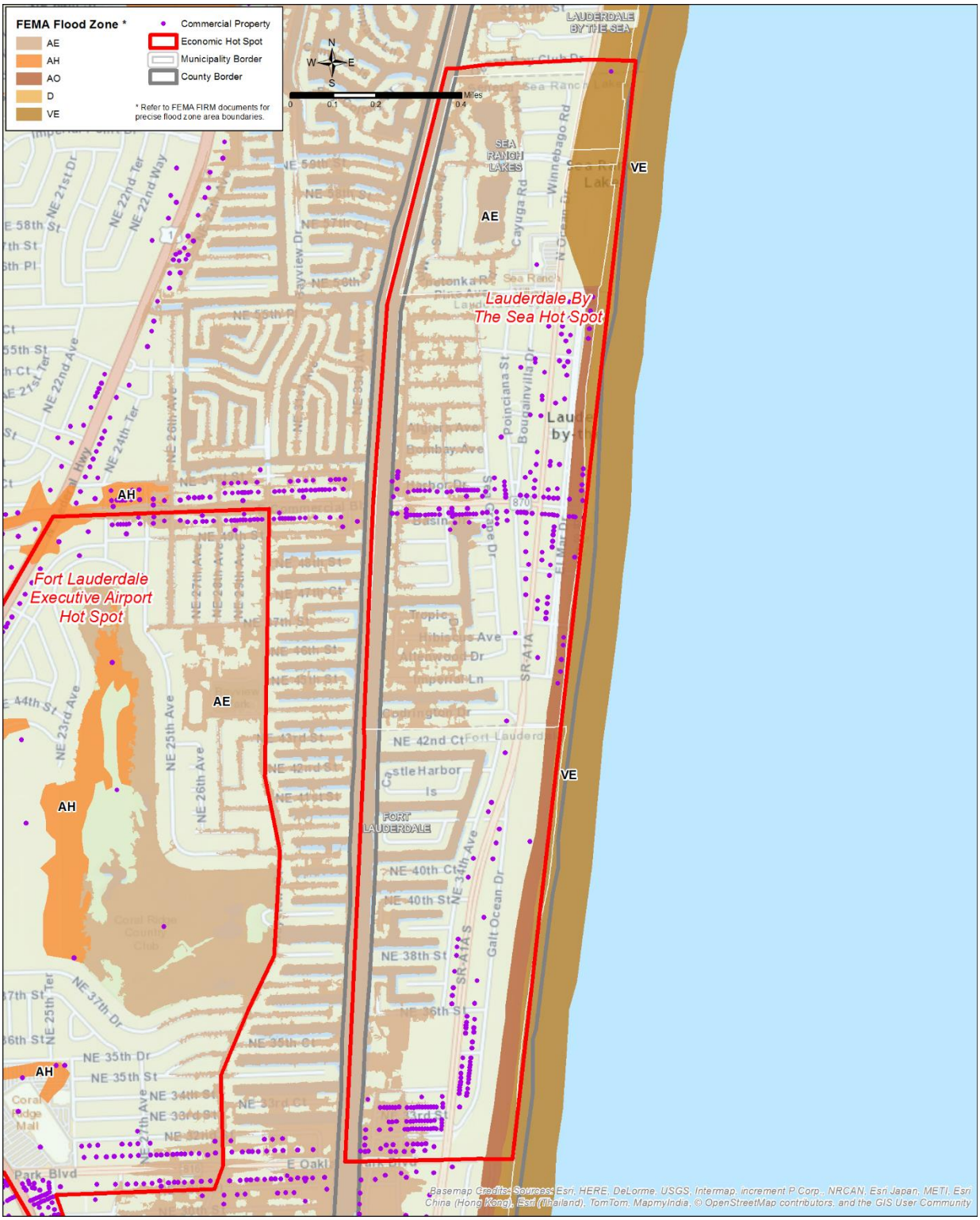
Maps

Map 5.21: Lauderdale-By-The-Sea Risk to Storm Surge



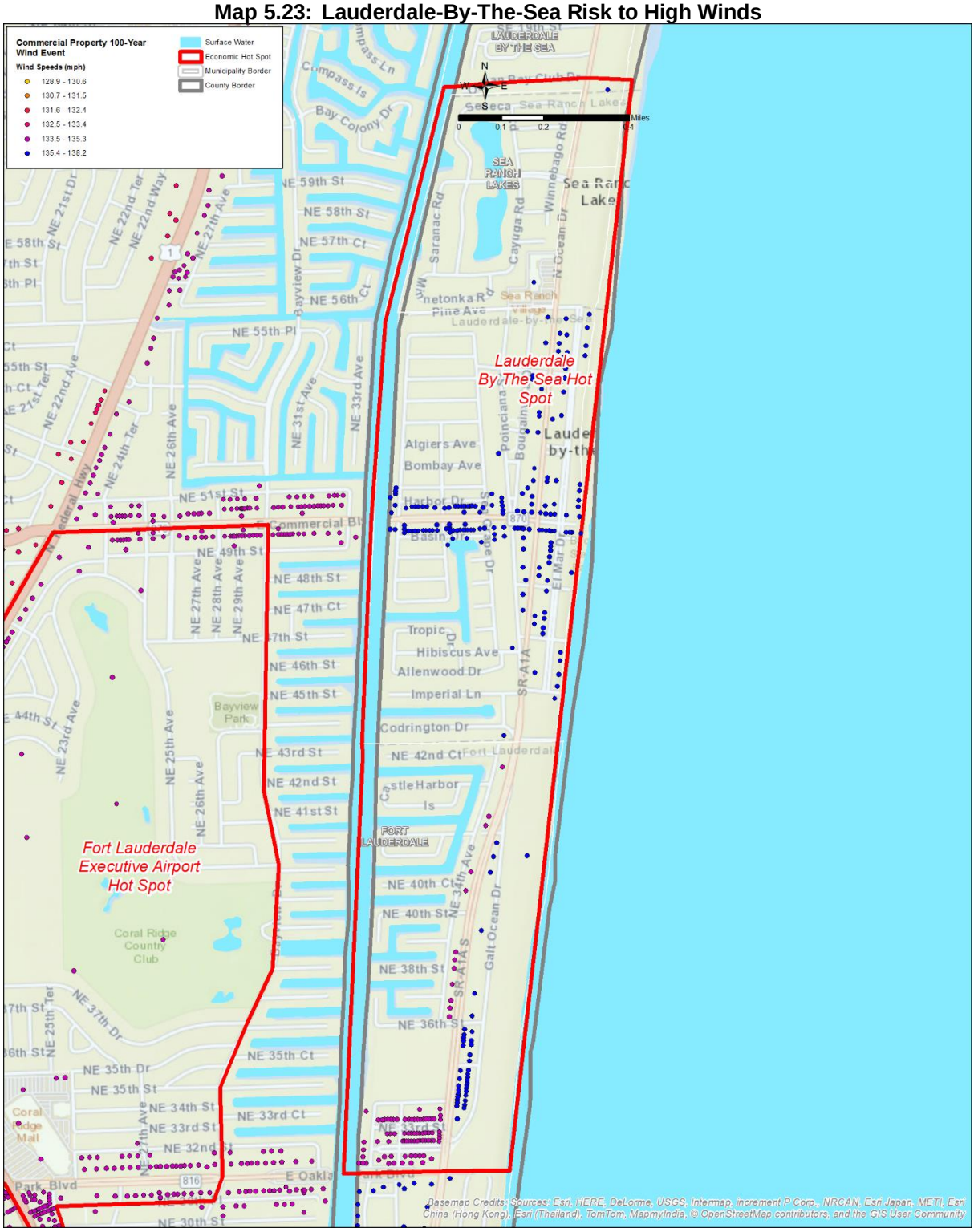
Source: Broward County Property Appraiser GIS, Broward County GIS

Map 5.22: Lauderdale-By-The-Sea Risk to Inland Flooding



Source: Broward County Property Appraiser GIS, US Census 2015, SFWMD, and FEMA NFHL

Map 5.23: Lauderdale-By-The-Sea Risk to High Winds



Source: Broward County Property Appraiser GIS, HAZUS 4.0

Hazus Information

Table 5.17: Hazus and Property Tax Data for Lauderdale-By-The-Sea Hot Spot

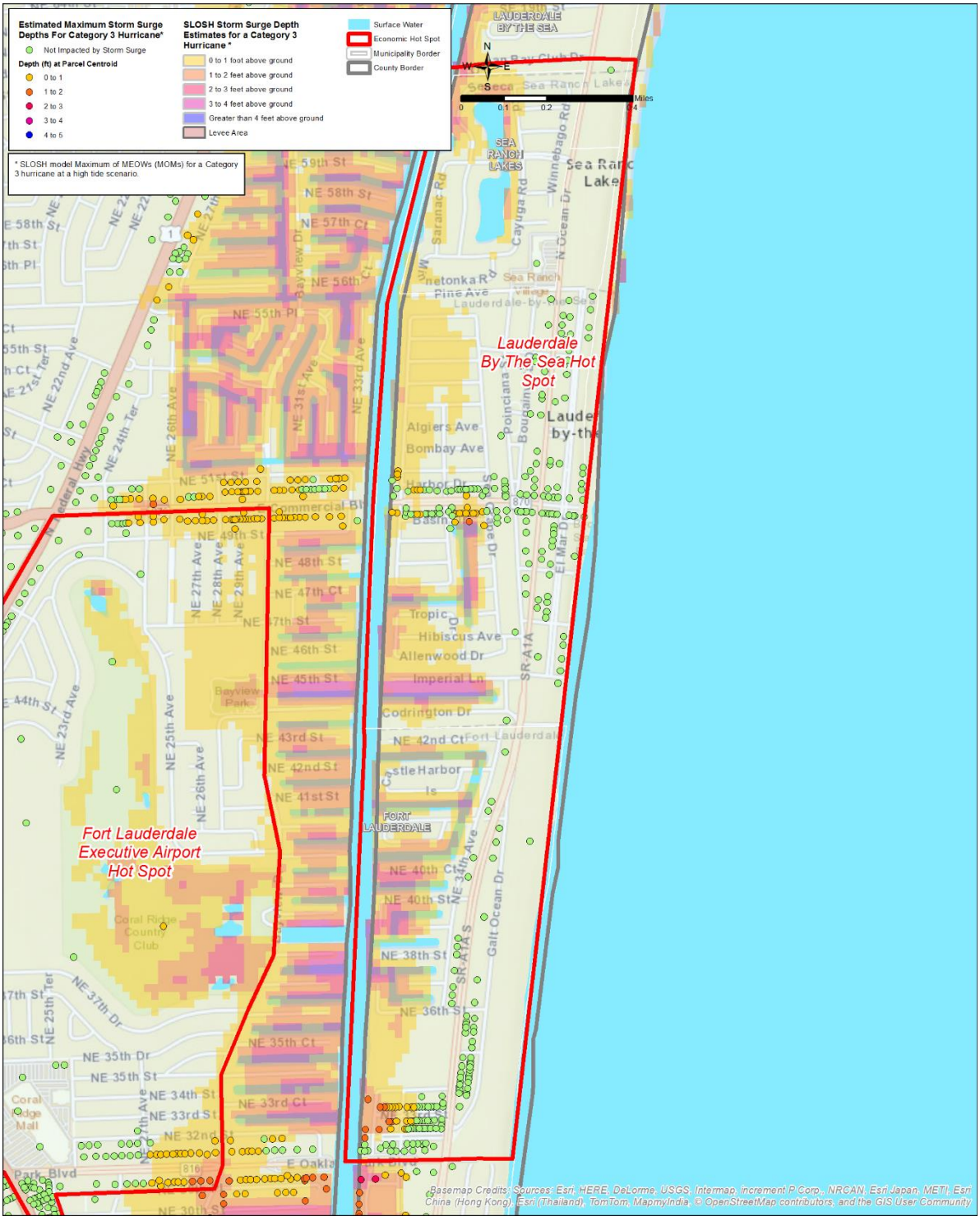
Total Commercial Exposure	Total Economic Loss to Commercial Buildings by Flood*	Business Interruption Costs by Flood**	Property Tax Estimated Loss from Flood	Total Economic Loss to Commercial Buildings by Wind*	Business Interruption Costs by Wind**	Property Tax Estimated Loss from Wind
$224,819,000	**$10,000**	**$0.00**	**$2,312,085**	**$69,992,440**	**$30,803,710**	**$2,413,023**

Source: Hazus 4.0 (flood) and Hazus-MH MR5 (wind)

* - includes Building, Content, and Inventory
** - Includes Income, Relocation, Rental Income, and Wage

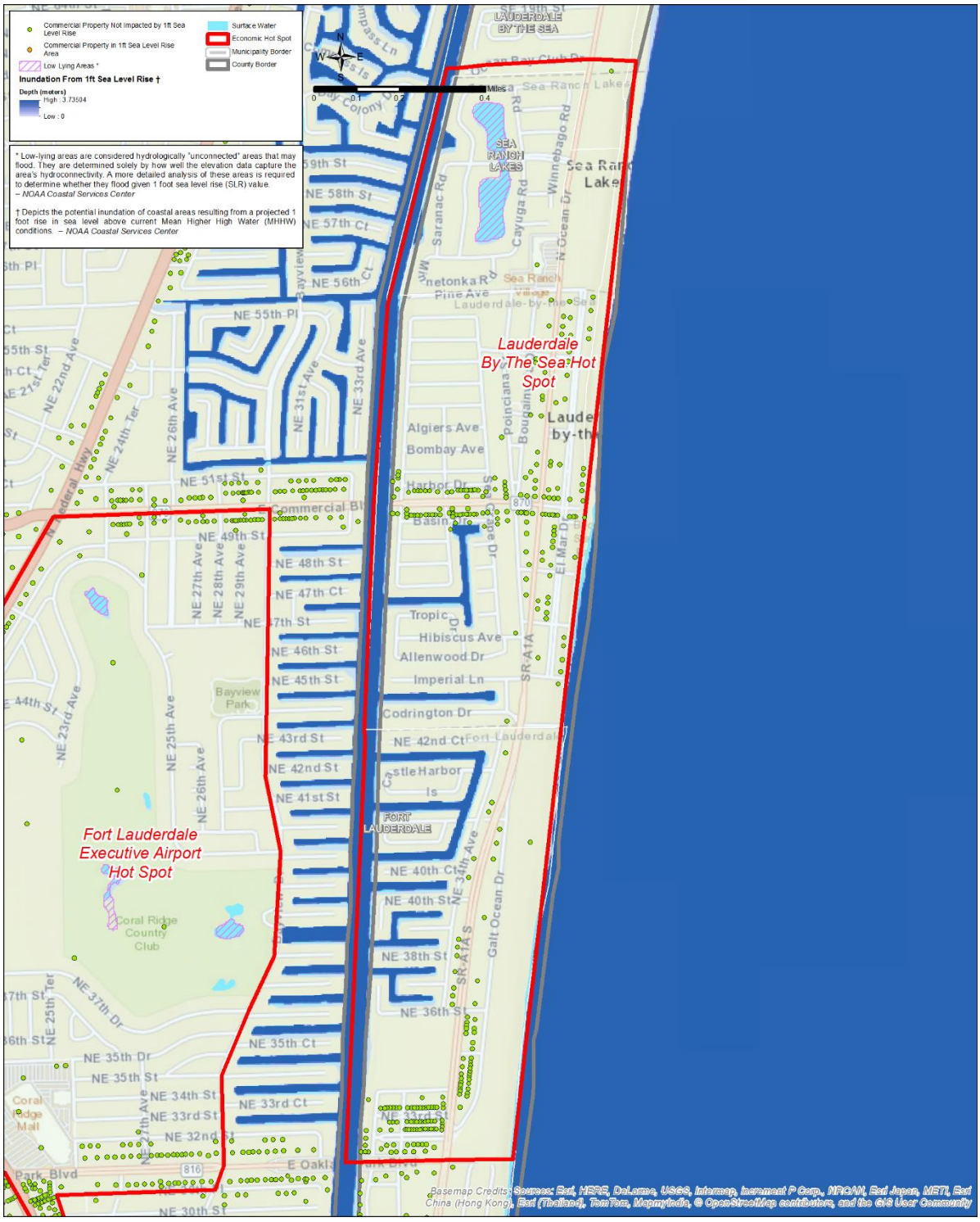
Storm Surge Depth Grid Maps and Sea Level Rise 1 foot scenario

Map 5.24: Lauderdale-By-The-Sea Storm Surge Depth Grid



Source: Broward County Property Appraiser GIS, NOAA SLOSH

Map 5.25: Lauderdale-By-The-Sea Risk to 1 foot Sea Level Rise



Source: Broward County Property Appraiser GIS and NOAA Coastal Services Center

Pembroke Park/West Park

General Information

Pembroke Park and West Park are 2 smaller municipalities in southeastern Broward County near the Miami-Dade County line. Pembroke Park has a robust commercial district along I-95 and has 17 manufactured home parks. Pembroke Park is composed of 2 non-contiguous parts surrounded by West Park, one of the County's newest municipalities having been incorporated in 2005.

Key Infrastructure, Facilities, and Businesses

- Seneca Industrial Park
- WPLG
- Coca-Cola Bottling Plant
- Lakeside Business Park
- Medical Specialties Distributors (MSD) – product distribution and full-service bio-med center

Key Economic Sectors

Table 5.18: Selected Economic Statistics for West Park - 2012–by Annual Payroll [no data available for Pembroke Park /larger than hot spot area]

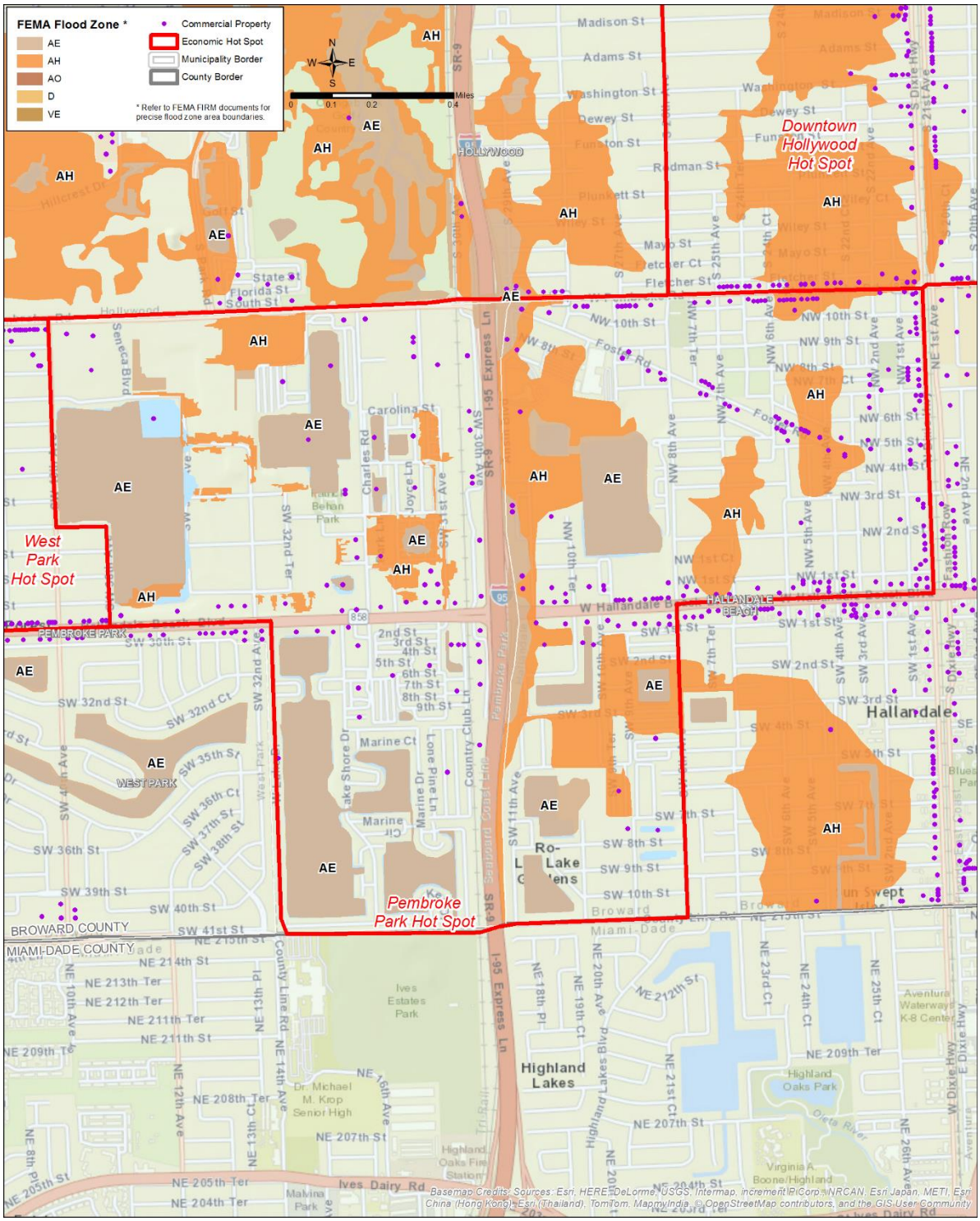
Industry	Number of Establish-ments	Sales, Shipments, Receipts	Annual Payroll	Number of Employees
Manufacturing	23	392,166	13,920	288
Wholesale trade	52	375,596	28,460	645
Retail trade	47	133,864	7,006	264
Administrative and Support and Waste Mang and Remediation Srvs	8	N/A	N/A	N/A
Other services (except public administration)	19	N/A	N/A	N/A
Real estate and rental and leasing	18	N/A	N/A	N/A
Accommodation and food services	14	25,314	4,370	226

Professional, scientific, and technical services	8	N/A	M/A	N/A

Source: U.S. Census Bureau (http://factfinder.census.gov)

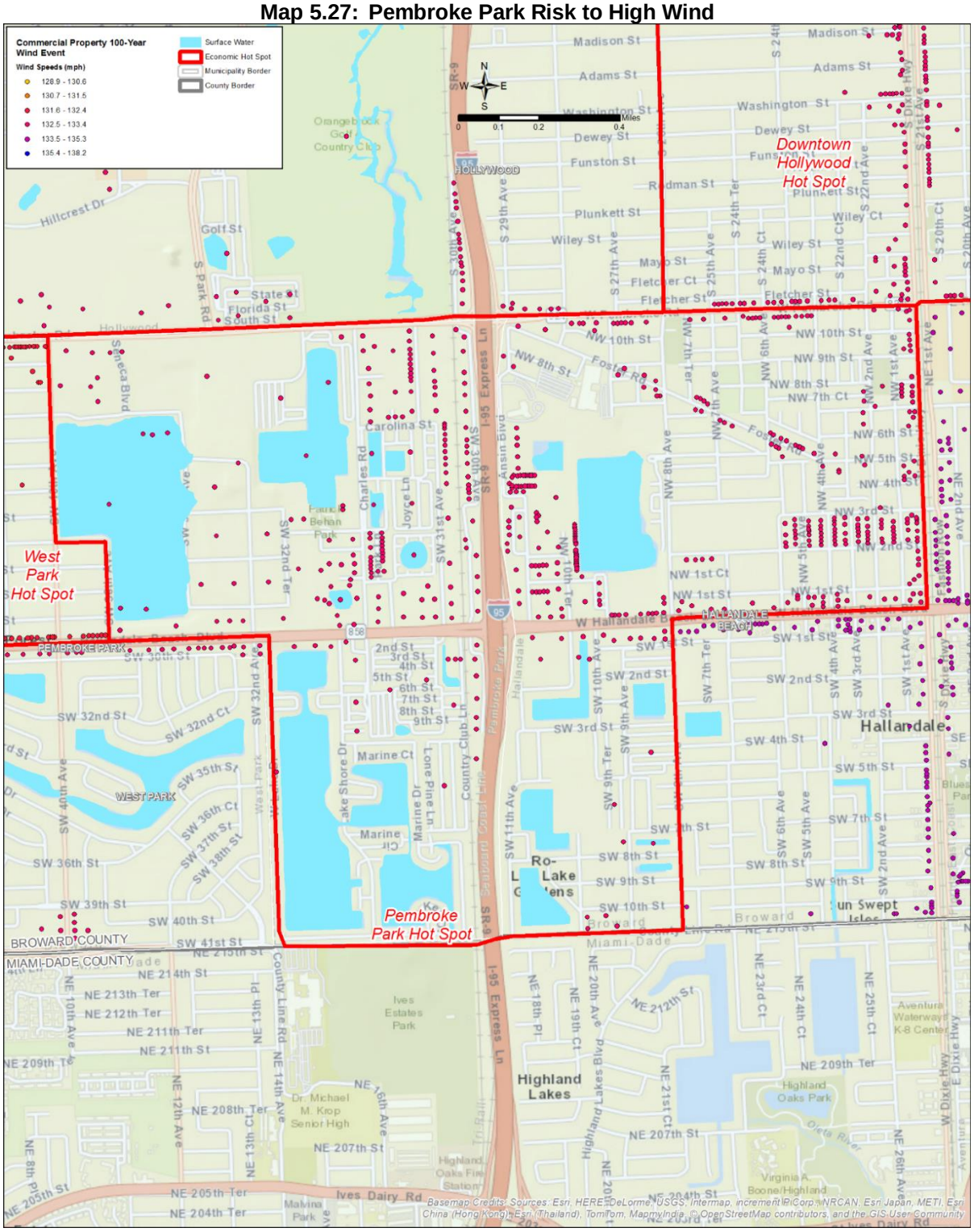
Maps

Map 5.26: Pembroke Park Risk to Inland Flooding



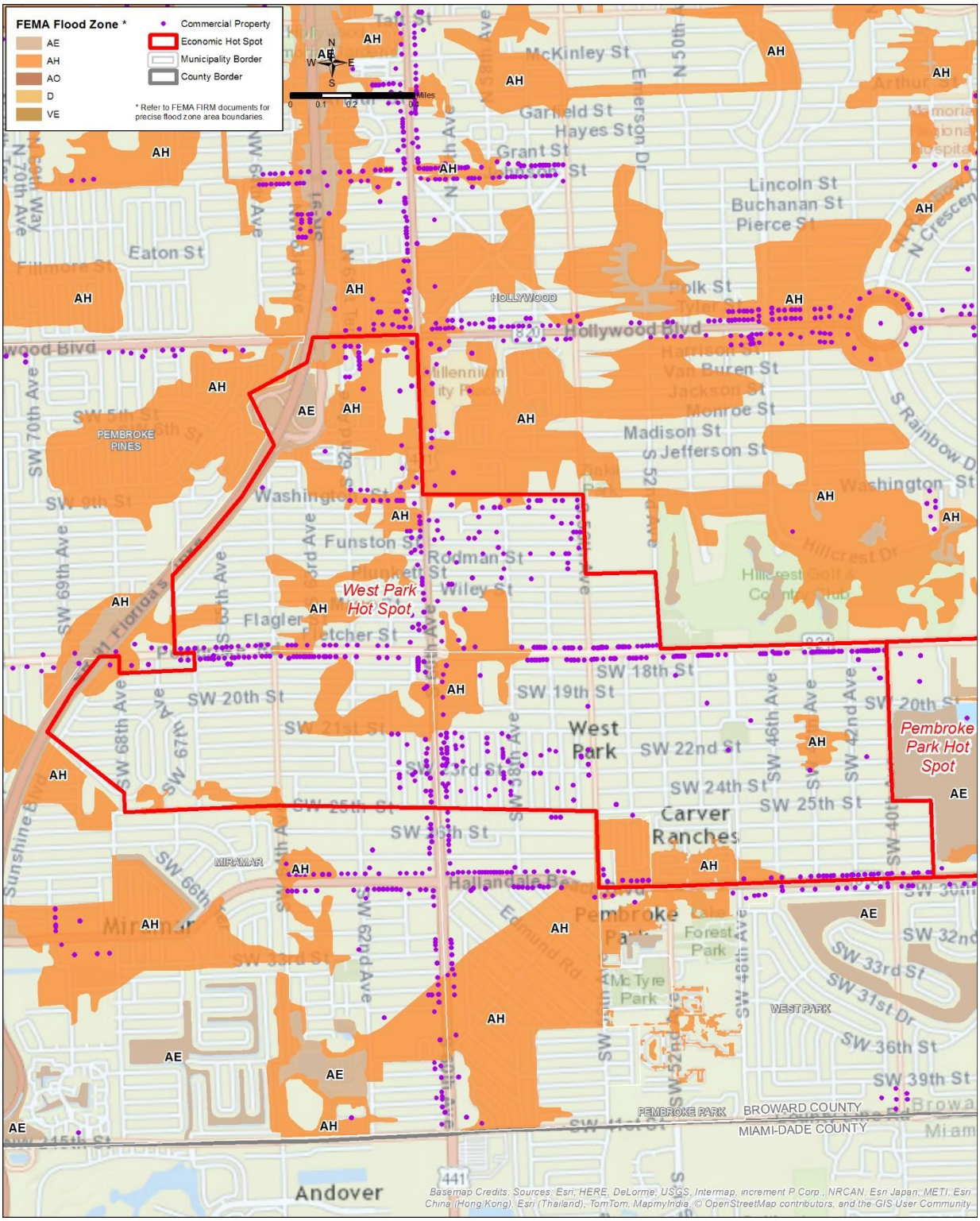
Source: Broward County Property Appraiser GIS, US Census 2015, SFWMD, and FEMA NFHL

Map 5.27: Pembroke Park Risk to High Wind



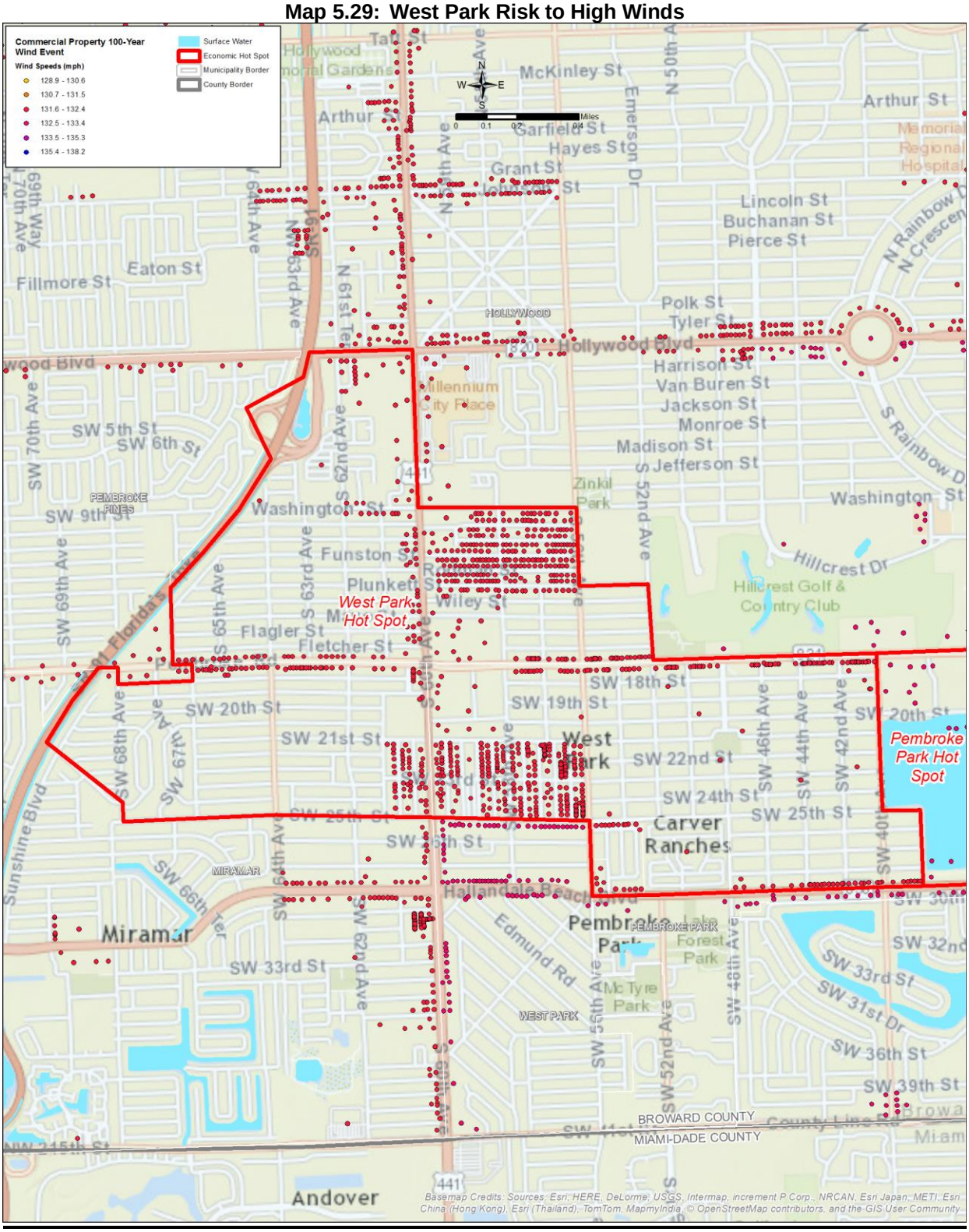
Source: Broward County Property Appraiser GIS, HAZUS 4.0

Map 5.28: West Park Risk to Inland Flooding



Source: Broward County Property Appraiser GIS, US Census 2015, SFWMD, and FEMA NFHL

Map 5.29: West Park Risk to High Winds



Source: Broward County Property Appraiser GIS, HAZUS 4.0

Hazus Information

Pembroke Park

Table 5.19: Hazus and Property Tax Data for Pembroke Park Hot Spot

Total Commercial Exposure	Total Economic Loss to Commercial Buildings by Flood*	Business Interruption Costs by Flood**	Property Tax Estimated Loss from Flood	Total Economic Loss to Commercial Buildings by Wind*	Business Interruption Costs by Wind**	Property Tax Estimated Loss from Wind
$283,391,000	$2,830,000	$50,000	$1,244,399	$72,622,750	$30,202,480	$2,040,144

Source: Hazus 4.0

West Park

Table 5.20: Hazus and Property Tax Data for West Park Hot Spot

Total Commercial Exposure	Total Economic Loss to Commercial Buildings by Flood*	Business Interruption Costs by Flood**	Property Tax Estimated Loss from Flood	Total Economic Loss to Commercial Buildings by Wind*	Business Interruption Costs by Wind**	Property Tax Estimated Loss from Wind
$403,317,000	$900,000	$160,000	$42,048	$97,283,790	$32,530,660	$589,188

Source: Hazus 4.0

* - includes Building, Content, and Inventory
** - Includes Income, Relocation, Rental Income, and Wage

Plantation Midtown Area

General Information

Plantation is an inland city in Broward County known for its commercial district. It includes Westfield Mall and many residential areas. This area was selected because it is a high concentration of businesses in an inland part of the County and provides a damage profile more typical of inland areas.

Key Infrastructure, Facilities, and Businesses

- Major Employers/Economic drivers in Midtown and/or City of Plantation
  - DHL's World Headquarters for the Americas (logistics company)
  - Goodwin Biotechnology Inc.(in City of Plantation, not Midtown area)
  - Motorola (in City of Plantation, not Midtown area)
  - National Beverage Corporation (in City of Plantation, not Midtown area)
  - Westfield Broward Mall
    - Westside Regional Medical Center
- University of Phoenix campus
- "Plantation Midtown" (http://www.plantation.org/Planning-Zoning/Economic-Development/Midtown/)
  - 860 acre urban center; "live-work-play" centerpiece to community
  - Roads carry ~275,000 cars daily
  - 2.5 million square feet of retail; 3 million square feet of office
- Plantation General Hospital (in City of Plantation, not Midtown area)
- Westside Regional Medical Center

Key Economic Sectors

Table 5.21: Selected Economic Statistics for Plantation - 2012 (larger than hot spot area) – by Annual Payroll

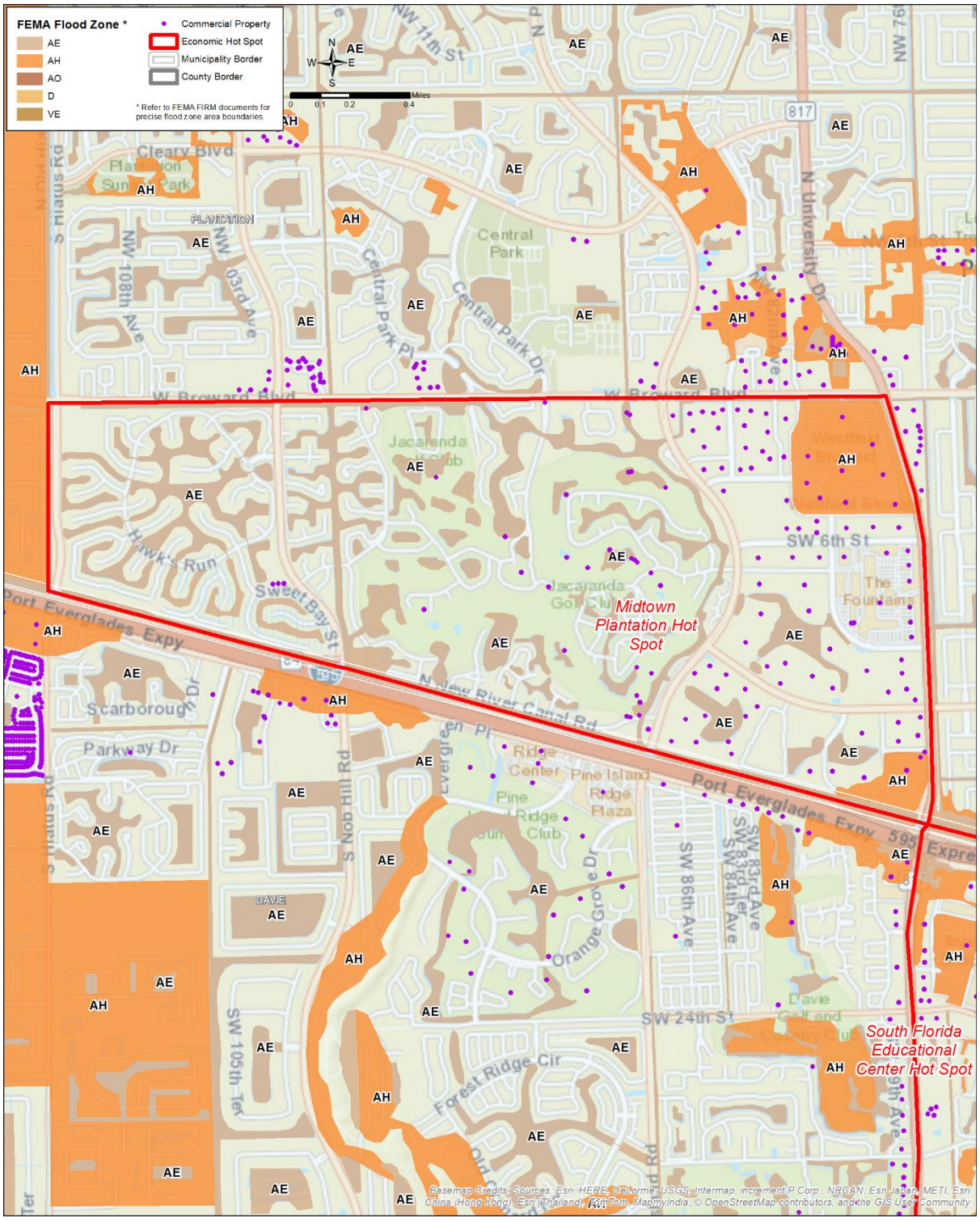
Industry	Number of Establish-ments	Sales, Shipments, Receipts	Annual Payroll	Number of Employees
Administrative and Support and Waste Mang and Remediation Srvs	257	408,899	200,204	6,420
Health care and social assistance	603	1,028,406	357,768	7,234

Industry	Number of Establish-ments	Sales, Shipments, Receipts	Annual Payroll	Number of Employees
Professional, scientific, and technical services	724	755.269	300,880	4.448
Retail trade	348	1,724,905	134,180	5,590
Information	58	N/A	65,333	2,746
Manufacturing	41	29,715	9,955	268
Real estate and rental and leasing	348	1,724,905	134,180	5,590
Accommodation and food services	188	218,532	56,003	3,356
Other services (except public administration)	206	110,366	30,392	1,002
Arts, entertainment, and recreation	53	N/A	N/A	N/A

Source: U.S. Census Bureau (http://factfinder.census.gov)

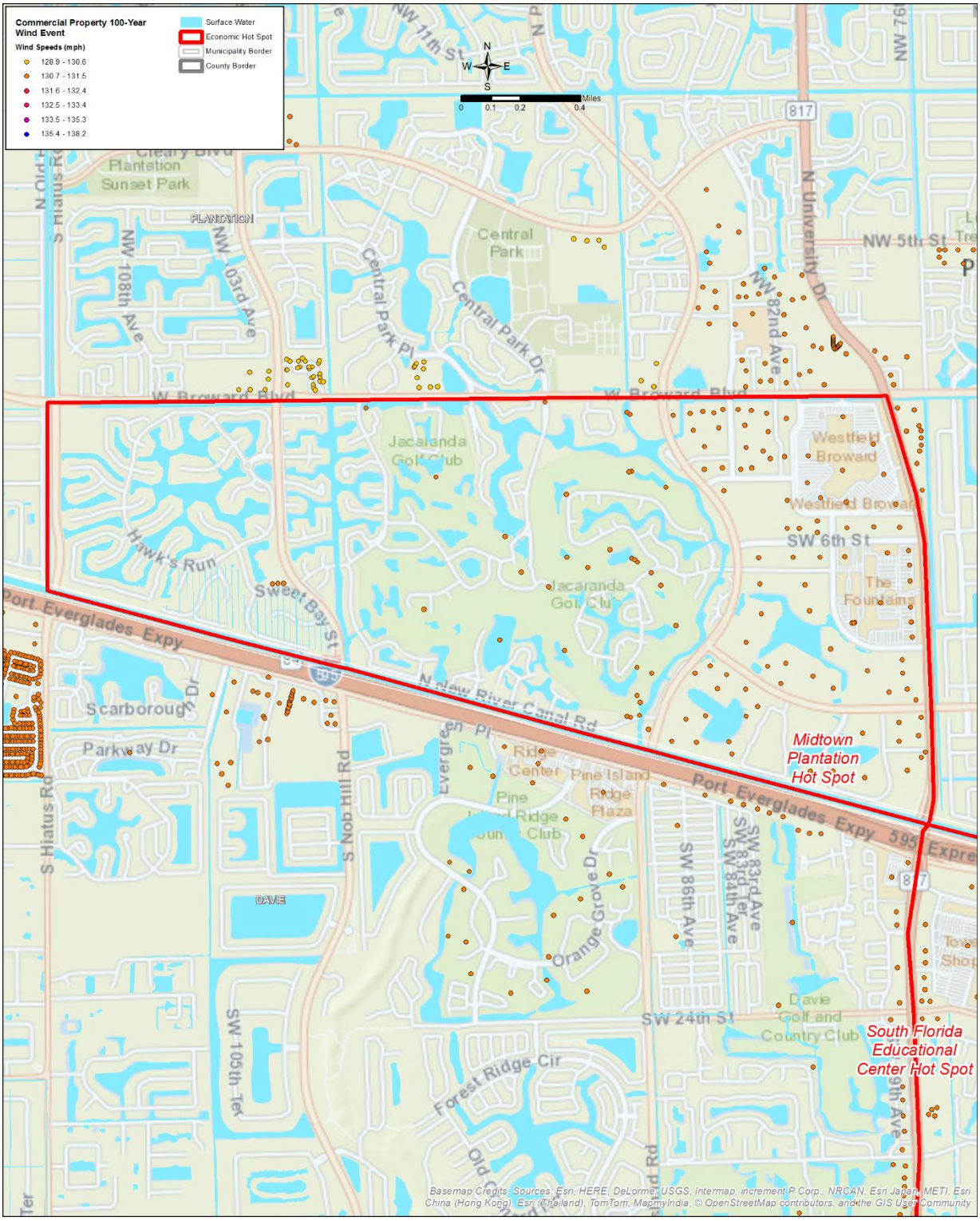
Maps

Map 5.30: Midtown Plantation Risk to Inland Flooding



Source: Broward County Property Appraiser GIS, US Census 2015, SFWMD, and FEMA NFHL

Map 5.31: Midtown Plantation Risk to High Wind



Source: Broward County Property Appraiser GIS, HAZUS 4.

Hazus Information

Table 5.22: Hazus and Property Tax Data for Midtown Plantation Hot Spot

Total Commercial Exposure	Total Economic Loss to Commercial Buildings by Flood*	Business Interruption Costs by Flood**	Property Tax Estimated Loss from Flood	Total Economic Loss to Commercial Buildings by Wind*	Business Interruption Costs by Wind**	Property Tax Estimated Loss from Wind
$529,625,000	**$7,880,000**	**$110,000**	**$8,814,648**	**$128,083,810**	**$50,765,240**	**$4,937,198**

Source: Hazus 4.0

* - includes Building, Content, and Inventory
** - Includes Income, Relocation, Rental Income, and Wage

Port Everglades/International Airport (www.porteverglades.net)

General Information

This hot spot is located within 3 municipalities (Hollywood, Ft. Lauderdale, Dania Beach) and Broward Municipal Services Districts Broward County. It includes 2 of the key transportation hubs in the region – Port Everglades and the Fort Lauderdale-Hollywood International Airport. Near the Port, is also the Fort Lauderdale Convention Center, a major attractor and source of revenue.

Key Infrastructure, Facilities, and Businesses

- *Port Everglades* (www.porteverglades.net)
  - All port operations handled by Broward County Board of Commissioners
  - Port Everglades Department is self-supporting Enterprise Fund (does not rely on local tax dollars)
  - Plans to deepen harbor (in line with increased sea traffic due to Panama Canal Expansion)
    - Current depth =42 feet; Planned Depth = 50 feet
  - 33 available berths
  - Total value of Economic Activity at Port: Approximately $18 Billion
  - Approximately 200,000 Florida jobs impacted by Port (including 10,000 for companies that provide direct services to Port)
    - More data on Economic Impact (http://www.porteverglades.net/about-us/economic-impact/)
  - *Port Waterborne Commerce Chart (FY 2010)*
    - Operating Revenue: $124.6 million, Gross Margin: $50.7 million
    - Total Ship Calls: 4,079
    - Cruise Passengers: 3.67 million, Cruise Revenue: $45.7 million
    - Container Cargo (tons): 5.2 million, Container Revenue: $29.5 million
  - One of U.S. top container ports:
    - Major petroleum storage and distribution hub (main seaport for receiving petroleum products in South Florida)
    - US Navy liberty port
    - Cargill Food Distribution
    - Current discussion of near-dock rail terminal to facilitate transfer of port cargo to the Florida East Coast Railway via a rail spur (from *The Journal of Commerce* dated June 15, 2011 and part of Port Everglades Master/Vision Plan)
  - One of world's busiest cruise departure ports
    - 55 different ships operated by 15 different cruise lines (2010-2011)
    - More than 3 million cruise passengers pass through/year
    - Peak season November – April
  - Starting in 2009, Royal Caribbean Cruise Lines began using Port as home port of world's largest passenger ship, *Oasis of the Seas*
  - The Foreign Trade Zone (FTZ) #25 at Port Everglades is the largest of the 20 FTZs in Florida and is one of the regions in the country that export more goods than are imported (posting an export surplus record of $22.2 billion in 2010). The port is a gateway to South and Central America and the Caribbean.
  - More than 143,000 Florida jobs are impacted by the Port and nearly 10,000 people work for companies that provide direct services to the Port

- *Fort Lauderdale-Hollywood International Airport* (http://www.broward.org/AIRPORT)
  - Website has statistical data/reports (http://www.broward.org/AIRPORT/ABOUT/Pages/Statistics.aspx)
  - 22nd busiest airport in U.S.; 54th worldwide (2009)
  - 10.9 million Enplaned Passengers (2010); 4.3% increase from 2009
  - 21.9 million Total (Enplaned and Deplaned) passengers (2010); 4.5% increase from 2009
  - 255,642 Aircraft operations (2010); 2.26% increase from 2009
  - 95,210 Total Tons (U.S. Mail and Air Freight) of Air Cargo (2010); -6.79% decrease from 2009
    - 93,024 Air Freight Tons (2010); down ~98,000 tons since 2001, 38,000 tons since 2008
      - Partly due to winding down and cessation of DHS in 2008 and global economic downturn (http://www.broward.org/Airport/About/Documents/Fy10aviationhistoricalanalysis.pdf)

- *Fort Lauderdale Convention Center* (http://www.ftlauderdalecc.com/)
  - Broward Convention Center Budget: $48.9 million (http://www.browardconventioncenter.com/)
  - 600,000 square feet; 3 levels (w/expansion)
  - $34 million, 230,000 square feet expansion recently completed
  - 4 exhibit halls, 2 ballrooms, and 31 meeting rooms
  - Working towards *Silver Level LEED Certification from the U.S. Green Buildings Council*
  - "Approximately 30% of the city's 10 million annual visitors attend conventions at the center." (2006)

- *Broward General Medical Center* (http://www.browardhealth.org) – at US. 1 and AIA (~.5 mile from Port)
  - Quick Facts at: http://www.browardhealth.org/?id=56&sid=1
  - 1,529 Licensed Beds in Total Medical Center (2010)
  - 8,313 Employees (2010)
  - 65,099 Inpatient Admissions (2010)
  - 301,233 Outpatient Medical Center visits (2010)
  - 265,521 Emergency Department Visits (2010)
  - 228,479 Physician Office Visits (2010)
  - Operating Budget (2011): http://www.browardhealth.org/upload/docs/Corporate/FY2011_OperatingBudget.pdf
  - Total Gross Patient Revenue: $3.92 billion (2011 Budget)
  - Total Operating Expenses: $1.03 billion (2011 budget)

- *Port Everglades Power Generating Station* (Florida Power and Light)
  - Includes a fairly large oil/gas power plant for Florida Power and Light. It has 4 units and a net capability of approximately 1,200 megawatts (making it 7 out of 14 in capability for FP&L plants)

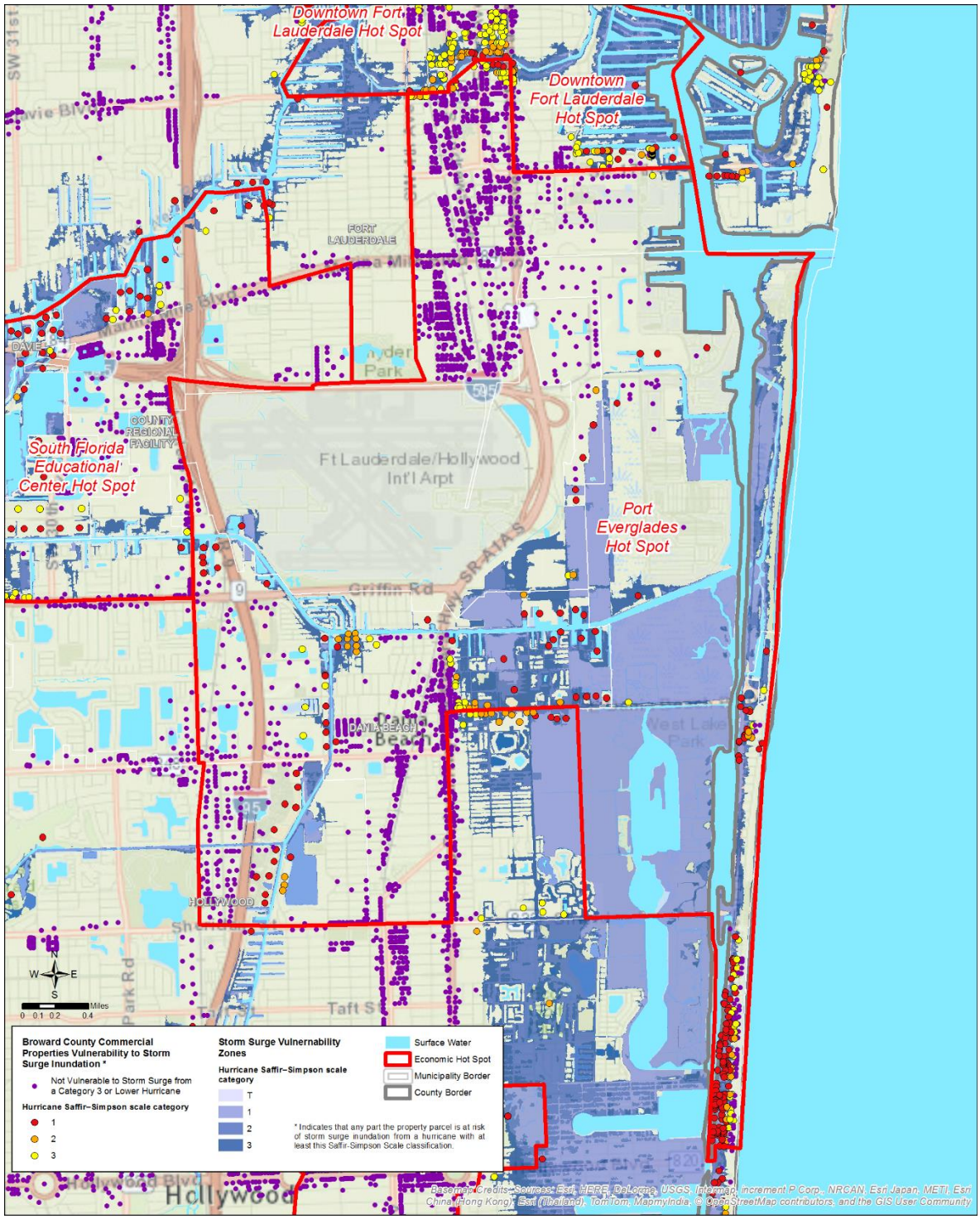
- *Broward County Wastewater Facility*

Key Economic Sectors

This Hot Spot is divided between Fort Lauderdale, Hollywood, and Dania Beach and there is too much overlap to provide meaningful analysis from the US Census Bureau data.

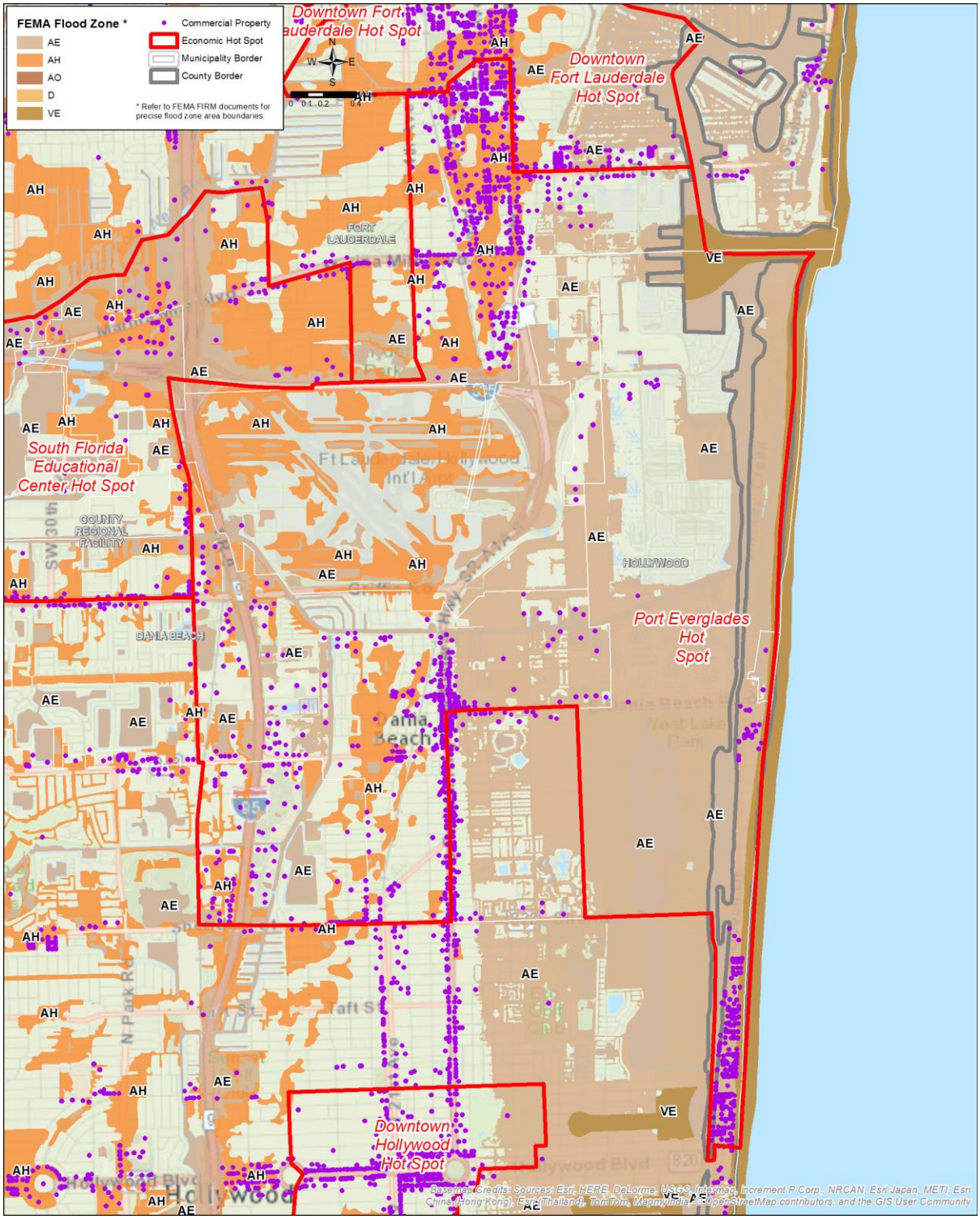
Maps

Map 5.32: Port Everglades Risk to Storm Surge



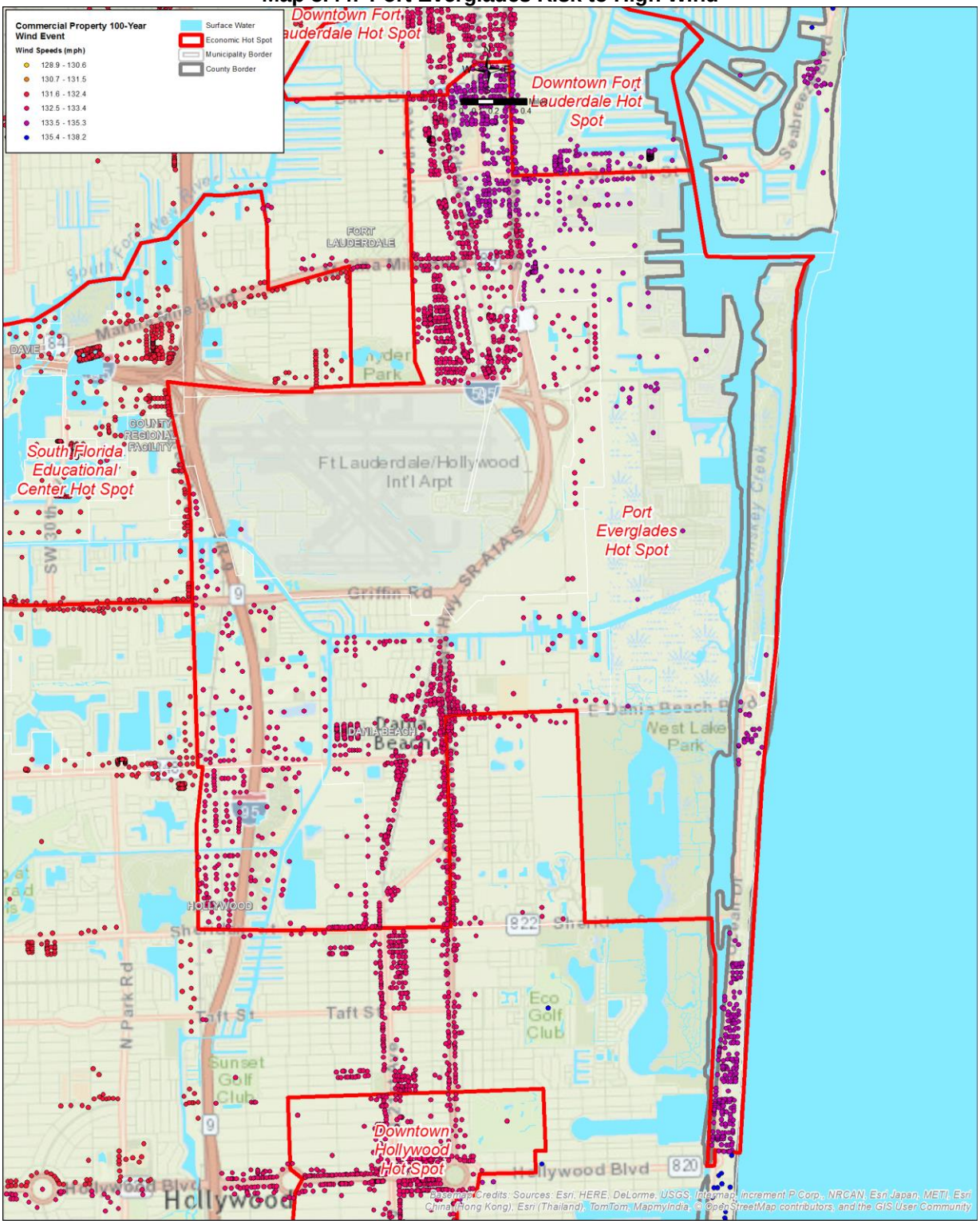
Source: Broward County Property Appraiser GIS, Broward County GIS

Map 5.33: Port Everglades Risk to Inland Flooding



Source: Broward County Property Appraiser GIS, US Census 2015, SFWMD, and FEMA NFHL

Map 5.44: Port Everglades Risk to High Wind



Source: Broward County Property Appraiser GIS, HAZUS 4

Hazus Information

Table 5.23: Hazus and Property Tax Data for Port Everglades Hot Spot

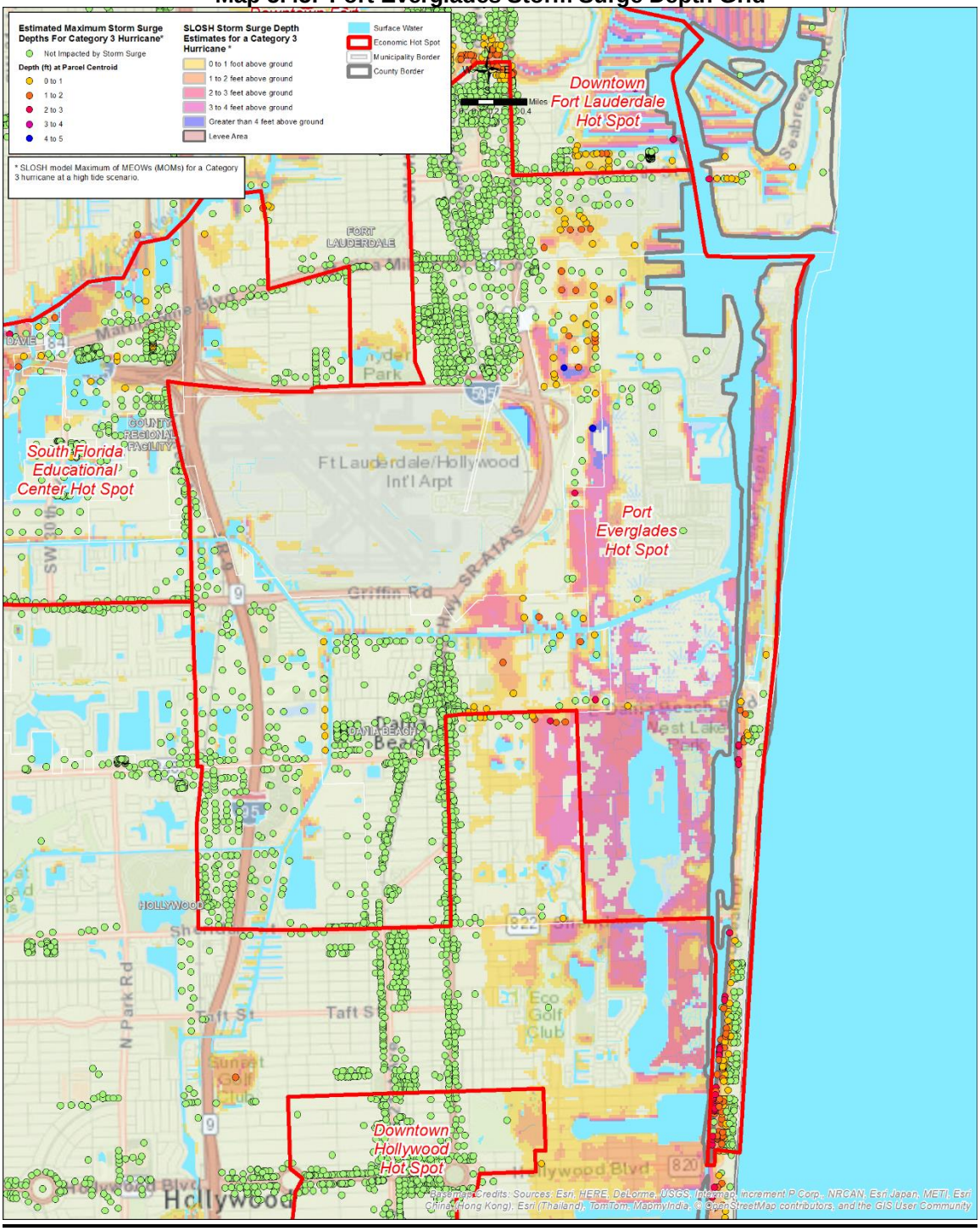
Total Commercial Exposure	Total Economic Loss to Commercial Buildings by Flood*	Business Interruption Costs by Flood**	Property Tax Estimated Loss from Flood	Total Economic Loss to Commercial Buildings by Wind*	Business Interruption Costs by Wind**	Property Tax Estimated Loss from Wind
$1,535,973,000	**$21,300,000**	**$750,000**	**$27,684,733**	**$370,812,380**	**$150,005,380**	**$25,142,021**

Source: Hazus 4.0

* - includes Building, Content, and Inventory
** - Includes Income, Relocation, Rental Income, and Wage

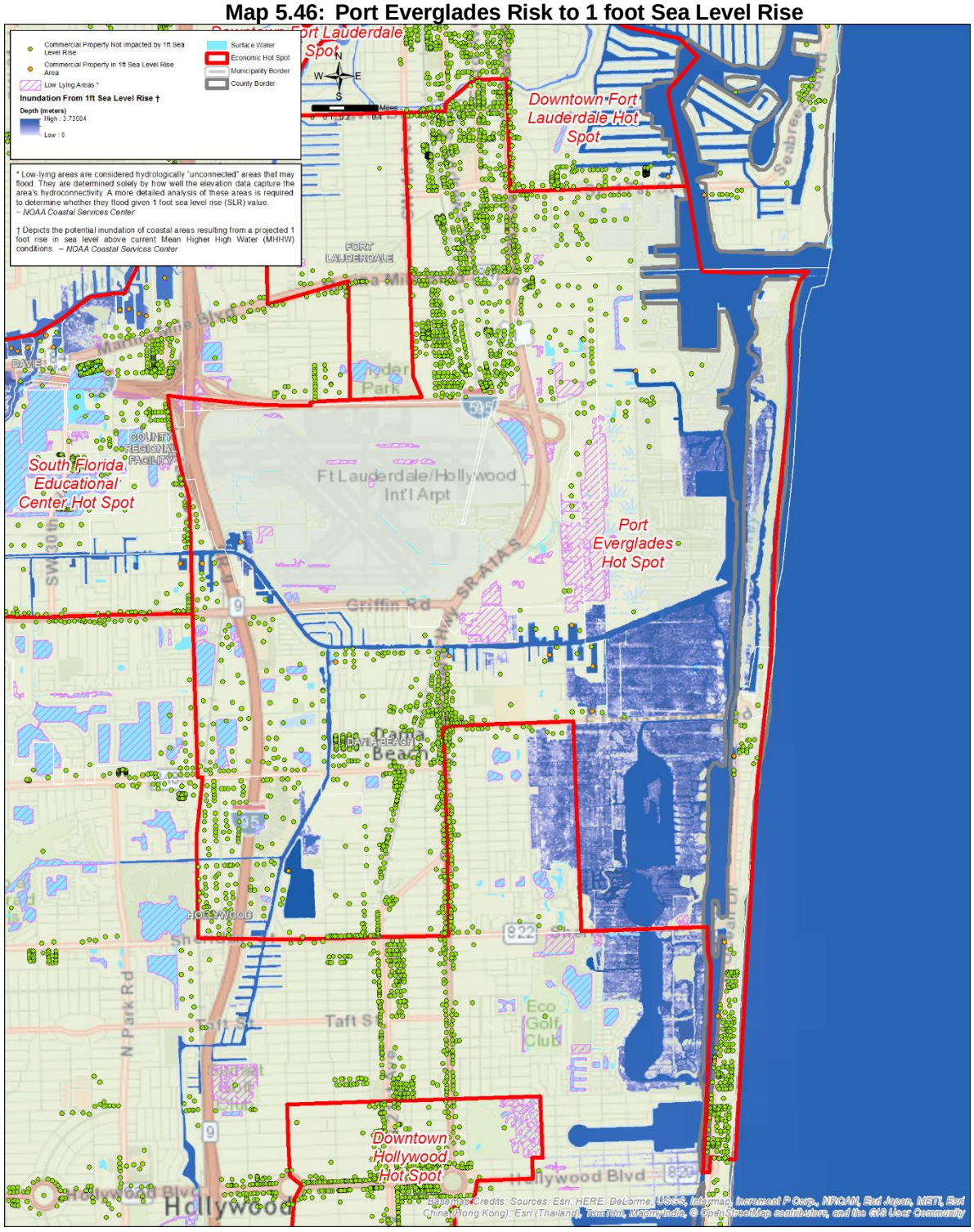
Storm Surge Depth Grid Maps and Sea Level Rise 1 foot scenario

Map 5.45: Port Everglades Storm Surge Depth Grid



Source: Broward County Property Appraiser GIS, NOAA SLOSH Model

Map 5.46: Port Everglades Risk to 1 foot Sea Level Rise



Source: Broward County Property Appraiser GIS and NOAA Coastal Services Center

Sawgrass Mills Shopping Mall in Sunrise

General Information (Sunrise)

The population of Sunrise is 92,000 residents and it claims to be "Host to several million national and international visitors each year (http://www.sunrisefl.gov/index.aspx?page=2). The hot spot area is a census block group within the city that is centered around the huge Sawgrass Mills Shopping Mall. The hot spot borders the Everglades to the west and Flamingo Road/NW 126th Avenue to the east. To the south, the border is SW 14th Street and the area includes the vital infrastructure intersection of I-595 and the Sawgrass Expressway (Route 869).

Key Infrastructure, Facilities, and Businesses

- Sawgrass Mills Shopping Mall
  - Over 2,380,000 square feet
  - Over 350 stores
  - 6th largest outlet shopping mall in US and 2nd largest in Florida (after Aventura Mall)
  - One of top tourist attractions (rivaling Disney World) in Florida
  - Visited by 26 million shoppers a year
- BankAtlantic Center
  - Home of NHL Florida Panthers

Key Economic Sectors

Table 5.24: Selected Economic Statistics for Sunrise - 2012 (larger than hot spot area) – by Annual Payroll

Industry	Number of Establish-ments	Sales, Shipments, Receipts	Annual Payroll	Number of Employees
Administrative and Support and Waste Mang and Remediation Srvs	215	901,437	405,524	10,092
Health care and social assistance	272	593,911	287,766	4,625
Retail trade	544	2,776,087	241,476	10,882
Professional, scientific, and technical services	364	366,122	135,491	2,464

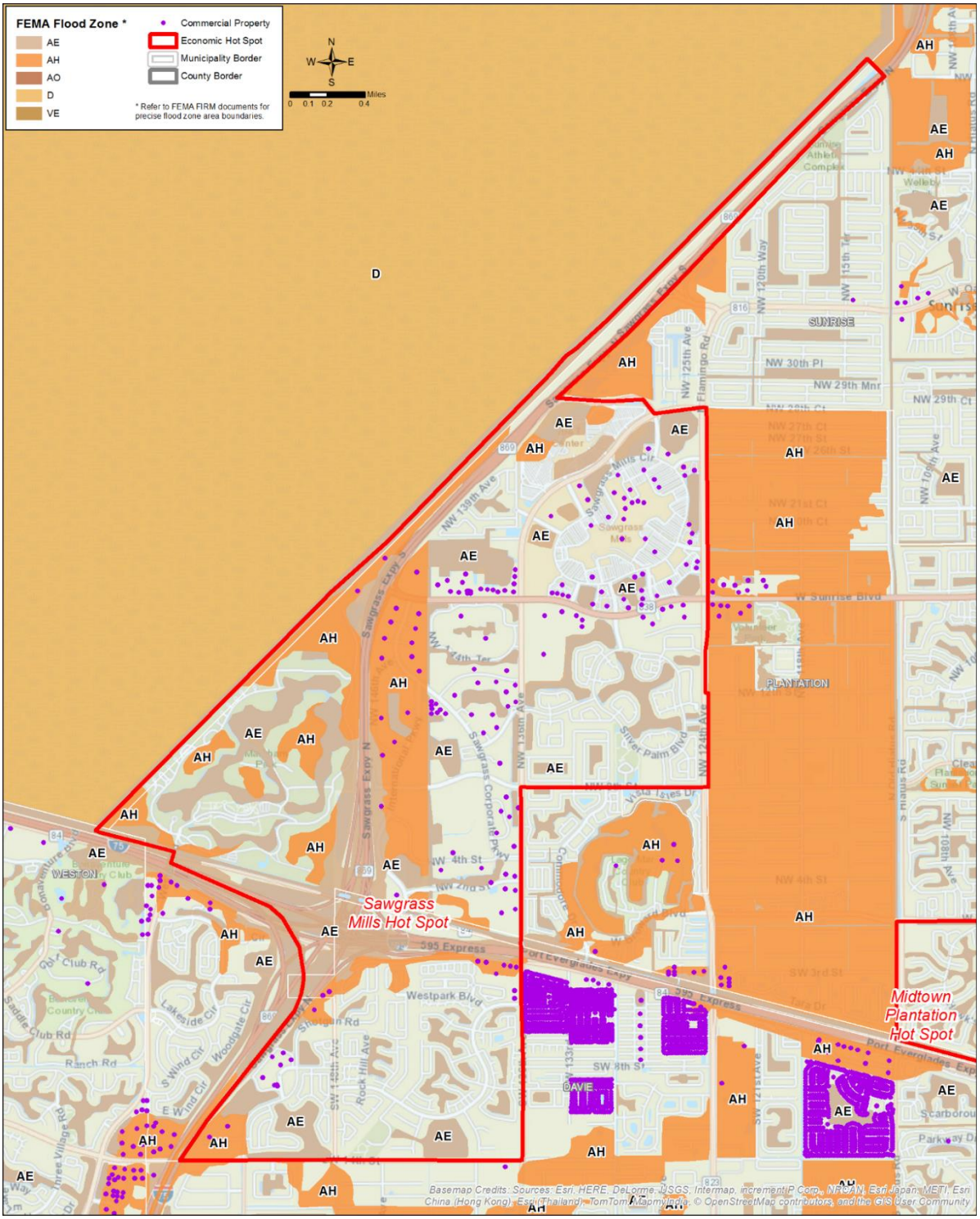
Industry	Number of Establish-ments	Sales, Shipments, Receipts	Annual Payroll	Number of Employees
Information	56	N/A	135,045	1,941
Accommodation and food services	187	217,374	61,887	4,135
Manufacturing	71	165,246	25,844	495
Real estate and rental and leasing	122	115,439	20,599	492
Other services (except public administration)	145	58,219	17,030	705

Source: U.S. Census Bureau (http://factfinder.census.gov)

Maps

Map 5.47: Sawgrass Mills Risk to Inland Flooding
Source: Broward County Property Appraiser GIS, US Census 2015, SFWMD, and FEMA NFHL

Map 5.48:[54] Sawgrass Mills Risk to High Wind



Source: Broward County Property Appraiser GIS, HAZUS 4

Hazus Information

Table 5.25: Hazus and Property Tax Data for Sawgrass Mills Hot Spot

Total Commercial Exposure	Total Economic Loss to Commercial Buildings by Flood*	Business Interruption Costs by Flood**	Property Tax Estimated Loss from Flood	Total Economic Loss to Commercial Buildings by Wind*	Business Interruption Costs by Wind**	Property Tax Estimated Loss from Wind
$409,625,000	**$288,653,000**	**$3,753,855**	**$25,748,784**	**$131,480,000**	**$42,217,281**	**$11,728,906**

Source: Hazus 4.0)

* - includes Building, Content, and Inventory
** - Includes Income, Relocation, Rental Income, and Wage

South Florida Educational Center in Davie (www.sfec.org)

General Information

The approximate boundaries are between South University Drive/Pine Island to the west and I-95 to east; I-595 to the north and SW 60th Street/Griffin Road to the south. The Florida Turnpike bisects the area. To the east of the Turnpike, the hot spot area is mostly undeveloped with a major county incinerator/landfill facility and the natural area known as Pond Apple Slough. To the west of the Turnpike are the concentration of institutes of higher education that are detailed below. Most of the hot spot is in Davie, FL. The SFEC is one of biggest generators of traffic in Broward (www.sfec.org).

Key Infrastructure, Facilities, and Businesses

- Nova Southeastern University
  - 28,796 students (Grad and Undergrad) (2008 Fall enrollment)
    - 92% of student population; 100% of housed students at Davie Campus
  - 6,300+ total staff (Academic and admin)
  - Miami Dolphins practice (daily) at Nova campus (AD Griffin Sport Complex)
- Florida Atlantic University (Davie Campus)
  - 3,488 students (13% of total FAU student body; 2nd largest campus by enrollment)
- University of Florida (Davie Campus): Fort Lauderdale Research & Education Center
- Broward College (Central Campus)
  - 55,000 students (Total in Broward College)
  - 1,000+ staff
  - Also home to College Academy (high school) at Broward College
- ITT Technical Institute
  - Davie, FL Campus of for-profit technical institute
- Unilatina International College
  - Vocational school
-

Key Economic Sectors

Table 5.26: Selected Economic Statistics for Davie - 2012 (larger than hot spot area)

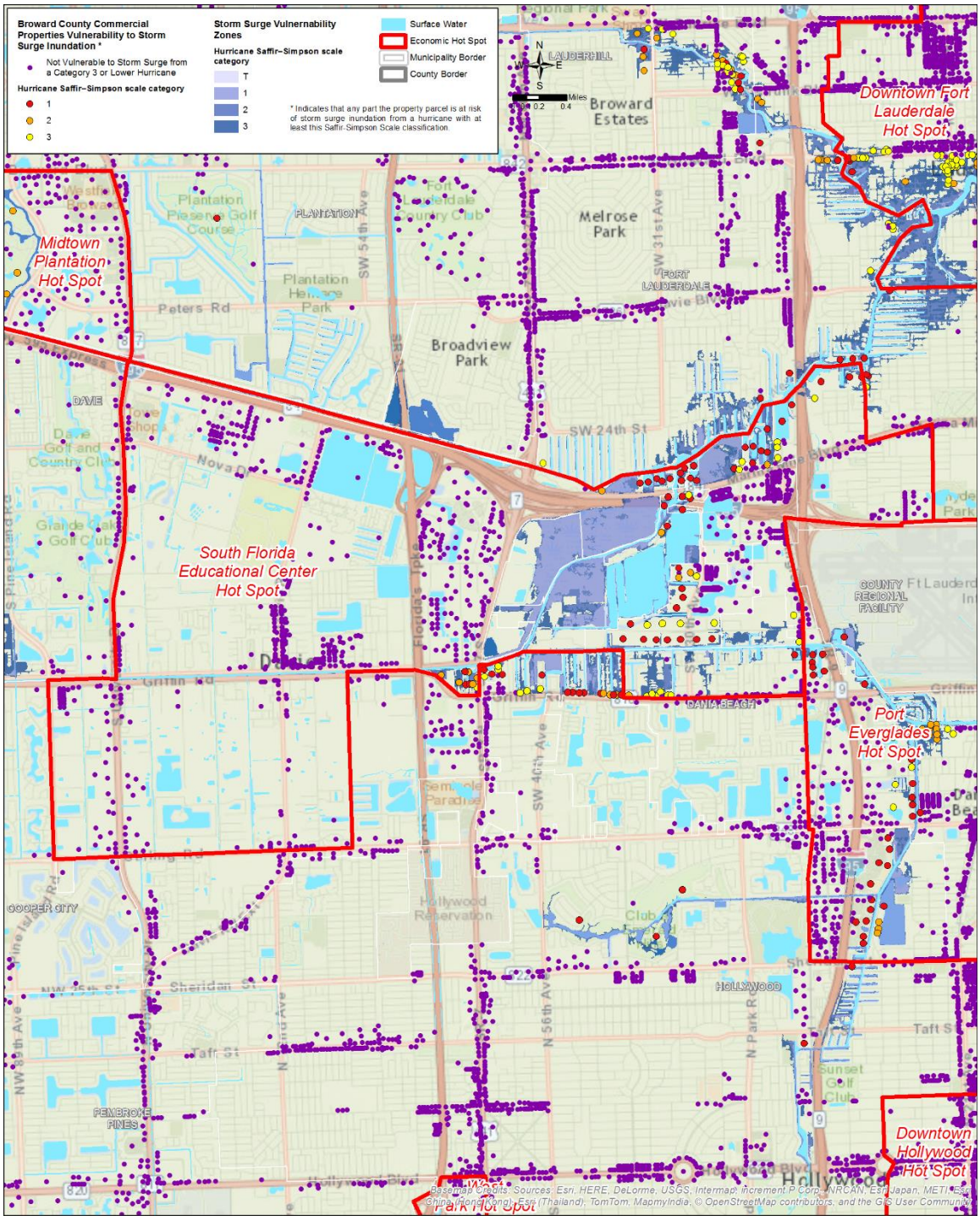
Industry	Number of Establish-ments	Sales, Shipments, Receipts	Annual Payroll	Number of Employees
Retail trade	405	$ 2,050,330	$170,304	5,802
Arts, entertainment, and recreation	50	$39,010	$11,521	540
Manufacturing	88	$924,055	$130,436	1,879

Industry	Number of Establish-ments	Sales, Shipments, Receipts	Annual Payroll	Number of Employees
Professional, scientific, and technical services	539	$275,745	$78,457	1,639
Administrative and Support and Waste Mang and Remediation Srvs	236	$299,855	$82,255	2,802
Accommodation and food services	195	N/A	N/A	N/A
Other services (except public administration)	266	$165,766	$39,469	1,282
Health care and social assistance	270	$169,037	$58,657	2,079
Educational services	46	$14,531	$84,490	244
Real estate and rental and leasing	196	$147,145	$24,905	604

Source: U.S. Census Bureau (http://factfinder.census.gov)

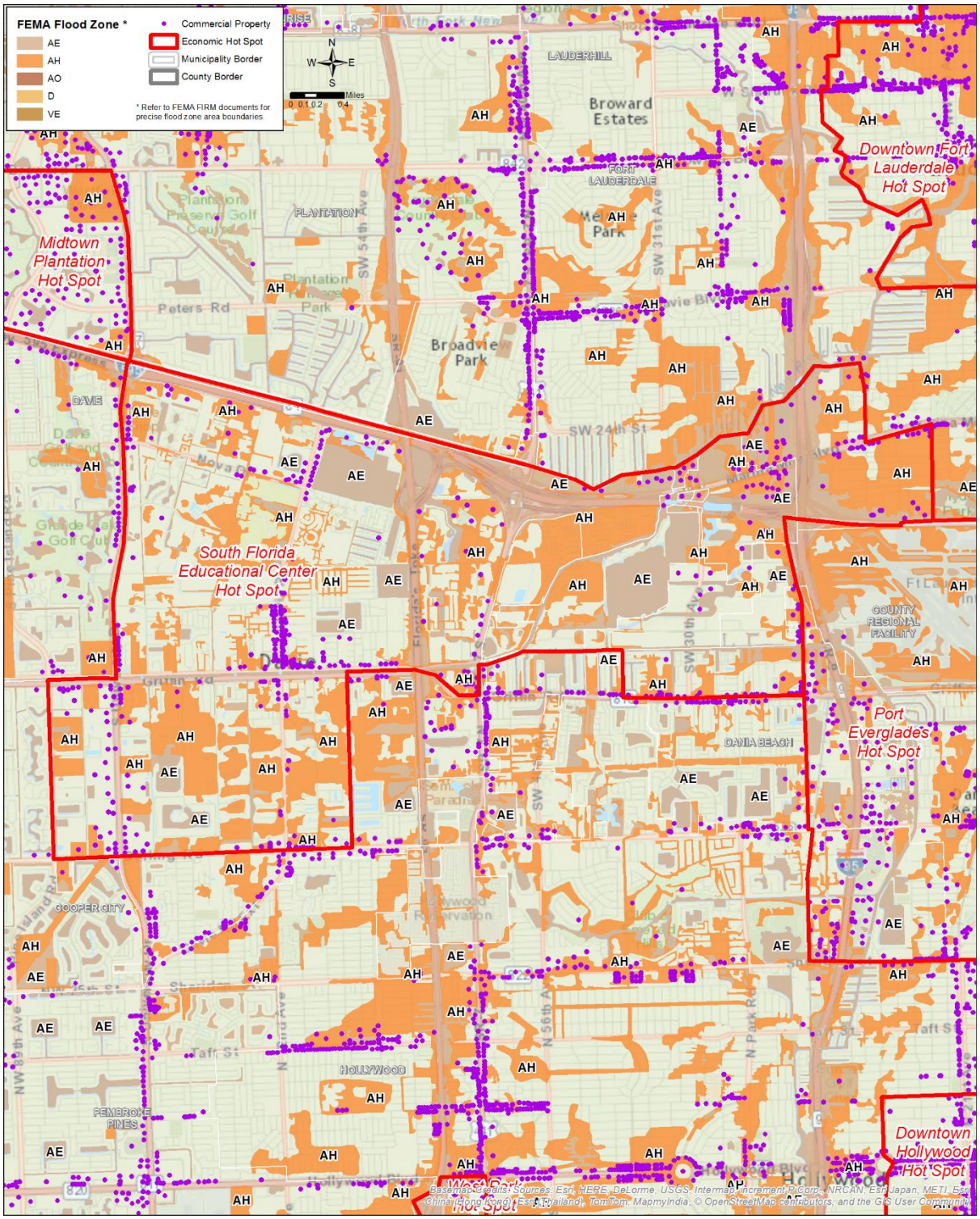
Maps

Map 5.49: South Florida Educational Center Risk to Storm Surge



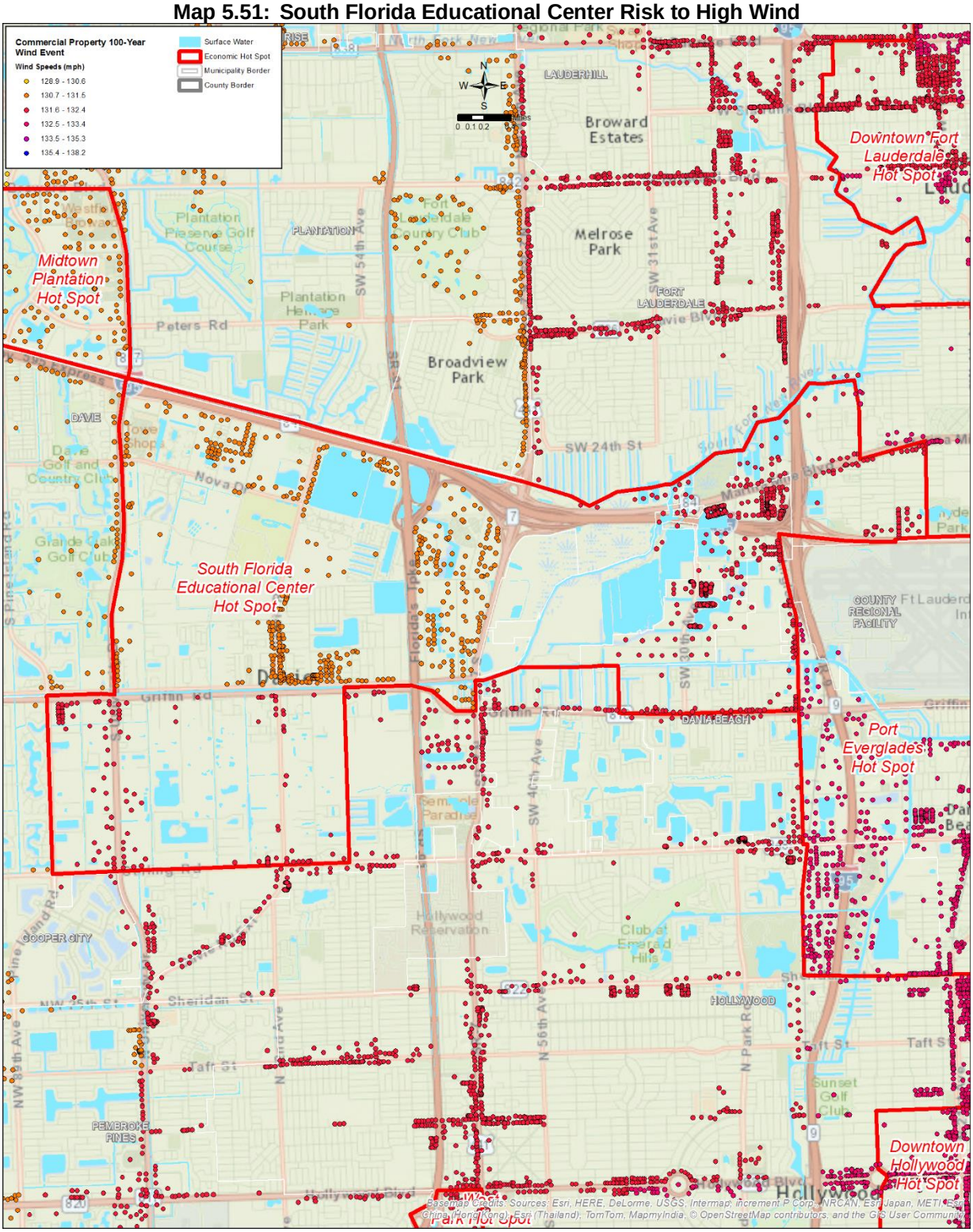
Source: Broward County Property Appraiser GIS, Broward County GIS

Map 5.50: South Florida Educational Center Risk to Inland Flooding



Source: Broward County Property Appraiser GIS, US Census 2015, SFWMD, and FEMA NFHL

Map 5.51: South Florida Educational Center Risk to High Wind



Source: Broward County Property Appraiser GIS, HAZUS 4.0

Hazus Information

Table 5.27: Hazus and Property Tax Data for South Florida Educational Center Hot Spot

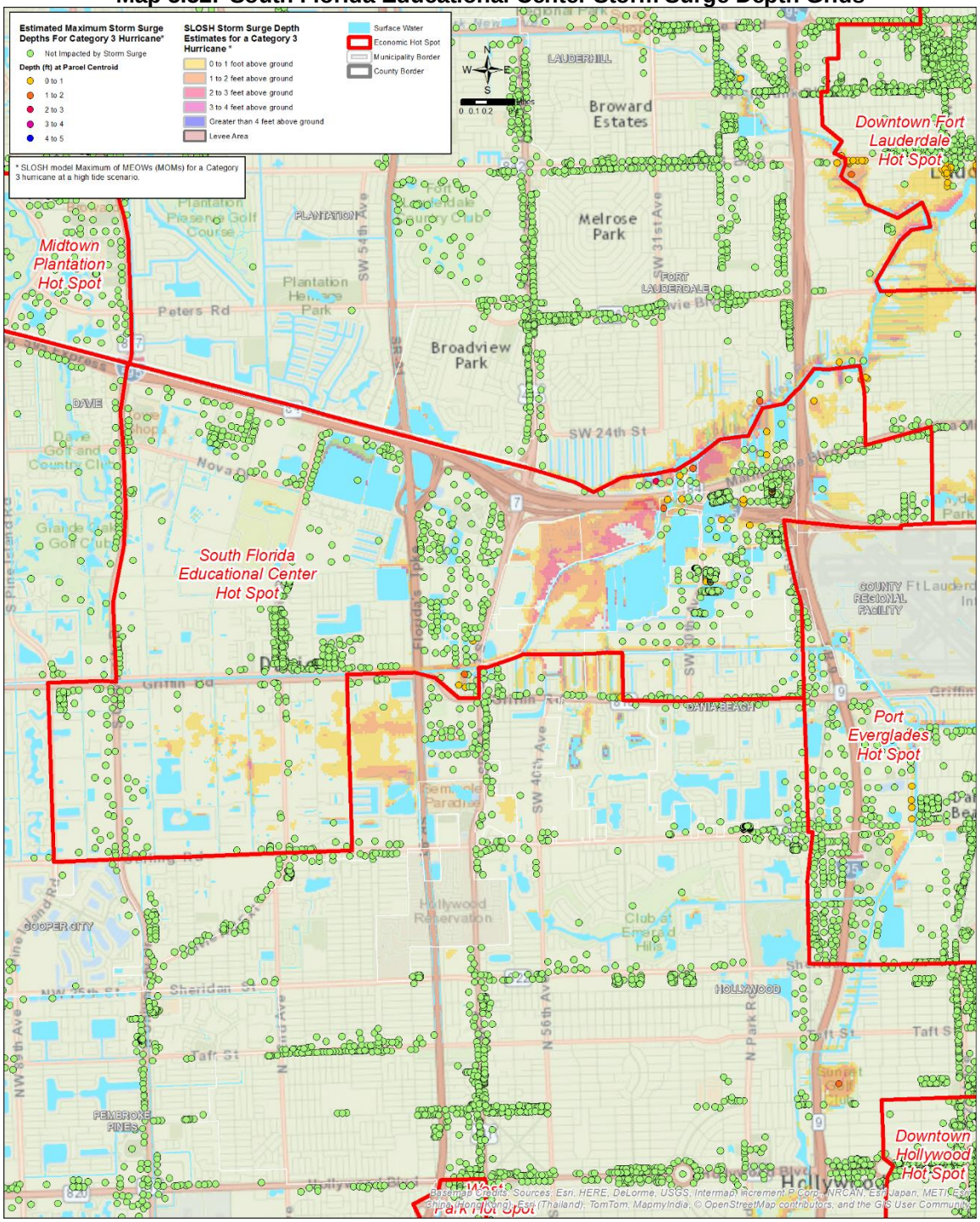
Total Commercial Exposure	Total Economic Loss to Commercial Buildings by Flood*	Business Interruption Costs by Flood**	Property Tax Estimated Loss from Flood	Total Economic Loss to Commercial Buildings by Wind*	Business Interruption Costs by Wind**	Property Tax Estimated Loss from Wind
$1,191,354,000	**$26,300,000**	**$560,000**	**$27,904,807**	**$291,240,450**	**$101,969,390**	**$9,937,115**

Source: Hazus 4.0

* - includes Building, Content, and Inventory
** - Includes Income, Relocation, Rental Income, and Wage

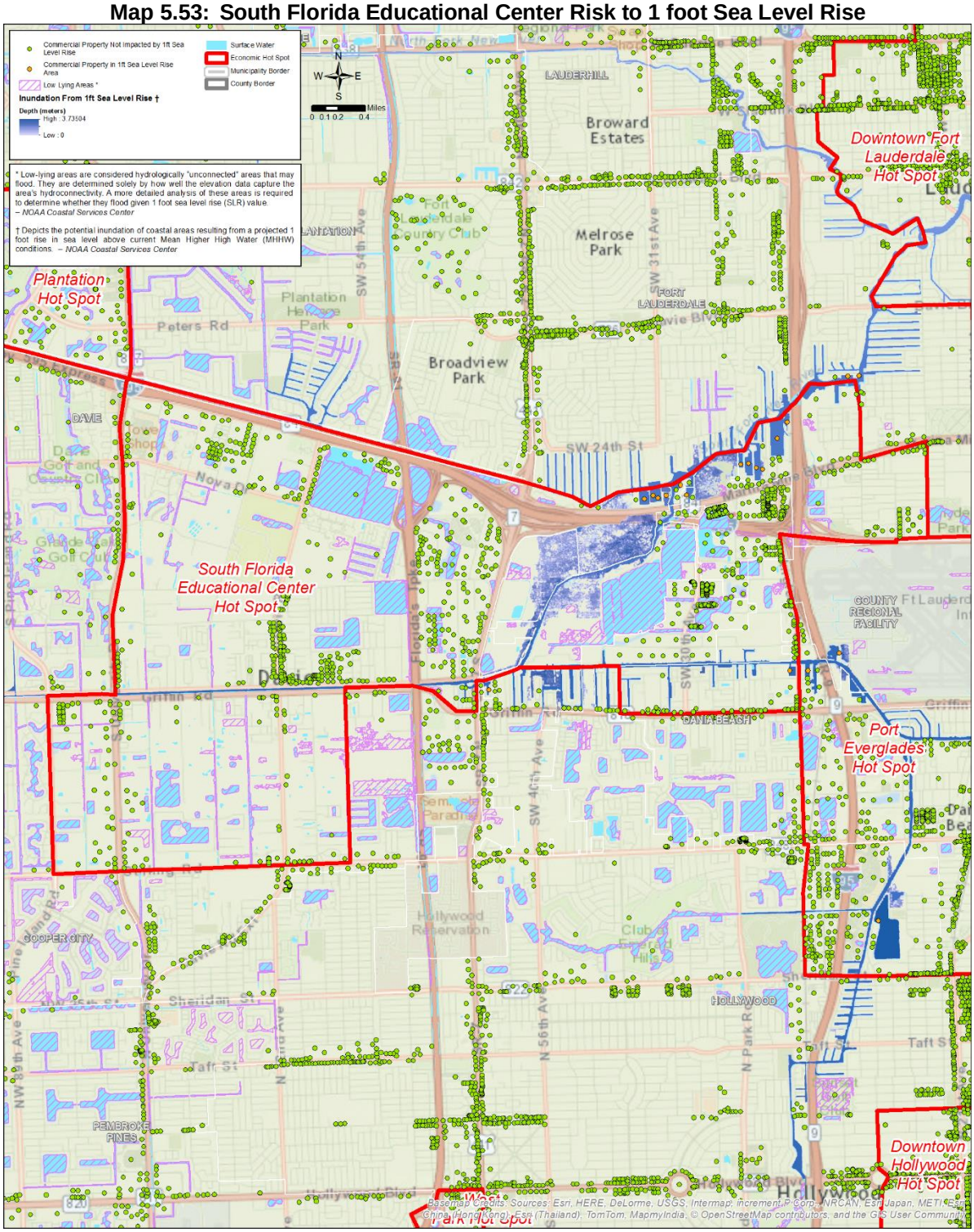
Storm Surge Depth Grid Maps and Sea Level Rise 1-foot scenario

Map 5.52: South Florida Educational Center Storm Surge Depth Grids



Source: Broward County Property Appraiser GIS, NOAA SLOSH Model

Map 5.53: South Florida Educational Center Risk to 1 foot Sea Level Rise



Source: Broward County Property Appraiser GIS and NOAA Coastal Services Center

Summary of Potential Impacts and Potential Areas for Redevelopment

Broward County is a large, diverse metropolitan area located in a high risk zone to the impacts of hurricanes. It would be vulnerable to any large scale event that damaged its key coastal infrastructure like the Port, Airport, and major coastal roadways like US-1 which caused multi-day power outages. The result of damage to these key transportation facilities would create a negative ripple effect that would create losses to some of its key industries; namely shipping, regional distribution, and tourism. Due to the presence of large regional distribution facilities in the Deerfield Beach/Pompano Beach area, any disruption to this supply chain (backlog of cargo, inability to move products) would cause a chain reaction. Damage to coastal hotels would reduce tourist capacity as well as impacting retail business that depends on tourism. News reports of severe damage in the County would also likely create a perception, nationally and internationally, that the County is temporarily crippled and not capable of handling tourists for a period of time.

Both New Orleans, after Hurricane Katrina, and the Gulf Coast, after the 2010 BP Oil Spill, suffered economically, especially tourism, from these realities and perceptions. Both sought to combat this perception by placing advertisements in key markets indicating they were 'open for business'. Sometimes, areas hit by a disaster like New York City after the 9/11 Terrorist attacks and New Orleans after Katrina will actually bring in tourists who are looking to support disaster-stricken areas and those that are curious about the disaster impacts.

Like most urban areas, Broward County is most vulnerable to disruption to the public water supply (a less probable event) and then the supply of electric power (a more likely event due to potential wind impacts on the electrical distribution network). Damages to communications and transportation network can be overcome to some degree. However, any major damage to the port and airport, while not completely devastating right after an event, would have severe mid to long term economic consequences as the County would miss out on the economic value provided by these vital transportation nodes.

Broward County has a fairly unique challenge with 2 major metropolitan areas to its north and south (Palm Beach and Miami-Dade respectively) with fairly similar makeup and composition. Each of these counties possesses a major international airport and Miami-Dade also has a large port facility. While the County governments, disaster recovery organizations, and business alliances cooperate and would likely do so after a major event, the reality is that some commerce, trade, and businesses would likely be siphoned off to these counties if they remained more functional than Broward after a large event.

Other considerations affecting a future economic recovery effort from disaster events include the fact that Broward County, according to the Economic Development Department, exports 1/3 of its workforce daily to Palm Beach and Miami Dade Counties. If something major or catastrophic occurred in either of those counties, it would directly affect the workforce of Broward County. Another factor to weigh in is the extent of an event's impact on the residential structures of the Broward County workforce thus impacting their ability to go to work each day. A shortage in the labor force due to destruction of residential structures had a profound impact in New Orleans after Katrina. While a significant issue, it is beyond the scope of the current enhanced LMS.

The temporary or long-term loss of major portions of the Broward County and its municipalities' tax base would negatively affect county and municipal services. Any reduced services would further contribute to the image of it as a 'damaged area' which may lead to additional businesses closing and some residents moving away.

Areas of redevelopment should be selected by the significance of the area to the transportation network or another key resource. Where possible, redevelopment should be shifted away from the more risky areas in the hot spot or the County. However, this may run counter to market forces that drive businesses to cluster around a desirable natural feature like the Atlantic Ocean or the New River in downtown Fort Lauderdale.

Broward County could align its future economic development goals, in attracting high-wage, high-income jobs that don't depend on access to water, to clusters away from higher risk areas. Generally, disasters will accelerate existing development trends. However, disasters also present the opportunity to rethink current trends or make definitive investments. Some of these areas, like the Executive Airport, already have a growing concentration of businesses.

Using the maps provided in the hot spot sections, communities in these areas could select less risky areas within hot spots to rebuild (like downtown Fort Lauderdale). Here are some suggested areas to consider:

- *Downtown Fort Lauderdale*
  - North of Broward Boulevard
  - East of SW 4th Street and/or two blocks off the two branches of the New River
- *Deerfield Beach/Pompano Beach*
  - No storm surge impacts; most of area is in AH zone (shallow flooding) which may change with new dFIRMs
- *Executive Airport Area*
  - No storm surge impacts; for inland flooding, areas west of I-95 and north of the Executive Airport are best for redevelopment
- *Downtown Hollywood*
  - No storm surge impacts; for inland flooding, areas north of 20th Avenue are best for redevelopment
- *Pembroke Park*
  - No storm surge impacts; for inland flooding, the south side of Pembroke Road, and the east side of SW 30th Street are best for redevelopment
- *West Park*
  - No storm surge impacts and most of the city is not prone to inland flooding
- *Plantation*
  - No storm surge impacts; most of area is in AH zone (shallow flooding) which may change with new dFIRMs
- *Port Everglades*
  - While many of the natural areas in this hotspot are vulnerable to storm surge impacts; some of the most important commercial areas, defined by developments west of US Highway 1, areas north of I-595/595 extension, and the existing footprint of the port (McIntosh Road to the west and to its southernmost point, the developed parts of the port to the east of these point to SE 17th Street in the north) are the least vulnerable.
- *Sawgrass Mills*
  - No storm surge impacts; most of area is in AH zone (shallow flooding) which may change with new dFIRMs
- *South Florida Educational Center* (Davie)
  - Some storm surge vulnerability; best areas for redevelopment are areas west of Highway 7 and east of 30th/south of I-595

Major Government Facilities/Infrastructure Analysis

The main county facilities are in the following places:

- Broward County Governmental Center (115 South Andrews Avenue) - downtown Fort Lauderdale [2 blocks north of New River]
- Government Center West (1 North University Drive) – Plantation
- Emergency Operations Center (201 NW 84th Avenue) – Plantation
- Public Safety Building (2601 W Broward Boulevard) – Fort Lauderdale [5 blocks west of I-95; 3 blocks SW of New River (north branch)]
- Judicial Complex (201 SE 6th Street) – downtown Fort Lauderdale [1 block south of New River]
- North Regional Courthouse (1600 W Hillsboro Boulevard) – Deerfield Beach
- South Regional Courthouse (3550 Hollywood Boulevard) – Hollywood
- West Regional Courthouse (100 N. Pine Island Road) - Plantation

The area that has a concentration of key county facilities at greatest risk is the Governmental Center and Judicial Complex in downtown Fort Lauderdale. Both are close to the North Branch of the New River (Judicial Center is next to it) and the Governmental Center is at a fairly high risk to a Category 3 storm surge (the Judicial Center less so because the flooding on the north side of the New River is worse than the south side between Andrews Avenue and Federal Highway (US-1)). Both of these facilities are also vulnerable to high winds being relatively close to the ocean.

Another concentration of high value government facilities is in the midtown Plantation area near the Westfield Mall. Both the Government Center West and the EOC are in this area. The EOC is the Alternate Relocation Facility for the downtown Governmental Center is inoperable for critical executive County Administration duties (according to the County Continuity of Operations (COOP) Plan). The nearby Government Center West would be the assembly site for the County Administrator's staff to continue its functions.

The most profound consequence of damage to the County's government facilities is an interruption to the delivery of government services, a perception that the government does not have control of the situation, and/or the loss of key functions/data that take place at these facilities. Economic consequences resulting from the damage to multiple key government facilities would be devastating; the resulting response and recovery operations would be greatly hindered. A slow response by the local government and a lack of clear, unified, and timely communication would create a lack of public confidence in the government's ability to protect its own assets; no less those of the general public. The psychological impact of this perception would be detrimental to residents and businesses alike.

The incapacitation, either temporary or long-term, of the Broward County office buildings would have substantial economic impacts and greatly impair the ability of government to function. Government provides the citizens of Broward County with numerous services, many of which would be impaired or ended without central administrative centers. Therefore, protection of government assets and functions should continue to be a priority in considering mitigation actions.

Although subject to impacts from any of the hazards of most significant concern, the greatest risk to the overall operation of the County is a large hurricane that makes landfall directly east of the County Governmental Center and then keeps moving due west to hit the EOC and Government

Center West. The risk to the downtown Fort Lauderdale facilities would be from both storm surge and high wind while the risk to the Plantation facilities would be wind although inland flooding is a possibility also. While the EOC is constructed to resist the impacts of most hurricanes, the road system providing ingress and egress may be inoperable due to downed trees/powerlines and flooding. Widespread power outages would further complicate the effort to continue government services.

Broward County continually updates its key preparedness, response, and recovery plans to maintain a high level of readiness. The alternate facilities will be examined to make sure they are suitable facilities with the proper equipment and ability to function after a storm.

An additional challenge for Broward County is the number of municipalities that share key infrastructure. The County Emergency Management Division can help resolve issues that affect multiple jurisdictions, a link to resources from the State and overarching support in terms of resources and manpower.

Table 5.28 provides categories of damages for government facilities in Broward County from the 100-year wind and flood events. This information can be used to derive loss of use estimates for these facilities. There are 530 government facilities total studied in this Hazus analysis. This study projects that 36.60% of the government facilities (194) would receive either no damage or minor damage from wind while 63.39% facilities (336) would receive either moderate or severe damage. A portion of those facilities falling in the latter categories (moderate/severe) may experience some loss of use. Flood damage is also a concern with almost 92 facilities receiving between 11 to 20% of damage (17.36% of all government facilities and 64.79% of facilities receiving some damage). The facilities in this category of flood damage may experience some loss of use due to the flooding.

Table 5.28: Hazus Damage Results to Government Facilities from 100-year Wind and Flood Events

WIND	No damage	Minor damage	Moderate damage	Severe damage	Destruction	
	Count / Percent	Count / Percent	Count / Percent	Count / Percent	Count / Percent	
Government Facilities	95 17.92 %	99 18.68 %	164 30.94 %	172 32.45 %	0 0.00 %	
FLOOD	**1-10% damage**	**11-20% damage**	**21-30% damage**	**31-40% damage**	**41-50% damage**	**Substantially (over 50%)**
	Count / Percent	Count / Percent	Count / Percent	Count / Percent	Count / Percent	Count / Percent
Government Facilities	50 35.21 %	92 64.79 %	0 0 %	0 0 %	0 0 %	0 0 %

Source: Hazus 4.0

Table 5.29 analyzes impacts to essential facilities, including projected loss of use, from the 100-year wind and flood events. Wind will cause a considerable impact with 4 of 4 EOCs (the total number that are included in this study), 28 of 28 fire stations, and 36 of 37 police stations receiving some loss of use from a 100-year wind. Although this study does not project any loss of use to hospitals and schools, the potential damage is quite high as evidenced by the

projection that 25 of 25 hospitals and 418 of 418 schools have a 50% probability of at least moderate damage. Flooding is comparable in its damage with 22 of 28 fire stations, 12 of 25 hospitals, 25 of 37 police stations, and 249 of 418 schools receiving some loss of use from a 100-year flood.

Table 5.29: Hazus Damage Results to Essential Facilities from 100-year Wind and Flood Events

WIND	Total # of Facilities	Probability >50% of at Least Moderate Damage	Probability >50% of Complete Damage	Expected Loss of Use < 1 day
EOCs	4	4	0	4
Fire Stations	28	15	0	28
Hospitals	25	25	17	0
Police Stations	37	37	0	36
Schools	418	418	0	0
FLOOD	**Total # of Facilities**	**At Least Moderate Damage**	**At Least Substantial Damage**	**Loss of Use**
Fire Stations	28	23	0	22
Hospitals	25	13	0	12
Police Stations	37	30	0	25
Schools	418	278	0	249

Source: Hazus 4.0

Conclusions/Recommendations

The Economic Vulnerability chapter portrays the projected level of impact from hazards of most significant concern for Broward County. However the study focused on a medium to large size hurricane with wind, storm surge, and inland flooding to the most important commercial centers of Broward County due to the high probability of impact and damaging economic implications. To better prepare for this type of event and to lower the risk ahead of time, it is recommended that the County do the following:

- Continually refine mitigation grant prioritization tools to determine how to get the most 'bang for the buck'
- Continue its effort to protect key and critical infrastructure through the pursuit of state/federal grants and by looking for opportunities to include mitigation in its Capital Improvement Program.
- Prepare a detailed plan to bring back key facilities Continually refine the Recovery Plan to include both measures to improve short-term recovery to keep businesses open and long-term recovery to facilitate long-term economic development and lower risk
- Consider having the Private Sector Committee take on the task of internally reviewing how businesses can mitigate their risk to all hazards and how the public and private sectors can communicate to support each other during an immediate recovery. This effort would include continual enhancement of ESF-18 to become the two-way communication channel between the public and private sectors during an emergency that allows the private sector to communicate its most critical recovery needs (e.g., permitting, schools, consistent

information, re-entry) and also allows the private sector to volunteer its expertise and resources to the most critical community needs (e.g., communication) to allow a more speedy recovery for all.

- To prioritize actions, focus on one Hot Spot a year. Coordinate with the leading businesses and organizations in that Hot Spot and discuss potential mitigation actions that can be undertaken by the business community. The County can support this effort by providing technical experts and considering mitigation actions involving public facilities and infrastructure.

- The businesses identified as vulnerable from the Hot Spots analysis should perform in-depth structural and operational analyses (similar to critical facilities analysis). The results of the analyses can be used to make structural improvements to minimize damages, shorten business interruption, and determine if their insurance coverage is sufficient to cover potential damages to expedite the recovery process, and/or develop a debris management plan.

Chapter 6 – Mitigation Initiatives

As an initial step in the development of the ELMS, it is necessary to determine what hazard mitigation initiatives are currently underway in the County, or planned for the immediate future in order to establish a baseline of known governmental activities to improve the county's resistance to the impact of disasters. This activity assists the Working Group in establishing its goals and objectives.

Existing Mitigation Initiatives

In order to complete an inventory of existing and planned initiatives, Broward County's LMS Planning Subcommittee met and worked with stakeholders to gather information regarding initiatives being implemented or planned by local governments in the county. The Planning Subcommittee through a Survey Monkey soliciting information as well as communications internally within the municipalities yielded the information needed to determine existing and future initiatives. A LMS survey form was given to each municipal LMS Working Group member as well as being disseminated to the Emergency Coordinating Council (ECC) made up of the emergency management contacts for each municipality. Now being more familiar with the definition of mitigation and having ownership in the survey instrument, all the municipalities answered in more detail about mitigation practices. Review of mitigation initiatives throughout Broward County is an ongoing effort.

Broward County and its current 31 municipalities and the Seminole Tribe of Florida participate in a full range of federal, state, and local mitigation programs and initiatives. These programs and initiatives include the LMS, the Community Rating System (CRS), the National Flood Insurance Program (NFIP), Flood Mitigation Assistance Program (FMA), Pre-Disaster Mitigation Program (PDM), Hazard Mitigation Grant Program (HMGP), Emergency Management & Assistance Program (EMPA), Citizen Corp, Continuity of Operations Plan (COOP), Continuity of Government (COG) Plan, ESF#18 – Business and Industry, Broward Recovery Plan and the Broward Comprehensive Emergency Management Plan. The overarching purpose of these activities is the elimination or reduction of hazards presenting significant risk to the county and its residents. Pre-disaster activities will be coordinated through the LMS Working Group (LMSWG). The LMS Coordinator will be the Liaison between the Working Group and the State. For post-disaster activities, the Recovery Manager will liaise with the State mitigation staff and if applicable, the Joint Field Office (JFO), formerly called the Disaster Field Office (DFO).

Some municipalities have proposed no or reduced building permit fees for shuttering of residential structures and related upgrades that are considered mitigation actions, provided that the action meets the South Florida Building Code. All building activity in Broward County (both new construction and renovations) must meet the South Florida building code, which is more stringent than the building code in the rest of the state.

A major mitigation priority of the LMS is the tracking and reduction of repetitive flood loss properties. The county and its CRS participating municipalities track repetitive loss properties county-wide on an ongoing basis using data gathered annually from FEMA and the State (See Chapter 4, "Flood" subsection). For mitigation planning and strategy development purposes, the LMS maintains updated GIS maps and informational databases of repetitive loss property locations relative to historical flood areas and designated Special Flood Hazard Areas (SFHA). Repetitive loss properties are an ongoing discussion and planning priority for the LMS. In the

future, a Flood/CRS technical subcommittee will be established to address these issues. The subcommittee is envisioned to be comprised of public and private sector representatives and will be encouraged to develop and promote mitigation project ideas and strategies.

Building Permitting Activities

The Planning Committee of the LMS Working Group was given the task of determining where mitigation measures are being applied to residential and commercial properties to serve as a benchmark for the LMS. It was determined to be too time consuming for each community to gather information and write a report on behalf of the Working Group. A survey instrument was developed to be filled out by each individual applicant as they apply for a permit in each municipality as part of the permitting process. The completed permit survey forms are gathered by each municipality and submitted to Broward County Emergency Management on a semi-annual basis. An annual report of all mitigation activity will then be compiled.

Capability Assessment

The mitigation strategy serves as a vital link between the risk described in the Risk and Vulnerability Assessment and the ultimate action outcomes of the plan and planning process. A necessary intermediary step is a understanding of the presence of the resources, laws, and programs that help implement mitigation actions. This step is known as the capability assessment and it's basis in the current regulations is 44 CFR 201.6(c)(3):

> 3) *A mitigation strategy* that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

"Future Mitigation Initiatives", found later in Chapter 6, outlines actions to expand on and improve existing tools. Some of the information below is detailed in other parts of the plan. It is summarized (and referenced) below to provide an overview of the authorities, policies, programs and resources (which includes committees, tools, laws and funding sources) that make mitigation possible on an on-going, not just post-disaster, basis in Broward County:

Funding programs

See "Funding Sources" found later in this Chapter.

County programs

- Broward County Risk Management Division – This division for the Broward County Board of County Commissioners is responsible for administering the County's self-insurance program for workers' compensation, general liability, automobile liability, and property damage claims. Broward County's purchased insurance program includes the procurement of property insurance which in 2011-2012 was Factory Mutual (FM) Global. The Division's mission is to continuously develop, manage, and improve insurance and safety/occupational health services in order to provide quality, cost-effective support to its customers and to protect the County's financial well-being.
    - The County has a deductible of $100,000,000 for its property and FM Global generally requires protection up to a Category 3 windstorm for properties it insures.

Planning policies and Laws

- Land Use Plan - The Broward County Planning Council is charged with the responsibility of preparing a county-wide land use plan under the Charter of Broward County, Florida. The Charter requires all local land use plans within the County to conform to the Broward County Land Use Plan. The Land Use Plan establishes the framework for the future development and redevelopment of Broward County and for the provision of facilities and services within the County. All development must be consistent with the uses, the densities and the intensities of this policy plan.
    - Objective 1.05.00 – Coastal Densities and Hurricane Evacuation: Consider appropriate densities in coastal areas with regards to Broward County hurricane evacuation clearance standards
    - Objective 8.03.10 – Encourages municipalities to prepare flexible land development codes and regulations that address negative drainage pattern impacts caused by impervious surface area of redevelopment/infill activities
    - Objective 8.08.00 – Post-Disaster Redevelopment and Hazard Mitigation: 1) Inventory hazard-prone properties and encourage building codes and development regulations that reduce future property damages and losses [*see Chapter 7 for suggestions for future changes*]. 3) Encourage acquisition or redevelopment of hazard prone property to avoid future damages.
    - Objective 9.07.00 – Protect Areas Subject to Seasonal or Periodic Flooding (identified floodplains): Includes requirements that redevelopment address existing flood problems.

- See "Plan Integration Efforts" in Chapter 7 and Appendix H for more information about how mitigation is integrated into other community plans including the County's Comprehensive Plan (which is only pertinent to the Broward Municipal Services District unincorporated parts of the County).

Building codes

- State of Florida Building Code - Broward County and South Florida have probably the most restrictive wind protection building code standards in the nation. Broward County must comply with the State of Florida Building Code, revised in 2010, which has the following wind protection requirements (effective March 12, 2012):
    - Ultimate Design Wind Speed is 170 miles per hour but for residential structures, the design pressures that the wind protection products are required to meet virtually stays the same as the 2007 code which for Broward was 140 miles per hour for the 3-second gust. All of Broward County is in the Wind-Borne Debris Region of the state.
    - Exposure Category (used to describe area around building): C. This category is the most second stringent standard in Florida. Areas affected by wind over open water that extends 5000 feet or 20 times the height of the building in the upwind direction are in Exposure Category D, the most stringent standard.
    - Building Risk Categories requirements for Broward (Ultimate Design Wind Speed):
        - Risk Category I Buildings and Structures: 156 mph
        - Risk Category II Buildings and Structures: 170 mph
        - Risk Category III and IV Buildings & Structures: 180 mph
    - Building Risk Categories are the following:

- **I** - Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to agricultural, minor storage and certain types of temporary facilities.
- **II** – Buildings/structures not listed in I, III and IV which is most residential and commercial buildings.
- **III** - Buildings and other structures that represent a substantial hazard to human life in the event of failure. A few examples include:
  - Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300.
  - Buildings and other structures containing elementary school, secondary school or day care facilities with an occupant load greater than 250.
  - Power-generating stations, water treatment facilities for potable water, waste water treatment facilities and other public utility facilities not included in Occupancy Category IV
- **IV** - Buildings and other structures designated as essential facilities. A few examples include:
  - Fire, rescue, ambulance and police stations and emergency vehicle garages.
  - Designated earthquake, hurricane or other emergency shelters.
  - Designated emergency preparedness, communications and operations centers and other facilities required for emergency response.
  - Aviation control towers, air traffic control centers and emergency aircraft hangars.
  - Water storage facilities and pump structures required to maintain water pressure for fire suppression.

- The Building Code Effectiveness Grading Schedule (BCEGS®) - Assesses the building codes in effect in a particular community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. The concept is simple: municipalities with well-enforced, up-to-date codes should demonstrate better loss experience, and insurance rates can reflect that. The prospect of lessening catastrophe-related damage and ultimately lowering insurance costs provides an incentive for communities to enforce their building codes rigorously — especially as they relate to windstorm and earthquake damage. Several Broward municipalities participate in the BCEGS rating system. In 2011, Broward Municipal Services District unincorporated Broward County, Lazy Lake, Hillsboro Beach and Lauderdale-By-The-Sea retained a 10% insurance discount because the Broward County Permitting Section of the Permitting, Licensing and Consumer Protection Division maintained its BCEGS rating.

Floodplain management/Flood insurance/Drainage

NFIP participation – As of April 2017, 30 out of 31 of Broward County's municipalities participate in the NFIP as well as the County itself and the Seminole Tribe which is partially located in Broward County. (https://www.fema.gov/cis/FL.pdf https://www.fema.gov/national-flood-insurance-program-community-status-book)

CRS participation – As of October 1, 2016, 24 of 31 Broward County's municipalities participate in the CRS program. The Broward's Municipal Services District (BMSD) also participates. (https://www.fema.gov/media-library-data/1476294162726-4795edc7fe5cde0c997bc4389d1265bd/CRS_List_of_Communites_10_01_2016.pdf https://www.fema.gov/media-library/assets/documents/15846)

Drainage responsibilities - Responsibility for canal and lake maintenance (storm water management systems) in most developments is that of the homeowners association. There are 24 independent and dependent districts that have jurisdiction over water related issues and several cities actively manage surface waters in their jurisdictions (e.g., South Broward Drainage District, Central Broward Water Control District). The Broward County Water Management Division has responsibility for seven dependent drainage districts and the Broward Municipal Services District unincorporated neighborhoods not within an independent drainage district. Permitting is done by the independent drainage districts in their districts and by Broward County Department of Planning and Environmental Protection (DPEP) for areas outside of the independent districts. SFWMD permits the larger developments throughout the County. (http://gis.broward.org/maps/webPDFs/EnvironmentalMaps/draindistrict.pdf)

Overarching and Collaborative partnerships

- Climate Change Task Force – On June 24, 2008, the Broward County Board of County Commissioners approved Resolution 2008-442 creating a Climate Change Task Force to develop recommendations for a coordinated county-wide strategy in mitigating the causes, and addressing the local implications, of global climate change. The Task Force members have been appointed by the Board and they will be supported by County staff. The duties and responsibilities of the Task Force have been determined. Subcommittees have been identified and their mission statements drafted.
    - Key responsibility related to hazard mitigation – "development and implementation of adaptation strategies to alleviate the likely adverse consequences of climate change including rising sea levels, hurricanes and other violent weather events"

- Climate Change Government Operations Group - The Broward County Climate Change Government Operations Workgroup (PDF) includes representatives from many county agencies that are organized into committees in the areas of buildings/infrastructure, waste, transportation, natural systems and policies. The Workgroup Steering Committee meets monthly to identify potential emission reduction actions and propose implementation of selected actions. The Workgroup works very closely with International Council for Local Environmental Initiatives (ICLEI) the Budget Office, the Broward County Climate Change Task Force, and other local organizations to identify funding opportunities for the implementation of GHG reduction projects.

- Southeast Florida Regional Climate Change Compact - Represents a joint commitment of Broward, Miami-Dade, Palm Beach and Monroe Counties to partner in mitigating the causes and adapting to the consequences of climate change. The Compact was formalized following the 2009 Southeast Florida Climate Leadership Summit, when

elected officials came together to discuss challenges and strategies for responding to the impacts of climate change. The Compact outlines a collaborative effort to participate in a Regional Climate Team toward the development of a Southeast Florida Regional Climate Change Action Plan. Among the actions the Compact takes related to hazard mitigation are:

- Unified Sea Level Rise Projection – partnered with SFWMD
- Prepare Inundation Mapping and Vulnerability Assessment of Areas at Risk by Sea Level Rise
- Develop Priority Planning areas and Adaptation Action Areas which involves preparing inundation mapping and risk assessments revealed the need to focus adaptation improvements in areas of increased risk of inundation due to sea level rise, and the means for directing future funding to these targeted areas. The term Adaptation Action Area (AAA) was created to provide for special designation of these priority planning areas where coastal and tidal flooding placed public and private infrastructure at risk.
  - Comprehensive plan – new iteration with Priority Planning Areas (later - Adaptation Action Areas) for Broward Municipal Services District unincorporated areas
  - Municipal versions of Priority Planning Areas – Ft. Lauderdale

- Intergovernmental Emergency Coordinating Committee (ECC) - Assists in identifying needs, operational structure, and guidelines; provide recommendations to Broward County and municipalities in Broward County regarding disaster preparedness and response and recovery efforts. Provides a forum to foster coordination and cooperation among county government and municipal governments in Broward County, together with such other public and private organizations which plan for and respond to disasters and other emergencies.

- Broward Surface Water Coordinating Council – This group is primarily composed of the SFWMD and local drainage districts. Broward County EMD officials have started attending these meetings to participate in discussions about drainage and public works needs.

- Enhanced Local Mitigation Strategy –Broward County has a currently approved ELMS and its efforts to enhance it were completed by September 2017. This effort for the 5 year required update is expected to be completed, approved and adopted by March 2018.

- South Florida Regional Planning Council – Oversees larger issues affecting the four counties in the South Florida area (Monroe, Miami-Dade, and Broward). As of May 2012, the SFRPC is investigating the possibility of conducting a regional economic analysis using modeling software from Regional Economics Modeling, Inc. Also acquires and maintains important economic and demographic data. The Council regularly reviews local government comprehensive plans and plan amendments for consistency with the Strategic Regional Policy Plan (SRPP). Local governments amend their plans regularly to adjust to changing conditions. Plan and plan amendments are reviewed to determine compatibility with the SRPP and for extra-jurisdictional impacts.

- Sustainability Tools for Assessing and Rating Communities (STAR Community)

- Broward County is a diverse, vibrant, urban community with parks, beaches, and green space. Broward has something for everyone. Positioned at the center of Southeast Florida, we are environmentally and economically sustainable and a gateway to the international marketplace. Broward County is a regional body working together with government partners and stakeholders to achieve common goals. We are home to innovation and a great place to live, work, play, and visit. For more information, visit http://www.broward.org/4STAR/About4-STAR/Pages/default.aspx. Broward County joined the STAR network as a Pilot Community in November 2012. As a Pilot, the community greatly helped to improve STAR through a year-long testing and evaluation period of the STAR Community Rating System and its associated tools and products. In February 2014, Broward County became the first county government in the United States to achieve a Certified 4-STAR Community Rating.

Post-disaster initiatives for mitigation

- See Broward County Recovery Plan

Federal standards

Department of Homeland Security (DHS) core capabilities - One of the goals of the National Preparedness System (NPS), based on Presidential Policy Directive (PPD) – 8, is the "the unrelenting pursuit of risk informed decisions and actions that increase resiliency". One central focus of the ELMS is to update and advance an understanding of risk in Broward County to natural and manmade hazards (updating of Chapter 4 including new subsection of Climate Change/Sea Level Rise and addition of Chapter 5). A follow-up to this effort is to review existing mitigation actions and develop new ones based on this better understanding of risk. The following are a listing of DHS core capabilities relevant to hazard mitigation and how the ELMS meets these capabilities:

- Threats and Hazard Identification – "Identify the threats and hazards that occur in the geographic area; determine the frequency and magnitude; and incorporate this into analysis and planning processes so as to clearly understand the needs of a community or entity."
    - ELMS meets this capability by providing detailed analysis of how different natural and manmade hazards and threat may affect the County and determine potential magnitudes as well as frequencies (likelihood of future recurrence). This analysis in Chapters 4 and 5 is the basis for the rest of the plan.

- Risk and Disaster Resilience Assessment – "Assess risk and disaster resilience so that decision makers, responders, and community members can take informed action to reduce their entity's risk and increase their resilience."
    - ELMS meets this capability by involving a wide representation of the community in LMS meetings and presenting them the findings of the risk and vulnerability assessment. In at least 3 meetings during the ELMS development in 2011-2012, the findings of the Economic Vulnerability and update Risk Assessment (e.g., sea level rise subsection) have been presented to the LMS. The LMS has increased its overall membership including the private sector. Under the Recovery

Framework development, leadership on the Technical Assistance Committees has emerged from multiple sources (e.g., County/municipal government, private sector).

- Community Resilience – "Lead the integrated effort to recognize, understand, communicate, plan, and address risks so that the community can develop a set of actions to accomplish Mitigation and improve resilience."
    - See response to "Risk and Disaster Resilience Assessment". The ELMS is available for review on the Broward County ftp site.

- Long-term Vulnerability Reduction – "Build and sustain resilient systems, communities, and critical infrastructure and key resources lifelines so as to reduce their vulnerability to natural, technological, and human-caused incidents by lessening the likelihood, severity, and duration of the adverse consequences related to these incidents."
    - ELMS meets this through the development of the MAT Tool process which sets up a system for reviewing county investments for mitigation opportunities. In addition, several projects on the current LMS list are for protecting key facilities and resources. The LMS is in partnership with the Climate Change Government Operations Group which is developing comprehensive planning principles to steer future infrastructure and development away from areas at highest risk from the impacts of climate change and hurricanes. A future step in this process will be to analyze the potential impacts of technological and human-caused impacts on lifelines and taking action. See Appendix O for more information.

- DHS Threat and Hazard Identification and Risk Assessment (THIRA) guide – It provides a comprehensive approach for identifying and assessing risks and associated impacts. It expands on existing local, tribal, territorial, and state Hazard Identification and Risk Assessments (HIRAs) and other risk methodologies by broadening the factors considered in the process, incorporating the whole community throughout the entire process, and by accounting for important community-specific factors
    - Step 1: Assess various threats and hazards facing a community of any size – Chapter 4 provides a comprehensive review of hazards and threats in Broward County
    - Step 2: Vulnerability of the community to these hazards in context with time, season, location, and community factors – Chapter 4 provides historical information indicating where and when these hazards have occurred. It also provides future likelihood and some maps of where the future project losses may occur. Chapter 5 looks specifically at how the major hazards may threaten key commercial core areas and key infrastructure in those area very specifically with maps and loss projections.
    - Step 3: Consequences of the threat and hazards impacting the community – In Chapter 5, under "Summary of Potential Impacts and Potential Areas for Redevelopment" and "Major Government Facilities/Infrastructure Analysis", consequences of some of the hazards impacting the community are described.
    - Step 4: Through the lens of DHS core capabilities, establish capability targets: This step is primarily geared toward preparedness but in this subsection, it is listed how the ELMS meets the four core capabilities related to hazard mitigation.
    - Step 5: Using the results of the THIRA process, set an informed foundation for mitigation planning activities – Chapter 6 lists County Initiatives, Appendix C lists

LMS projects, and Chapter 7 provides how mitigation is incorporated into county planning processes which demonstrate how the County responds through actions and initiatives to the risk outlined in Chapters 4 and 5.

Future Mitigation Initiatives

During the 2011-2012, the following additional components were included in the ELMS:

- Inclusion of climate change and sea level rise impacts including proposed changes from the Climate Change Government Operations Group (e.g., the Priority Planning areas as part of the Adaptation Action Areas revision to the Comprehensive Plan)
- More robust private sector involvement including ways to help businesses mitigate and recover quicker from hazard events
- Coordination with the Recovery efforts including all documents in the Broward County Recovery Framework (formerly County-wide Recovery Process or CRP)
- Use of cost-effectiveness screening tools like the Loss Estimation Tool (LET), which was developed during the ELMS process (Appendix L)
- Integration with community planning and capital improvement funding processes
- Development of a secure website for applicants to submit LMS projects. It will include access to the Loss Estimation Tool and will allow for an automated process of prioritizing the projects based on the criteria in the current prioritization matrix (Appendix A).
- Development of public website to contain guidance materials for the community on mitigation projects for their homes
- Suggested change to Broward County Land Use Plan found in Chapter 7
- HSEEP-compliant workshop on April 12, 2012 to discuss how ELMS meets DHS core capabilities related to hazard mitigation

During the 2017 Risk and Vulnerability Analysis Workshop the following current or planned Mitigation Capital Improvement Projects were identified:

Table 6.1: Mitigation Capital Improvement Projects

Jurisdiction	Project Description
Broward County	• Traffic Engineering Division has a mast arm conversion program underway to change concrete signals to a mast arms system. Approximately10 signals per year being completed and they are two-thirds transitioned at this point. Also upgraded traffic sign post program with sturdier square posts. • Construction Management Division – Testing Uplift System
BCAD – Aviation	• Planned Emergency Operations Center – Improved Physical Location
Town of Davie	• Davie is hiring a consultant and getting a Storm Water Master plan completed so that they can further understand their risk and invest dollars in the most effective place for mitigation. • New Field Operations Center Construction • Employee Cybersecurity Training
City of Deerfield Beach	• Storm Water Management Master Plan • Facility (Structural) renovations and rebuild

City of Fort Lauderdale	• The City of Fort Lauderdale has been leveeing residential areas to deal with flooding. City recognizes it needs to improve storm water handling. They have imposed a fee on the Greater Ft. Lauderdale Convention & Visitors Bureau (CVB) and will be imposing it on all residents as well to help pay for this.
City of Hallandale Beach	• Hallandale Beach is nearing the end of a loss mitigation plan that they instituted with the help of FEMA money. HSGP funding providing a Storm Water Pump System with injection wells. • Replacement Lift Station with improved generator built to account for sea-level rise.
City of Margate Engineering	• DEES (Engineering) – Flood Plan Managers, Planning Development Review • PW – Storm water maintenance and improvements • IT – Cybersecurity Threats
City of Margate Fire Department	• Acquisition of Drones for aerial surveillance
City of North Lauderdale	• Repaving and creating more green area • Programming more CIP funding for updated servers for computers and back-up systems. • Making sure pumping stations are up-to-date, used and tested.
Oakland Park	• New EOC with state-of-the-art technology for improved communications. • Drainage improvement program that was initiated in 1998 and is ongoing. • New pump station. • Upgrade of traffic signage (heavier gauge, sturdier)
City of Parkland	• Road Stabilization
City of Pembroke Pines	• Storm Water Improvements – Utility Infrastructure Hardening
City of Tamarac	• Undergone drainage improvements, specifically tree planting and repaving. • Pumps in business district – westside of flood plain • Government Cyber-security investment • Upgrades to canal system

Appendix C contains the latest update of Broward County's LMS Mitigation Project List. The list of projects is ever changing as projects completed through self-funding or with grant assistance are dropped and new proposed and planned projects are added. Jurisdictions and other potential project sponsors, particularly those not having projects on the current list, are encouraged to submit projects. The expectation is that all eligible applicants are represented on this list with projects that address identified local hazards, vulnerabilities, and mitigation strategies.

The status for each project is included.

Goals and Objectives and Strategies

The Executive Committee has been given the task of formulating the goals and objectives for the LMS. Mitigation goals and objectives must be consistent with the goals and objectives of the county and the individual municipalities' master plans, their codes and ordinances, as well as other endeavors that reflect the aspirations for the welfare, safety and quality of life of their citizens. The 2016-2017 update also included additional new goals and objectives and the identification of proposed strategies that would serve as guidance in achieving goals and objectives. The strategies, goals and objectives were reviewed again in 2016-2017. Most of the existing goals were affirmed and a few revisions/additions were made to the objectives.

The following are the goals and objective of the ELMS:

Mission Statement

The mission of the Broward County Local Mitigation Strategy Working Group (LMS) is to promote a comprehensive mitigation program to strengthen Broward County and its communities and to minimize the impact of natural, technological, and societal hazards. This can be achieved by increasing public awareness, documenting the resources for risk reduction, and identifying activities that will guide the county towards building a safer community.

I. Proposed Strategies:

A. Encourage requiring damaged housing structures in the City (municipality) and the Broward Municipal Services District (BMSD) to be restored using hazard mitigation measures to reduce hazard vulnerability.
   1. There is a building official's roundtable that meets monthly and Committee Members will engage and participate if allowable to ensure consistent communication and information.

B. Establish a Disaster Resistant Economic Action for Mitigation (DREAM) Team in the municipalities to assist businesses that will need to mitigate future disasters and increase the likelihood of their continuity. This will become and initiative for the Private Sector Subcommittee.

C. Incorporate disaster mitigation and resiliency type projects identified and funded in the Enhanced Local Mitigation Strategy (ELMS) into the municipalities Capital Improvement Plans (CIPs).

Goal #1 – Protect human health, safety, and welfare

Objectives

1.1 Limit long-term public investment in areas identified as subject to repetitive damage from disasters.

1.2 Ensure the protection of critical facilities such as prohibitions on constructing critical facilities in high-hazard areas (which includes 100-year and 500-year floodplains prohibited by FEMA in 44 CFR Part 9 if federal funds are involved).

1.3 Reduce or eliminate development in hazard prone areas such as floodplains (e.g., short term focus on 100-year floodplain and long-term 500-year floodplain).

1.4 Implement additional development restrictions in high-hazard areas especially as related to post-disaster redevelopment.

1.5 Consider the use of land acquisition programs for properties subject to development that are located in high-hazard areas.

1.6 Coordinate with SFWMD to discuss what measures need to be taken to prepare and retrofit water control structures for sea level rise to maintain salinity barrier and offer flood protection.

Goal #2 – To increase business, residential, and community awareness and implementation of hazard mitigation

Objectives

2.1 Identify segments of the community most at risk and develop strategies that will ensure effective dissemination of mitigation information.

2.2 Implement a strategy to educate interest in obtaining disaster mitigation and preparedness training.

2.3 Develop a single clearinghouse to disseminate accurate and consistent information relating to disaster mitigation.

2.4 Maintain a profile of available funding sources for mitigation projects and make it available through the Broward County website.

2.5 Create and maintain a listing of successfully mitigated projects to showcase best practices county-wide.

2.6 Actively support the Private Sector Committee and help businesses identify mitigation opportunities for self-funding; particularly in areas identified as vulnerable in the 'hot spots' of Chapter 5.

2.7 Create and maintain a list of highly successful sea level rise adaptation projects to showcase best practices utilized in the South Florida region.

2.8 Hotels, especially those high-rises in coastal mandatory evacuation zones should consider mitigation measures that allow guests and staff to shelter-in-place to protect guests, protect property, and reduce the pressure on shelters.

2.9 With results from Housing Vulnerability Chapter of ELMS (soon to be added), work with municipalities to identify mitigation measures and state/federal funding available to residents in areas of highest vulnerability.

Goal #3 – To ensure adequate training opportunities to support hazard mitigation and enhance outreach efforts that educate the public on existing identified hazards as well as new and emerging threats and hazards

Objectives

3.1 Develop ongoing education and exercise curricula for public and private officials in the areas of hazard mitigation and emergency management.

3.2 Support local training opportunities in hazard mitigation construction techniques for building officials, engineers, and other public officials.

3.3 Support existing hazard mitigation training efforts.

3.4 Maintain a profile of existing available resources for mitigation training projects.

3.5 Partner with businesses to offer hazard mitigation classes for residents, especially at hardware and home improvement stores (see also Miami-Dade's "*Mitigation for Misers"*).

Goal #4 – To facilitate preventive measures to mitigate hazards

Objectives

4.1 Encourage local municipalities and eligible nonprofit entities to review site and building plans for hazard mitigation issues and to include storm hardening in the building plans, including retrofit and renovation, of all municipal structures. Link hazard mitigation considerations to each municipality's capital improvement funding process.

4.2 Encourage retrofitting of existing residential and business structures using disaster mitigation construction techniques.

4.3 Encourage the development of hazard mitigation related building codes and inspection procedures.

4.4 Encourage local governments to implement prioritized hazard mitigation projects.

4.5 Maintain a profile of existing available funding sources for structural mitigation projects and make it available through the Broward County website, press releases (as applicable), and any Broward County newsletters available to the general public.

4.6 Encourage County and municipal agencies to identify mitigation needs for key facilities identified for post-disaster use in COOP plans and research ways and means to mitigate vulnerabilities.

Goal #5 – To facilitate planning initiatives that ensure effective hazard mitigation programs and policies

5.1 In the Adaptation Action Areas, all regulatory agencies should discourage expenditures of public funds for infrastructure improvements that attract new residential development. [see Appendix H and Chapter 7, "County Comprehensive Plan" under "Plan Integration Efforts for more information on Adaptation Action Areas"]

5.2 Develop strategies to reduce risk to healthcare patients and special needs medical populations within vulnerable areas, including land development code revisions to discourage the construction of new year-round residential facilities for treatment of special needs medical populations in Adaptation Action Areas.

5.4 Encourage all municipalities to develop and maintain an all-hazard Comprehensive Emergency Management Plan (CEMP) that is consistent with other county plans and procedures.

5.5 In areas identified by the vulnerability analysis as being a threat due to the presence of hazardous materials, local governments should encourage compatible land uses, and improve public safety.

Goal #6 – Develop and enhance regional mitigation efforts

Objectives

6.1 Coordinate with other government agencies to develop regional mitigation efforts to include a variety of hazard related events and potential future sea level rise threats.

6.2 Work with SFWMD to upgrade and/or retrofit water control structures for flooding and changing sea level rise conditions.

6.3 County should continue to work in collaboration with municipalities, adjacent counties and continue to focus on efforts to mitigate against sea level rise, especially in the face of a probable decrease in funding from state and federal government.

Goal #7 – Promote mitigation partnerships and innovative methods of financing mitigation

Objectives

7.1 Develop effective partnerships with public and private sector organizations and significant agencies and businesses for future hazard mitigation efforts.

7.2 Identify Alternative Financing for mitigation measures for locally funded actions beyond code, beyond county insurer requirements

7.3 Evaluate use of Global Match credit to be tracked for potential use with HMGP projects

7.4 Utilize County personnel (EMD, OIAPS/Grants Management) in an effort to assist municipalities on
obtaining grants or other funding for infrastructure repair/improvement projects especially those that improve drainage in areas historically prone to flooding or Repetitive Loss (RL) or Severe Repetitive Loss (SRL) properties.

Goal #8 – Lower flood insurance premiums through Community Rating System (CRS) activities

Objectives

8.1 Encourage 100% municipal participation in the CRS.

8.2 Because the LMS Working Group recognizes that flood insurance premiums will continue

to rise, pursue actions whenever possible which will result in CRS credit for the county and all municipalities within it.

Goal #9 – Encourage resilient infrastructure county-wide

Objectives

9.1 Utilize the LMS Project List to prioritize projects that encourage sustainable, resilient infrastructure and include as part of annual project list update process with revision of language on screening forms.

9.2 Utilize the LMS as a means to promote the incorporation of green infrastructure where and when possible, mitigate existing critical facilities and promote activities which address climate change concerns.

Prioritization of Mitigation Projects

A mechanism for determining and prioritizing mitigation projects for Broward County was sought out as part of the early Local Mitigation Strategy. A consultant drafted the first version of prioritization procedures, but as the LMS Working Group evolved, members began the process and realized a more simplified version would be necessary for implementation. In 2015 as part of the EMAP self-assessment phase and in 2016-2017 as part of the ELMS process and with oversight by the Executive Committee the Matrix was slightly revised to include language changes that incorporated compliance with emergency management standards. The latest Project Prioritization Matrix version can be found in Appendix A and the revised Proposed Mitigation Project Form in Appendix B.

It is the responsibility of each jurisdiction/agency to identify mitigation projects. As projects are identified, the jurisdiction/agency should screen the project using the Loss Estimation Tool and must complete a submission form in order for the project to be considered (see Appendix B). This tool incorporates FEMA mitigation grant cost-effectiveness principles in a user-friendly format and is an excellent way to screen projects on their likelihood to be cost-effective. Once completed, the project proposal form is then submitted to the LMS Coordinator, who in turn presents them to the Executive Committee to be scored and ranked. In the future, a formal review schedule will be developed. See Appendix L for Loss Estimation Tool information.

A current listing of active projects can be found in Appendix C and will be reviewed by the Executive Committee on an annual basis, or as deemed necessary, to validate its ranking and applicability. In addition to these projects, which should undergo a resubmittal using the revised Appendix A and B forms, the ELMS process created additional overarching mitigation actions that are listed in “Future Mitigation Initiatives” and “County Initiatives” in this chapter. As part of the annual updates, all entities who have submitted projects are required to indicate if a project has remained viable. If not, that project will be removed from the active list and coded “Inactive”. Completed projects will also remain on the list to show progress in implementing the mitigation plan.

Presently, the top 10 priority projects are listed, along with scoring numbers. In the near future, it is a priority for the LMS Working Group to completely review and update all projects to reflect current costs and applicant priorities.

In the event of a Presidentially Declared Disaster, Broward County Emergency Management Division will work with federal, state, and local officials to coordinate and manage FEMA Disaster Assistance funding programs. When the State opens the application period for HMGP and/or PDM funds, the most current prioritized projects, which meet the HMGP and/or PDM requirements, will be gathered and reviewed by the Executive Committee. Consideration for projects for other FEMA funding sources, e.g., FMA, Repetitive Flood Claims (RFC) and Severe Repetitive Loss (SRL), will occur as needed based on funding availability and meeting these programs' more restrictive eligibility criteria.

A tiered approach will be used in order to best utilize the available HMGP funding throughout Broward County. Projects will be categorized as Single Jurisdiction, Multi-jurisdictional, and County-wide. The applicable percentage applied for each category will be established by the Executive Committee for each disaster.

County Initiatives

These are larger overarching actions that require the leaderships of the County EMD and the LMS Executive Committee to consider for implementation. These are recommended actions resulting from the various components of the ELMS process. Overall, they will respond to the updated risk information from Chapter 4 and Chapter 5.

- Use the National Weather Service (NWS) Storm Data Report as recommended by the Florida Division of Emergency Management/Florida Planning and Development Lab's "Recommended Integration Practices: Strengthening the Floodplain Management Plan and Portions of the Local Mitigation Strategy"[18]. The County EMD should facilitate the adoption of this process with the municipalities. It provides a uniform, credible source of data collection that is stored in a centralized area on a more permanent basis that can endure changes in staff level at local level. It is accessible to anyone with an internet connection and has the following procedures:
    - Storm Data Report allow multiple avenues for the submission of storm data which includes phone reports, internet reports , collection from local media sources, and calls to local emergency dispatchers during or after a severe weather occurrence. This data will then be compiled and stored in the online NWS Storm Data Database where it may be accessed online at the following address: http://www.srh.noaa.gov/StormReport/SubmitReport.php?site=mlb. It is critical to include critical detailed Information like a listing of structures impacted and flood depths with each report.
- Coordinate with the SFWMD and Surface Water Coordinating Council on larger-scale drainage projects.
- Support the Climate Change Government Operations Group on the following actions that overlap with hazard mitigation from the 2010 Climate Change Action Plan:

[18] Reference to the August 2011 draft version of this FDEM/FSU document

  - Collaborate on legislative policies that can bring funds to implement action items in South Florida
  - Collaborate broadly on mitigation and adaptation policies (with municipalities, groups like Broward League of Cities, neighboring counties, non-profits, etc.) [Mitigation can piggyback on Climate Change efforts]
  - Lead advocacy on climate change policies with national and state groups like National Association of Counties, Florida Association of Counties, and Florida League of Cities
  - Work to integrate sustainable practices and adaptability into comprehensive plans (priority planning areas and Adoption Action Areas) and long-range transportation plans
  - Join the support of state, regional and local agencies in mitigation and adaptation plans
  - Revise Land Use Plan to address mitigation and adaptation policies [see suggested changes in Chapter 7]
  - Remove barriers to restricting development in vulnerable areas
  - Adopt adaptation standards for all new public buildings by considering sea level rise and climate change impacts
  - Inventory county owned infrastructure at risk from sea level rise/climate change impacts [several agencies have completed inventories]
  - Develop strategies for retrofitting flood control gates for sea level rise
  - Improve inundation mapping capabilities [in progress]
  - Develop new 100-year storm maps and encourage FEMA to consider sea level rise in map updates
  - Support technical efforts to better understand risk from potential climate change scenarios
  - Encourage green and climate impact resistance construction practices
  - Review contents in County buildings for mitigation opportunities because it is self-insured
  - Validate that structures not viable for mitigation/loss control are properly valued for insurance replacement value purposes
- Support efforts to restore funding to SFWMD needed for long-term drainage assistance.
- Build on public involvement efforts detailed in Chapter 7 in developing a website or webpage to provide the general public guidance materials on mitigation projects for their homes. This effort and any follow-up technical assistance/outreach activities will help mitigate the vulnerability of residential housing in Broward County depicted in Appendix J.

Funding Sources

The following is a list of the primary funding sources for mitigation projects with key information (also see Appendix M):

Federal

- **FEMA HMGP** – Key purpose is to provide an opportunity to take critical mitigation measures to reduce the risk of loss of life and property from future disasters during the post-disaster reconstruction process. The State of Florida has additional parameters on

how HMGP funds are made available in the state post-disaster. (See **Table 6.1** for a list of eligible project types for HMGP and the other 4 FEMA mitigation grant programs).

- **FEMA PDM** – Key purpose is to provide a sustained pre-disaster natural hazard mitigation program to reduce the risk to population and structures from future hazard events. The program is funded out of non-disaster programs with the intent to reduce reliance on Federal funding from future disasters. The PDM annual budget is subject to periodic fluctuations based on Congressional priorities.

- **FEMA FMA**– Key purpose is to reduce or eliminate claims under the NFIP by making available funds for flood mitigation projects for structures covered by flood insurance policies.

- **FEMA RFC** – Key purpose is to make grant funds available to reduce flood damages to individual properties for which one or more flood insurance claim payments for losses have been made and that will result in the greatest savings to the National Flood Insurance Fund (NFIF) in the shortest period of time.

- **FEMA SRL** – Key purpose is to make grant funds available to reduce flood damages to residential properties that have experienced severe repetitive losses under flood insurance coverage and will result in the greatest savings to the NFIF in the shortest period of time.

- **FEMA Public Assistance (PA) 406 Mitigation Grant Program** (this potential funding source is also detailed in the Broward County Recovery Framework (former CRP) – Is available for counties included in a FEMA presidential disaster declaration if they are otherwise eligible for the PA program, a valid and eligible PA project is included in the Project Worksheet in a timely manner, and the FEMA PA group administering the disaster is in agreement. Project types range from floodproofing, to wind protection to road elevation to drainage upgrades/improvements. For more information on this program, visit the following website: www.fema.gov/government/grant/pa/9526_1.

- **Department of Housing and Urban Development (HUD) Community Development Block Grant program (CDBG) Disaster Recovery Program** – This program is made available on a case-by-case basis by the U.S. Congress and is usually authorized after larger disaster events that already received a presidential disaster declaration. Project types are generally for residential properties (acquisition, elevation) but can also be available for small businesses including rental properties (elevation). Code enforcement support is also potentially eligible. To get additional information on this program, visit the following website: www.hud.gov/offices/cpd/communitydevelopment/programs/drsi.

- **US Army Corps of Engineers Mitigation -** The USACE's Flood Control (Structural & Non-Structural), Section 205 of the 1948 Flood Control Act, as amended, authorizes the U.S. Army Corps of Engineers to develop and construct small flood control projects. Each project is limited to a Federal cost of $7,000,000.00 and must be economically justified, environmentally sound, and technically feasible. See the following website for more information: http://www.nww.usace.army.mil/html/pub/ap/facts/sec205.pdf. The USACE's Emergency Streambank and Shore Protection program, Section 14 of the 1946 Flood Control Act, as amended, authorizes the USACE to develop and construct streambank

and shoreline protection projects. The goal of the program is to protect endangered highways, bridge approaches, public works facilities, churches, public and private nonprofit public facilities. Each project is limited to a Federal cost of $1,500,000.00 and must be economically justified, environmentally sound, and technically feasible. See the following website for more information: http://www.nww.usace.army.mil/html/pub/ap/facts/sec14.pdf. Section 103 of the 1962 River and Harbor Act authorizes the USACE to develop small projects for the purpose of shore protection and beach restoration. Each project is limited to a Federal cost of $3,000,000, and must be economically justified, environmentally sound, and engineering feasible. Eligible applicants include local municipalities and public agencies.

- **Department of Homeland Security (DHS), State Homeland Security Program (SHSP) –** Eligible activities include planning, training, exercise, and organization including mitigation and recovery activities from acts of terrorism and catastrophic events. For more information, see the following website: www.fema.gov/government/grant/hsgp.

- **Coastal Management Program Grants –** Includes the Coastal Resource Improvement Program which funds on small-scale construction or land acquisition projects that enhance public access to the coast, facilitate redevelopment of urban waterfronts, or preserve and restore coastal resources. There are other grant programs available; go to the following website for more additional information: http://coastalmanagement.noaa.gov/funding/welcome.html.

- **Department of Education Emergency Management for Higher Education (EMHE)** - A grant program for institutions of higher education to evaluate their risk and prepare for risks from natural and manmade hazards. In 2008-2009, Broward College received an EMHE grant. Eligible project activities include plans, vulnerability assessments, support building, organization and training. For more information on this program, go to the following websites: http://www2.ed.gov/programs/emergencyhighed/index.html and http://rems.ed.gov/index.php?page=EMHE_Grant.

- **EPA grants for stormwater including Green Infrastructure, Clean Water grants, and Impaired Streams** (usually must include water quality element) – see http://water.epa.gov/grants_funding)

Table 6.2: Eligible Project Activities of the 5 FEMA Mitigation Grant Programs

ELIGIBLE ACTIVITIES	HMGP	PDM	FMA	RFC	SRL
1. Mitigation Projects	☒	☒	☒	☒	☒
Property Acquisition and Structure Demolition	☒	☒	☒	☒	☒
Property Acquisition and Structure Relocation	☒	☒	☒	☒	☒
Structure Elevation	☒	☒	☒	☒	☒
Mitigation Reconstruction					☒
Dry Floodproofing of Historic Residential Structures	☒	☒	☒	☒	☒
Dry Floodproofing of Non-residential Structures	☒	☒	☒	☒	

Minor Localized Flood Reduction Projects	☒	☒	☒	☒	☒
Structural Retrofitting of Existing Buildings	☒	☒			
Non-structural Retrofitting of Existing Building/Facilities	☒	☒			
Safe Room Construction	☒	☒			
Infrastructure Retrofit	☒	☒			
Soil Stabilization	☒	☒			
Wildfire Mitigation	☒	☒			
Post-Disaster Code Enforcement	☒				
5% Initiative Projects	☒				
2. Hazard Mitigation Planning	☒	☒	☒		
3. Management Costs	☒	☒	☒	☒	☒

Source: FEMA Hazard Mitigation Assistance Unified Guidance

State

- EMPA Competitive Grant Program
- Emergency Management Performance Grant
- County Base Grant Program
- The Florida Coastal Management Program
- Florida Coastal Partnership Initiative –http://www.dep.state.fl.us/cmp/grants/index.htm
- Hurricane Loss Program (formerly Residential Construction Mitigation Program)

Any required local match will be the responsibility of the applicant. For FEMA approved projects using HMGP funds, there can be instances where project costs increase and the federal share become less than the applicable cost share, typically 75%. If this occurs and additional funding becomes available, the LMS may choose to increase the federal cost share to the maximum allowable amount. Any locally-funded hazard mitigation projects should be brought to the attention of the LMS Executive Committee for potential Global Match credit.

Pending Wind Mitigation Actions

The Broward County Division of Construction Management obtained FEMA hazard mitigation grants for four County hazard mitigation projects. The funding was used to fortify the Main Library, the Ron Cochran Building at the Public Safety Complex, the East Wing of the Broward County Judicial Center and Fleet Service Center Number Three in Pompano Beach. This work will primarily involve the replacement of windows at each location with new impact-resistant glass and frames.[19]

Completed Flood Mitigation Actions and National Flood Insurance Program (NFIP) by Jurisdiction

[19] From Broward County eCounty website, accessed on 4/27/12, which delivers news at http://www.broward.org/ecountyline/Pages/vol_33_no_3/news.htm

As required by 44 CFR §201.6(3)(ii), each jurisdiction must address its "participation in the NFIP, and continued compliance with NFIP requirements as appropriate". The National Flood Insurance Program Community Book http://www.fema.gov/fema/csb.shtm verifies all Broward County communities are listed as participating in the National Flood Program. The following activities are broken down by community:

Broward County, Unincorporated Broward Municipal Services District – (CRS Community)

Unincorporated Broward County has been a CRS community since October 20, 1972 and is currently a class 7. The county has designated the Environmental Engineering and Licensing Manager as the CRS Coordinator and Floodplain Manager. CRS activities undertaken in the past 6 years include:

- Maintain Elevation Certificates for New/Substantially Improved Buildings
- Provide Flood Zone Information
- Inform Lenders, Insurance Agents, and Real Estate Offices of Our Services
- Keep Old and Current FIRMs
- Produce/Distribute Flood News Newsletter
- Maintain Flood Protection Materials at Library
- Provide Flood Protection Assistance
- Preserve Open Space in Floodplain
- Enforce Floodplain Management Regulations
- Use/Update Flood Data GIS Information
- Produce/Distribute Property Protection Information to Repetitive Loss Areas
- Prepare Floodplain Management Plan (LMS) Annual Progress Report
- Inspect/Repair/Maintain Drainage Systems
- Implement Drainage System Portions of CIP
- Provide Information on Stream Dumping Regulations
- Implement Flood Warning Program

Broward County's current Floodplain Management Ordinance reflects the latest FIRM maps. As of January 2016, the County had 14,988 NFIP policies in force (in 2011, this count was 36,871).

Coconut Creek, City of– (CRS Community)

CRS activities undertaken in the past 5 years include:

1. Constant monitoring of the drainage systems and drainage basins.
2. On-going Capital improvement projects to improve water quantity and quality of the drainage system, which consist of waterways dredging and maintenance. The design and permitting are performed in-house.
3. On-going preventive maintenance programs consisting of swale re-grading, and stormwater systems cleaning and repairs. Maintenance program performed mainly in-house.
4. Training by Floodplain Manager of Engineering Department staff, who reviews building permits. Training includes NFIP regulations and Elevation Certificates.
5. Maintenance of a clear map depicting various Flood Zone designations.

6. Brochures related to flooding and NFIP requirements were sent to every household in the City.
7. Answering various residents with questions about Flood Zones, Flood Hazards, and how to mitigate flooding. Courtesy site visits are also available.
8. GIS mapping of all utilities including drainage in the City as well as Flood Zones. The maps can also be accessed by the public since it is web-based.
9. Maintenance and scanning of all elevation certificates database.
10. Maintenance of all Letter of Map Revision (LOMR) database.
11. CRS 510 Floodplain Management update for year 2010 (see attachment).

The City of Coconut Creek's current Floodplain Management Ordinance reflects the latest FIRM maps.

Cooper City, City of– (CRS Community)

The City of City of Cooper City has been a CRS Community since 1992. CRS activities undertaken in the past 5 years include:

- Conduct and document drainage system maintenance throughout the community
- Conduct drainage system maintenance by inspecting/repair/maintain drainage system
- Continue to preserve and maintain our open space and parks system
- Enforce Floodplain Development Permits
- Enforce Floodplain Management Regulations
- Enforce stormwater management ordinances
- Enforce our stream dumping regulations
- Inform lenders, insurance agents, and real estate offices of our services
- Inform residents of the Broward County "Home Damage Assessment Program" which will benefit the City by providing critical information where major damage has occurred
- Maintain and keep old and current FIRMs
- Maintain Elevation Certificates for all new/substantially improved buildings
- Maintain flood protection materials at the local library
- On-going training for staff relative to floodplain management
- Prepare/distribute Floodplain Management Plan (LMS) Annual Progress Report
- Preserve open space in floodplain
- Produce and maintain a log and history of drainage system maintenance provided to residents
- Produce/distribute outreach projects to all residents/businesses within the floodplain and all of Cooper City
- Produce/distribute property protection information to Repetitive Loss Areas
- Produce/distribute property protection information to Repetitive Loss Properties
- Provide copies of Elevation Certificates to residents and/or businesses
- Provide flood protection assistance

- Provide information on “no dumping” signage throughout the City.
- Provide letters of Flood Insurance Rate Map Determination
- Provide property protection assistance to homeowners and/or businesses
- Update and maintain the Flood Information on the City's website

The City of Cooper City’s current Floodplain Management Ordinance reflects the latest FIRM maps..

Coral Springs, City of– (CRS Community)

The City of Coral Springs has been a CRS community since 1992. Coral Springs is currently a Class 8 Community. The Development Services Department serves as the CRS Coordinator and Floodplain Manager. CRS activities undertaken in the past 5 years include:

- Elevation Certificates are required by the Building Department to be completed for all projects in areas considered in the special flood hazard areas.
- The City’s Engineering Department provides basic flood zone information as well as personal assistance and site visits to all inquirers.
- Maps showing the City’s flood zones are provided at the library and can also be accessed at http://www.coralsprings.org/floodinformation/floodmap.pdf
- Coral Springs provides information to every city resident through its “Under the Sun” magazine. Information in the magazine includes knowing about hazards, protecting people, protecting property, preparations and warning systems, and education
- about wetlands
- Coral Springs also hosts “Slice of the Springs” meetings which provide more specific education and information to local areas of the City.
- The City’s Engineering Department also provides information available to residents who call or visit the office with questions regarding flood information.
  The City also provides flood information online at: http://www.coralsprings.org/living/flood-zone-information. The City of Coral Springs' current Floodplain Management Ordinance reflects the latest FIRM maps.

Dania Beach, City of– (CRS Community)

The City of Dania Beach has been a CRS Community since December 1992. Dania beach is currently a Class 9 Community. The city has designated Eleanor Norena, City’s Community Development Operations Manager as CRS Coordinator and Floodplain Manager. CRS activities undertaken in the past 5years include:

- Maintenance of Elevation Certificates on all new and substantially improved building in our Special Flood Hazard Area.
- Availability of elevation certificates for newer properties as requested.
- The Building Division provides flood insurance rate map information to inquiries and keeps electronic record of the information provided.
- Flood insurance rate maps are updated as necessary.
- The Broward County Main Library maintains flood protection materials.
- Floodplain management provisions outlined in the City’s zoning and building codes are enforced.

- The Florida Building Code is enforced by the City of Dania Beach.

The City of Dania Beach's current Floodplain Management Ordinance reflects the latest FIRM maps. As of May 31, 2017, Dania Beach has 3,161 flood policies (in 2011 this count was 2,084).

The last Community Assistance Contact (CAC) was October 20, 2010 by the State at which time FEMA found no violations or other programs deficiencies.

Davie, Town of– (CRS Community)

The Town of Davie has been a CRS Community since 1992. CRS activities undertaken in the past 5 years include:

- Elevation Certificates
- Map Information Service
- Outreach Projects
- Flood Protection Information
- Open Space Preservation
- Higher Regulatory Standards
- Flood Data Maintenance
- Stormwater Management
- Floodplain Management Planning
- Drainage System Maintenance
- Dam Safety

The Town of Davie enacted its initial floodplain management ordinance on June 16, 1976 through Ordinance 1976-23, and still reflects the latest FIRM maps. There have been 4 revisions, in 1977, 1988, 1995, and 2005. Based on this ordinance, the Town's Building and Engineering Departments enforce the floodplain management ordinance. As of January 2011, the Town had 17,752 NFIP flood policies in force (in 2009, this count was 19,294).

The State of Florida conducted its Community Assistance Contact (CAC) in February 2006. The Community Assistance Visit (CAV) identified that additional definitions were necessary in the Town's floodplain management ordinance. The Town Council revised the ordinance to reflect these new definitions in March 2005

Deerfield Beach, City of– (CRS Community)

The City of Deerfield Beach has been a CRS Community since 1992. CRS activities undertaken in the past 5 years include:

- Elevation Certificates
- Map Information Service
- Outreach Projects
- Flood Protection Information
- Open Space Preservation
- Higher Regulatory Standards
- Flood Data Maintenance
- Stormwater Management

- Drainage Systems Maintenance
- Flood Warning Program

The City of Deerfield Beach's current Floodplain Management Ordinance reflects the latest FIRM maps.

Fort Lauderdale, City of– (CRS Community)

The City of Fort Lauderdale has been a CRS Community since 1992 and is currently a Class 6. The city has a standalone Floodplain Manager, who is also designated as the CRS Coordinator. The Floodplain Manager has a staff of three Floodplain Development Review Specialists. CRS activities undertaken in the last 5 years include:

- Provide On-going Training for Staff and External Stakeholders Relative to Floodplain Management
- Maintain Elevation Certificates for New/Substantially Improved Buildings
- Provide Flood Zone Information • Inform Lenders, Insurance Agents, and Real Estate Offices of Our Services
- Keep Old and Current FIRMs
- Maintenance of all Elevation Certificates in an Electronic Database
- Develop and Distribute Floodplain Management Related Outreach
- Maintain Flood Protection Materials at Local Libraries
- Provide Flood Protection Assistance
- Preserve Open Space in Floodplain
- Enforce Floodplain Management Regulations
- Use/Update Flood Data GIS Information
- Produce/Distribute Property Protection Information to Repetitive Loss Areas
- Prepare Floodplain Management Plan (LMS) Annual Progress Report
- Inspect/Repair/Maintain Drainage Systems
- Conduct Drainage System Portions of CIP
- Provide Information on Stream Dumping Regulations

The City of Fort Lauderdale's current Floodplain Management Ordinance reflects the latest FIRM maps. As of June 26, 2017, the City had 39,239 flood policies. The Florida Division of Emergency Management, State Floodplain Management Office conducted a Community Assistance Visit in 2013 and found no violations or other program deficiencies. The last ISO CRS Cycle Visit was in 2016 and reviewed the City's documentation regarding current and past CRS activities. The last Community Assistance Visit was conducted by FEMA in the summer of 2017.

Hallandale Beach, City of– (CRS Community)

The City of Hallandale Beach has been a CRS Community since 1994. Hallandale Beach is currently a Class 6. The city has designated the Building Official as the CRS Coordinator and the Floodplain Manager. CRS activities undertaken in the past 5 years include:

- Maintain Elevation Certificates on all new and substantially improved buildings in our Special Flood Hazard Area
- Provide Flood Insurance Rate Map information; inform lenders, insurance agents, real estate offices of the above activity
- Provide an annual outreach project to the community
- Maintain flood protection materials in our public library
- Provide flood protection assistance to inquirers and maintain records of the service
- Preserve open space in the floodplain
- Enforce storm water management provisions through our Zoning, Engineering, Building, and local Code of Ordinances
- Mandate a drainage system maintenance program
- Develop a Program for Public Information (PPI)

The City of Hallandale Beach's current Floodplain Management Ordinance reflects the latest FIRM maps.

Hillsboro Beach, Town of– (CRS Community)

The Town of Hillsboro Beach has been a NFIP participating community since 1978 and a CRS Community since October 1994.

On September 10, 2008 the Town had a 5-year Cycle Visit and no violations or deficiencies were noted. The Town expanded the Public Outreach and Map Information Services for this visit. GIS Based Flood Plain Maps were prepared relative to FEMA Flood Zones, Parcel Lines, Future Land Use and Zoning Districts. The Town's Website and Flood Prevention Brochure were updated and provided to all Town residents.

Hollywood, City of– (CRS Community)

The City of Hollywood, Florida has been a NFIP participating community since 1972 and a CRS Community since October 10, 1992. CRS activities undertaken in the past 5 years include:

- Elevation Certificates
- Map Information
- Outreach Projects
- Flood protection Information
- Flood Data
- Open Space preservation
- Higher regulatory Standards
- Flood Data Maintenance
- Storm Water Maintenance
- Stormwater management
- Floodplain Management
- Drain System Maintenance
- Dam Safety

The current Floodplain Management Code of Ordinance for the City of Hollywood titled Chapter 154: Flood Damage Prevention reflects the latest FIRM maps including: Map Numbers 12011C0304, 307,308,309,312,316,317,319 with Map Index 12011C000 Revised 10/2/97. The

City's code specifically regulates new construction and substantial improvement to existing structures.

Lauderdale-By-The-Sea, Town of– (CRS Community)

The Town of Lauderdale- By-The-Sea has been a CRS Community since 2000. CRS activities undertaken in the past 5 years include:

- Outreach Programs
- Enforcement
- New Drainage and Maintenance
- Community Activities include:
    - Open Space preservation
    - Map Information
    - Maintaining Elevation Certificates on all new and substantially improved buildings in our Special Flood Hazard Area (SFHA)
    - Continue to make copies of elevation certificates on newer properties available on the community's present office location
    - Provide Flood Insurance Rate Map information, advise information on the flood insurance purchase requirement to inquirers, and keep records of the service
    - Continue to keep our FIRM updated and maintain old copies of the FIRM
    - The public library continues to maintain flood protection materials
    - Continue to provide flood protection assistance to inquirers.
    - Continue to enforce our current building code
    - Continue to enforce the floodplain management provisions of our zoning, subdivision, and building' code ordinances
    - Continue to enforce the stormwater management provisions of our zoning, subdivision, and building code ordinances for new developments in the watershed
        - Continue to implement our drainage system maintenance program including record keeping of the maintenance activities
    - Continue to implement the sections of our Capital Improvements Program which pertain to drainage system maintenance
    - Continue to enforce our stream dumping regulations

The Town of Lauderdale-By-The-Sea's current Floodplain Management Ordinance reflects the latest FIRM maps.

Lauderdale Lakes, City of

The City of Lauderdale Lakes has been a participating NFIP community since 1979 and in good standing. In 2006, the City passed a Floodplain Management Ordinance that continues to reflect the current FIRM maps. The designated Floodplain Manager is the Operations Manager of the Public Works & Engineering Services Department. Permitting in Special Flood Hazard Areas (SFHAs) is issued through a consultant contracted by the Engineering Services Division.

Lauderhill, City of– (CRS Community)

The City of Lauderhill has been a CRS Community since October 2, 1992. The City of Lauderhill is currently a Class 7. The City has designated the City Engineer as Floodplain Manager and Mrs. Joan Fletcher as the CRS Coordinator. CRS activities undertaken in the past 5 years include:

- Maintaining two pump stations (A and B) which control 2/3 of the entire canal channel which reduces flooding and give the City of Lauderhill control of the canal elevation.
- Yearly cleaning of the catch basins throughout the communities to ensure entire drainage system is free of blockage.
- The installation of new drainage and the lowering of the swale area.
- Repaving the roads redirecting the rain water toward the drainage or catch basins.
- Culvert rehabilitations (Canal 30 and NW 82 Avenue, NW 50 Avenue, and NW 19th Street)
- Canal/Lake embankment stabilizations
- Water Treatment Plant Drainage Reconfiguration
- A Northwest Quadrant Drainage Project to assist in the drainage improvements after storm events.

The City of Lauderhill current Floodplain Management Ordinance reflects the latest FIRM maps. As of January 2017, the City has 3,020 flood policies. Most of the City was removed from the Special Flood Hazard Area in the 2014 FEMA Flood Map update. The last CAC was conducted in January 11, 2012, at which time the State found no violations or other program deficiencies. The next CAC is scheduled for May 1, 2018.

Lazy Lake, Village of

The Village of Lazy Lake has been a participating NFIP community since 1992 and in good standing. Lazy Lake has an approved Flood Damage Prevention Ordinance that continues to reflect the current FIRM maps. The designated Floodplain Manager is the Mayor.

According to current maps, the Village of Lazy Lake has no identified Floodplain and manages development as required by a participating member of NFIP.

Lighthouse Point, City of – (CRS Community)

The City of Lighthouse Point has been a CRS Community since 1993. CRS activities undertaken in the last 5 years include:

- Providing outreach to its property owners by way of the City website and newsletter with regard to flood zone information. The information in the City newsletter is mailed to every property owner on an annual basis, and a brochure is mailed annually to all properties in the community's Special Flood Hazard Area (SFHA). The information is also on display at the City's public buildings. The City Library has available a multitude of periodicals, such as books, pamphlets, brochures, and fact sheets with regard to disaster preparedness and recovery, flood insurance program, and its supporting documentation. During hurricane season, the Library places on display hurricane/wind/flood disaster preparedness in a showcase which includes sources of information, damage, and disaster control.

- The City's Building Department maintains both on site and off site elevation certificates for new and substantially improved buildings and recordkeeping of floodplain inquiries. Upon

request, elevation documentation, and the Flood Insurance Rate Map (FIRM) is provided to the public. Additionally, technical advice and assistance is provided to interested property owners. The available documentation and technical assistance is annually publicized and always displayed on the community's website.

- Overall the City maintains its designated open space preservation sites. The City's Stormwater Management Plan enforces the stormwater management regulations, including freeboard in non-SFHA zones, soil and erosion control, and water quality. The City enforces a regulation prohibiting dumping in the drainage system. The drainage system inspection and maintenance is conducted on an on-going basis. A Capital Improvement Program is ongoing for the drainage system management.

The City of Lighthouse Point current Floodplain Management Ordinance reflects the latest FIRM maps.

Margate, City of– (CRS Community)

The City of Margate has been a CRS Community since the year 2000. Margate became a Class 7 Community in 2011. The City has designated Reddy Chitepu, Director, as both the Floodplain Manager and CRS Coordinator. CRS activities undertaken in the past 5 years include the following activities:

- Maintain Elevation Certificates on all new and substantially improved buildings in Special Flood Hazard Areas (SFHA).
- Maintain database for permits issued for new or substantially improved buildings in the SFHA.
- Provide Flood Insurance Rate Map (FIRM) information and information on the flood insurance purchase requirements to inquirers.
- Complete annual outreach project to the community.
- Keep our FIRM updated and maintain old copies of our FIRM.
- Maintain flood protection materials on the city website and the public library.
- Update flood information on the city website annually.
- Provide flood assistance/information to anyone requesting such assistance/information.
- Preserve or increase open space in the floodplain
- Enforce the floodplain management provisions of our zoning, subdivision, and building code ordinances.
- Use and update our flood data maintenance system.
- Enforce the stormwater management provisions of our zoning, subdivision, and building code ordinances for new developments in the watershed.
- Track building improvements and repairs
- Enforce the requirement that all new buildings must be elevated above the street or base flood elevation.
- Inspect and maintain all city drainage facilities.
- Enforce the current building code.
- Use and update our flood data
- Provide flood management data to our repetitive loss properties as well as our defined repetitive loss areas.
- Implement our drainage system maintenance program.
- Enforce our stream dumping regulations.

- Maintain our system of Benchmarks.
- Maintain our Flood System Threat Recognition

The City of Margate's current Floodplain Management Ordinance reflects the latest FIRM maps. As of January 2011, the City had 10,884 flood insurance policies.

Miramar, City of– (CRS Community)

The City of Miramar, Florida has been a CRS Community since 1994. Miramar is currently a Class 8. The City has designated the Assistant Public Works Director as the CRS Coordinator and Senior Zoning Specialist as Floodplain Manager. CRS activities undertaken in the past 5 years include:

- Elevation Certificates
- Map Information Service
- Outreach Projects
- Flood protection Information
- Flood protection Assistance
- Update flood information on the City's website
- Open Space preservation
- Higher Regulatory Standards
- Flood data maintenance
- Stormwater management
- Floodplain management Planning
- Drainage System maintenance
- Flood Warning program
- Dam Safety
- Canal embankment stabilizations

The City of Miramar's current Floodplain Management Ordinance reflects the latest FIRM maps. As of April 2017, the City had 7,193 flood policies. The last Community Assistance Visit was conducted on 2013 at which time no violations or other program deficiencies were found.

In 2011, the City of Miramar purchased a replacement street sweeper as part of its continuing efforts to reduce the amount of debris on the roads and contaminants entering the City's stormwater system, canal, and waterways. These actions are in accordance with the City's Best Management Practices and NPDES requirements for flood protection
n and pollution control.

Flood Damage Reduction Projects Follow-up

Historic Miramar Redevelopment is a major City priority in preserving and upgrading the historical eastern areas of the City. During the Historic Miramar Infrastructure Improvements Phase 1 project, the City invested $10 million to enhance and improve the underground utilities infrastructure. These improvements were completed in 2007. In 2010, Phase 2 was started and completed in December 2013 for $700,000. Phase 3 was bid in September 2016 and awarded in May 2017 for $8.4 million with an expected completion date of late 2018. A goal of this project is to provide water and sewerage, and enhanced flood protection.

Canal/Lake Embankment Stabilization Project

The City of Miramar owns the canals and lakes east of University Drive in Historic Miramar. Many of these canal and lake banks are experiencing erosion and failing seawalls. In 2012, the City embarked on a canal/lake embankment stabilization program for the repair/reconstruction of eroded canal/lake banks. The City retained a consultant to perform an Engineering Feasibility and Needs Assessment Study of the canal/lake embankments. In February 2016, Phase 1 was started and completed in March 2017 for $260,000. The City has allocated $1.7 million to future phases of the project over the next five (5) years. Stabilization of the canal/lake embankments will prevent further loss of land on the affected properties; and help improve the water quality in the canals and lakes. In addition, the associated dredging of the canals/lakes bottoms will increase the storage capacity of water in the canals/lakes.

North Lauderdale, City of– (CRS Community)

The City of North Lauderdale has been a NFIP participating community since 1979 and a CRS Community since October 1993. CRS activities undertaken in the past 5 years include:

- Secure and store elevation certificates
- Firm Map Information to the public, lending institutions, and insurance agents
- Outreach Projects such as quarterly newsletters and special events
- Flood Protection Information through the Broward County Library System in the city
- Flood Protection Assistance by providing certified construction and stormwater inspectors to address public concerns
- Open Space Preservation throughout the 153.7 AC of parks in the SFHA to control flooding potential
- Stormwater Management and participation with Broward County in compliance with our NPDES permit
- Drainage System Maintenance is conducted by the North Lauderdale Water Control District personnel

The City of North Lauderdale current Floodplain Management Ordinance reflects the latest FIRM maps.

Oakland Park, City of– (CRS Community)

The City Of Oakland Park (ID #120050) has fully participated in the NFIP Community Rating System (CRS) since June 9, 1994. The City's CRS activities undertaken in the past 5 years include:

- The maintenance of a Stormwater Management Ordinance as part of the City's Land Development Code, enforcing floodplain management requirements related to drainage which includes regulating all and substantially improved construction in special Flood Hazard Areas (SFHAs).

- The City's Engineering & Community Development Department along with the Public Works Department are committed to enforcement of regulations, procedures, and design criteria as it relates to the City's Stormwater/Floodplain Management Plan. New development/redevelopment is regulated by the City's Land Development Code, Chapter 24. Sections pertaining to Stormwater Management include Article IX, Environmental Regulations and Article X, Floodplain Management. The City's Building Official enforces

all development/redevelopment in accordance with the latest edition of the Florida Building Code.

- The City's Public Works Director and the City Engineer jointly enforce all regulations as adopted in Chapter 12 of the City Code, Article II, Stormwater Management. The City's Building & Permitting Division of Engineering & Community Development Department maintains all elevation certificates for new and substantially improved buildings. Copies of those elevation certificates are made available to the public upon request. Oakland Park has also adopted the Broward County Local Mitigation Strategy (LMS).

In addition, the City participates in the following NFIP/CRS activities:

- Map Information Service
- Open Space Preservation
- Flood Data Maintenance
- Community Assistance
- Higher Regulator Standards
- Community Outreach
- Drainage System Maintenance Program
- Stormwater Management
- Repetitive Loss Properties

The City of Oakland Park's current Floodplain Management Ordinance reflects the latest FIRM maps. Oakland Park provides an annual Floodplain Management Plan update to the CRS as a requirement of our annual recertification. In addition, the City maintains a database in relation to the FEMA flood insurance rate map amendments and uses GIS floodplain identification and mapping techniques for data collection, research, and public information purposes.

Parkland, City of

The City of Parkland has been a participating NFIP community in good standing since 1979. In 1988, the City passed a Floodplain Management Ordinance that continues to reflect the current FIRM maps. The designated Floodplain Manager is the Building Official. Permits in Special Flood Hazard Areas (SFHAs) are issued by the Building Division, excluding development permits such as for infrastructure and roadways, which are permitted by the Engineering Department. The City of Parkland has not approved any variances to the Floodplain Management Ordinance.

Other Information

Most property in the City is zoned residential. All commercial and most residential construction in the City is post-FIRM.

Approximately half of all properties within the City are designated Zone 'X' since December 1992, with a very small area of Zone 'X' (shaded). At the time of the City's adoption of the Floodplain Management Ordinance, this area represented the approximate physical boundaries of the City.

The other, western 'half', which was farm land subsequently annexed into the City, is for the most part designated Special Flood Hazard Area 'AH'. The base flood elevations were determined to be 12, 13, and 14 at the time of the printing of the rate maps, August 18, 1992. The major

developer, who added lakes, culverts, and a pumping station, received approval for 2 LOMRs, which essentially modified most of this property from AH 13 or 14 to AH 12.

In addition, the City received notification from FEMA approving LOMAs for 33 individual lots and one 35-lot residential subdivision development in this western area, re-designating each of these SFR structures from AH 12 to Zone 'X'.

Pembroke Park, Town of

The Town of Pembroke Park has been a participating NFIP community in good standing since May 1, 1979. In 1979, the Town passed a Floodplain Management Ordinance that continues to reflect the current FIRM maps. The designated Floodplain Manager is the Public Works Director. Permitting in Special Flood Hazard Areas (SFHAs) is issued by the Chief Building Official. The Town has not allowed variance to the flood plain ordinance.

Pembroke Pines, City of

The City of Pembroke Pines has been a CRS Community since October 1, 1994. Pembroke Pines is currently a Class 7. The City has designated the City Engineer as the CRS Coordinator and Floodplain Manager. CRS activities undertaken in the past 5 years include:

- Publishing a flood awareness flyer to all residential and commercial address twice per year
- A pro-active drainage system maintenance program
- Adding flood zone information to our public website as well as a trained staff member available by telephoning the department
- Acquisition of open space
- Modification of our flood protection ordinance

The City of Pembroke Pines' current Floodplain Management Ordinance reflects the latest FIRM maps. As of January 2017, the City had 10,022 flood policies (in 2011, this count was 35,622). The last CAV was on November 14, 2007, at which time the FEMA found no violations or other program deficiencies.

Plantation, City of– (CRS Community)

The City of Plantation has been a CRS Community since October 1, 1992. The City of Plantation is currently a Class 6. The City has designated Brett Butler, City Engineer, as the CRS Coordinator and Floodplain Manager. CRS activities undertaken in the past 5 years include:

- Maintain Elevation Certificates on all new and substantially improved buildings in Special Flood Hazard Areas (SFHA).
- Maintain database for permits issued for new or substantially improved buildings in the SFHA.
- Provide Flood Insurance Rate Map (FIRM) information and information on the flood insurance purchase requirements to inquirers.
- Complete annual outreach project to the community.
- Continue to keep our FIRM updated and maintain old copies of our FIRM.
- Maintain flood protection materials on the city website and the public library.
- Continue to preserve or increase open space in the floodplain

- Continue to enforce the floodplain management provisions of our zoning, subdivision, and building code ordinances for new developments in the watershed
- Continue to enforce the requirement that all new buildings must be elevated above the street or base flood elevation.
- Continue to inspect and maintain all city drainage facilities.
- Provide property protection and flood management data to our repetitive loss properties as well as our defined repetitive loss areas.
- Continue to implement our drainage system maintenance program.
- Continue to enforce our stream dumping regulations.

The City of Plantation's current Floodplain Management Ordinance reflects the latest FIRM maps. As of January 2017, the City had 7,698 flood policies (in 2011, this count was 21,240). The Insurance Services office conducted a verification visit on October 12, 2017.

Pompano Beach, City of– (CRS Community)

The City of Pompano Beach has been a CRS Community since 1993. Pompano Beach is currently a Class 7 and has been since 2012. The city has designated Paola A. West, Principal Planner, as the CRS Coordinator and Michael P. Rada as the city's Floodplain Manager. The following is the summary of the city's current program for NFIP compliance:

- Prevention for new properties:
  - The City of Pompano Beach has land development regulations which mandate the height of all new residential buildings at 18" inches above the crown of the road and of all new nonresidential buildings at 6" inches above the crown of the road. Section 152.29 (C) (1) (a) & (b)
  - The City of Pompano Beach requires that the elevation of seawalls newly erected, or repaired in a manner which effects elevation, shall be consistent with the elevations of adjacent seawalls. Persons so desiring to construct or repair a seawall to an elevation above adjacent seawalls shall furnish a plan to the City Engineer for approval prepared by an engineer in the State of Florida, showing elevations of proposed and adjacent seawalls referenced to North American Vertical Datum of 1988 (NAVD 88) and justifying the desired seawall elevation. The design shall provide for a stepped transition from proposed to existing seawall elevations with a rise not to exceed seven inches and a run or tread not less than eleven inches. However, the desired seawall elevation shall not exceed an elevation of five feet ten inches NAVD 88. Section 151.05. By the end of July, a revision to this code section is anticipated to be adopted whereas the "stepped transition" for seawalls will be removed and will read as follows: The desired seawall elevation shall not exceed an elevation of five feet ten inches NAVD 88. Persons so desiring to construct or repair a seawall shall furnish a plan to the City Engineer for approval prepared by an engineer in the State of Florida, showing elevations of proposed and adjacent seawalls referenced to North American Vertical Datum of 1988 (NAVD 88).
  - The State of Florida established a coastal construction line pursuant to section 161.053, F.S. Floodplain development permits and building permits shall include a condition that all other applicable state or federal permits be obtained before commencement of the permitted development, including but not limited to the Florida Department of Environmental Protection for construction , reconstruction, changes, or physical activities for shore protection or other activities seaward of the coastal construction control line ; section 161.141, F.S. Section 152.24.

- Drainage Facilities are required for all new development. The level of service is established in the Drainage Element of the Comprehensive Plan. Section 154.74
- The City of Pompano Beach has a stormwater utility which maintains the existing drainage facilities and constructs new drainage facilities. Section 53.16 (E)
- Property protection: To protect existing properties from flooding and maintain drainage, the city limits paving of the swales in the right-of-way (Section 100.38); encourage existing homeowners to maximize green space and regrade their properties to direct stormwater into swales and catch basins; the city regularly regrades swales, as needed, and maintains catch basins and routinely clean drains to ensure flooding due to clogged catch basins is minimized; the City has spent $14.7 million in the past 5-years on capital improvement projects that improve stormwater management and reduce flood potential on private property; the city has a 5-year capital improvement plan with $29.0 million worth of stormwater improvements to be implemented in the next 5-year time frame. The City also assists the private sector in issuing Letters of Map Amendments (LOMAs) and Letters of Map Revisions (LOMRs); maintains training in the NFIP; and in the review of Elevation Certificates. The City currently has six (6) Certified Floodplain Managers in the Building Division and one additional Floodplain Manager in the Planning and Zoning Division. The city also maintains a GIS system with elevation and flood plain data and keeps the city website updated with all flood related information that might be useful to the private sector.
- Natural resource protection: The city has a dune restoration program along the beach and also maintains several pine scrub preserves within the city limits.
- Emergency services: In coordination with the City of Pompano Beach and the National Weather Service, Broward County issues hurricane and tropical storm watches and warnings as well as storm surge watches and warnings (new in 2017). Broward County and the City of Pompano Beach operate Emergency Operations Centers and the city currently utilizes the CodeRed system for emergency notification messages. The water utility phone base is utilized for contact information and the public can also opt into the system through the city's Website.
- Structural projects: Beach renourishment is performed at irregular intervals and the city implements an annual list of stormwater improvement projects as mentioned above. The city has updated the Floodplain/Stormwater Management Master Plan which is a 2-year process that will culminate in an updated Capital Improvements Program to continue to improve the structural integrity of the drainage system.

Public Information:

- The City of Pompano Beach maintains digital flood zone maps on a GIS system with an aerial base map that shows an extremely high level of detail and can be searched for specific properties based on the property address for any property in the city.
- The City of Pompano Beach mails the Tradewinds magazine to residents twice a year. Tradewinds contains an article on flooding and flood protection.
- The City of Pompano Beach mails a letter to insurers, lenders, and real estate offices each year to inform them of the availability of flood zone information.
- Flood plain maps are available at the City’s libraries as well as City Hall.
- People can call the City for technical assistance. The telephone number is published in Tradewinds article.
- The city mails an 11-page, highly detailed "Flood Hazard" brochure to all property owners near the start of each hurricane season.
- The city has established a specialized email address floodzoneinfo@copbfl.com for people to request their flood zone information.

The City of Pompano is scheduled to be converted from the 2007 CRS Manual to the new 2013 CRS Manual at its verification visit sometime next year. In order to assess the current flood mitigation practices of the City, find new ways to reduce flood risk (and possibly obtain a lower classification and increase flood insurance discounts), and to convert practices to the "new" manual standards, the City has entered into a Service Agreement with CRS (Community Rating System) Max Consultants. CRS Max Consultants has recently identified a few areas where changes in regulations can help obtain additional CRS points, with the goal of improving the City's rating from a 7 to either a 6 or 5. An analysis is being done to determine if/how adoption of the freeboard standard, which requires that new residential buildings or substantial improvements to existing residential buildings be constructed 1 foot or more above the Base Flood
Elevation, could be implemented in Pompano Beach. The freeboard approach is different from the current regulation which mandates the height of all new residential buildings and substantial improvements to existing buildings be at base flood or 18" inches above the crown of the road--whichever is greater, and all new nonresidential buildings be base flood plus one foot or 6" inches above the crown of the road--whichever is greater (Section 152.29 (C). Adoption of the freeboard standard has been identified by CRS Max Consultants as one of these changes. Additionally, the City is currently working on creating a Program for Public Information (PPI) Committee to find additional ways to obtain credit through outreach.

The City of Pompano Beach current Floodplain Management Ordinance reflects the latest FIRM maps that were adopted on August 18th, 2014. As of May 2017, the city had 19,426 flood policies (in 2013, this count was 25,824).

Sea Ranch Lakes, Village of

The Village of Sea Ranch Lakes has been a participating NFIP community in good standing since 1977. Sea Ranch Lakes has an approved Flood Damage Prevention Ordinance that continues to reflect the current FIRM maps. The designated Floodplain Manager is the Chief of Police. Permitting in Special Flood Hazard Areas (SFHAs) is issued by the Village Clerk.

Southwest Ranches, Town of

The Town of Town of Southwest Ranches has been a participating NFIP community in good standing since November 2004. In 2004, the Town passed a Floodplain Management Ordinance that continues to reflect the current FIRM maps. The new designated Floodplain Manager will be the Town Engineer. Permitting in Broward County Emergency Management Special Flood Hazard Areas (SFHAs) will also be issued by the Town Engineer.

Sunrise, City of– (CRS Community)

The City of Sunrise has been a CRS Community since 1996. Sunrise is currently a Class 7. The City has designated the Deputy Utilities Director as the CRS Coordinator and City Engineer as the Floodplain Manager. CRS activities undertaken in the past 5 years include:

- Maintaining Elevation Certificates for New/Substantially Improved Buildings
- As requested, provide Flood Insurance Rate Map information and copies of available Elevation Certificates to residents, lenders, insurance agents, and real estate offices.
- Providing annual outreach to all property owners, including residents within the flood plains, receiving a water bill.

- Our website and public library maintains flood protection materials.
- We use our regulatory flood data before a new development can proceed in our floodplain.
- We continue to enforce the floodplain management provisions of our zoning, subdivision and building code ordinances.
- Updating or flood data maintenance system on an annual basis as needed.
- Enforcing the stormwater management provisions of our zoning, subdivision and building code ordinances for new developments in the watershed.
- We continue to implement our drainage system maintenance program.
- We continue to enforce our stream dumping regulations.
- We continue to preserve our open space in the floodplain open space within the floodplain.

The City of Sunrise's current Floodplain Management Ordinance reflects the latest FIRM maps. As of October 2016 there were 5,750 flood insurance policies in force in the City of Sunrise. The City of Sunrise is currently preparing for the next CRS Cycle Visit, which will take place on September 7, 2017, and will be based on the 2017 CRS manual.

Tamarac, City of – (CRS Community)

The City of Tamarac has been a CRS Community since 1992. CRS activities undertaken in the past 5 years include:

- Print and mail out to all residents and business owners a Flood Protection Brochure twice a year where explaining to all property owners' things to know such as, the National Flood Insurance Program, the Benefits of having Flood Insurance in each property, Flood Plain Development Permit Requirements, Flood Warning Systems, and Flood Hazard Information.
- Provide copies of Elevation Certificates when available and Make Flood Zone Determinations with the FIRM map, and the Special Flood Hazard Area Map.
- The City continues to preserve approximately 1,352 acres in the Special Flood Hazard Areas as open space.
- The City continues to enforce the requirements that all new buildings must be elevated above the crown of the road as required in our City Ordinance.
- The Public Works Department has a Drainage System Maintenance Program for the entire City.
- The Public Works Department provides site visits regarding Flooding, Drainage, and Storm Water related problems in order to address any issues and correct them as required.
- The City also has an Outreach Program to the Community thru Neighborhood Meetings, Homeowners Association meetings, and information in The City's Website to help and alert the residents and the business community about The City's Flood Programs.
- On March 10, 2010 the Tamarac City Commission approved Resolution 2010-29 adopting the December 2009 Revision of the Broward County Multi-Jurisdictional Local Mitigation Strategy Plan.

The City of Tamarac current Floodplain Management Ordinance reflects the latest FIRM maps.

West Park, City of

The City of West Park has been participating in the NFIP community since 2006. In 2005, the City passed a Floodplain Management Ordinance. To this end, the City has already started by completing the following:

- Stormwater Management Program adoption
- Drainage System Maintenance Public Outreach & Education
- Storm Drainage Cleaning and Maintenance
- Twin Lakes Maintenance
- Retention Pond Maintenance
- Tree Planting
- Map Information Service
- Open Space Preservation
- Adherence to National Pollutant Discharge Elimination System (NPDES) Permit Requirements
- Adoption of Capital Improvement Plan
- Streamlined Illegal Dumping Ordinance
- Floodplain Management Plan is being Updated

The City is constantly monitoring drainage system and catch basins.

The City of West Park will continue to be an active member of the Broward County Local Mitigation Strategy.

Weston, City of

The City of Weston has been a CRS community since May 1, 2009. (Refer to Appendix G for Approval Letter and Verification Report) Weston is currently a Class 8. The city has designated the Director of Public Works as the CRS Coordinator and consultant Calvin, Giordano & Associates as Floodplain Manager. CRS activities undertaken in the past year include:

- Review and Maintain Elevation Certificates on all new and substantially improved buildings in our Special Flood Hazard Area.
- Provide Flood Insurance Rate Map information to the public, lenders, insurance agents, and real estate offices.
- Provide Flood protection assistance to inquirers and maintain a “records of service”.
- Provide an annual outreach project to the community.
- Provide a copy of the community’s flood Insurance Rate Map and an explanation of their
- use in our public library.
- Enforce storm water management provisions through our Zoning, Engineering, Building,
- and local Code Ordinances.
- Preserve open space in the Floodplain
- Provide a copy of property protection for repetitive loss areas
- Exercise an outreach program that informs the public of flood warnings and safety
- measures.
- Administer a drainage system maintenance program.

The City of Weston’s current Floodplain Management Ordinance reflects the latest FIRM maps. The City adopted the ELMS March 18, 2013 via City of Weston Resolution No. 2013-23.

As of March 2017, The City had 4,422 NFIP policies in force (in 2011, this count was 3,637). The last CAV was in April, 2012, and the City's ISO Community Rating Visit was on March 4, 2008, at which time the State and FEMA found no violations or other program deficiencies.

Wilton Manors, City of

The City of Wilton Manors has been a participating NFIP community in good standing since 1987. In 1987 (amended 2005), the City passed a Floodplain Management Ordinance that continues to reflect the current FIRM maps. The designated Floodplain Manager is the Director of Community Development Services. Permitting in Special Flood Hazard Areas (SFHAs) is issued by the Director of Community Development Services.

Continued Compliance

Broward County and all its jurisdictions are committed to continued participation and compliance with the National Flood Insurance program (NFIP). A major mitigation priority of the LMS is the reduction of repetitive flood loss properties. The County and its CRS participating municipalities track repetitive loss properties county-wide on an ongoing basis using data gathered annually from FEMA.

For mitigation, planning, and strategy development purposes, the LMS maintains updated GIS maps and informational databases of repetitive loss property locations relative to historical flood areas and designated Special Flood Hazard Areas. Repetitive loss properties are an ongoing discussion and planning priority for the LMS. All committees of the LMS are encouraged to develop and promote mitigation project ideas and strategies.

Specific prioritized actions for continued compliance with the NFIP for the next 5 years cycle include:

- Promote and continue to participate in the National Flood Insurance Program
- Identify and reduce the number of repetitive loss properties in each jurisdiction
- Provide additional support to the Community Rating System (CRS) to increase Class Ratings
- Continue activities within the CRS Subcommittee/User Group to address reduction in CRS Class ratings
- Identify and implement storm water projects that would eliminate flooding in urban and residential areas

County-wide Flood Loss Reduction Strategy

Flood is consistently the most recurrent and costly hazard to the residents, businesses, and government operations. Therefore, an important part of the ELMS was to place special emphasis on addressing and mitigating the flood risk. A new chapter, Economic Vulnerability, described in great detail the flood risk and potential loss scenarios for key economic areas in the County.

Renewed emphasis has been placed on active participation in CRS and SFWMD has become an active partner in the LMS. By 2013, Broward County will have updated digital Flood Insurance Rate Maps (dFIRMs).

The items below, which may be repetitive of other sections of the plan, have been grouped here to show the overall recently invigorated effort to reduce the County's flood risk:

- Encourage all municipalities to participate in CRS and encourage currently participating communities to implement activities that will accrue more CRS credit points.
- Continued engagement of the LMS CRS Subcommittee/User Group and include sea level rise issues
- Leverage public-private partnerships to mitigate flood vulnerabilities identified in the Economic Vulnerability Chapter of the ELMS
- Integrate flood mitigation measures and policies into other community planning processes like comprehensive plans
- Consider adopting 500-year flood elevation standard
- Continue the partnership with SE Florida Regional Climate Change Compact group to address sea level rise
- Continue frequent communication with the SFWMD through the District's Broward Intergovernmental Representative (who in 2012 was also a member of the County LMS group) to find ways to strengthen partnership in addressing flood hazards
    - Support the SFWMD Operations and Maintenance (O&M) Plan implementation
    - Review the SFWMD's 50-year plan and find out what is relevant to Broward County flood mitigation
    - Support the SFWMD's effort to modernize its older facilities in Broward County
        - Consider larger scale flood projects on canal system under FEMA programs like HMGP and PDM
        - Consider sea level rise impacts on water control structures and canals under SFWMD jurisdiction (SFWMD coordinates with the County and municipalities on sustainability actions)
    - County EMD mitigation and recovery officials should continue, along with other key LMS representatives, attend the quarterly meetings of the Broward County Water Resources Task Force and Broward Surface Water Coordinating Council (which includes the SFWMD, local water control districts like the South Broward Drainage District (some are also known as '298s' after Chapter 298 of Florida Statutes))
        - Consider use of WebEOC to tie in SFWMD and local drainage districts before and during likely flood events
    - Work with SFWMD to scope and pursue project that include mitigation measures from funding sources for stormwater projects (e.g., the Environmental Protection Agency's grant programs). These grant pursuits would likely need to include multiple objectives like water quality.
        - The LMS should coordinate with local elected officials and Broward state legislators to seek state funds for combined stormwater/mitigation projects
        - SFWMD should continue to work with local drainage districts to find solutions to more localized drainage issues (e.g., installation of gates and change in operating criteria in Southwest Ranches)

Chapter 7 – Plan Maintenance

Introduction

This Chapter of the LMS Plan describes the process that will ensure the Plan remains an effective and relevant document over time. This includes continual integration with other community planning processes and input into county financial investment decisions. This chapter also highlights the on-going importance of obtaining state and federal grants to assist with financing mitigation actions. It establishes the method and schedule for monitoring, evaluating, and updating the LMS during a 5-year plan update cycle. In addition, the Chapter describes how the public will continue to be involved in the mitigation planning process.

Plan Maintenance Approach

- Incorporate hazard mitigation actions into existing community planning mechanisms (e.g., attend comprehensive planning meetings, communicate frequently with community planners on land use issues, on-going meetings with community planners on issues of overlapping interest)
- Provide input and feedback into annual county budget process (e.g., capital improvement spending) for consideration of hazard mitigation measures beyond code
- Partner with the Risk Management Division and the County's property and casualty insurer to coordinate efforts to lower risk and augment mitigation measures at each facility when opportunities present themselves (i.e., through the CIP or other spending)
- Encourage communities to find new ways to accrue CRS credit points or join CRS if not currently in the program
- Coordinate with and engage the County's Climate Change Government Operations group on mutual interests to increase effectiveness of both groups
- Revisit indicators of project/action effectiveness or success and monitor/evaluate projects/actions that have been implemented
- Collect important damage data after storm events when feasible
- Implement the evaluation/revision schedule established in this Chapter to ensure plan is up-to-date at the end of 5-year cycle
- Continue refining the process for public input and community involvement during the entire 5-year cycle

FEMA Requirements

The LMS Working Group Planning Subcommittee created the plan maintenance strategy consistent with the process and steps presented in FEMA's How-To-Guide: "Bringing the Plan to Life" (FEMA 386-4). The following FEMA requirements are addressed in this section:

- **Requirement §201.6(c)(4)(i):** [The plan maintenance process ***shall*** include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan with a 5-year cycle.

- **Requirement §201.6(c)(4)(ii):** [The plan ***shall*** include a] process by which local governments incorporate the requirements of the mitigation plan into other planning

mechanisms such as comprehensive or capital improvement plans, where appropriate.

- **Requirement §201.6(c)(4)(iii):** [The plan maintenance process ***shall*** include a] discussion on how the community will continue public participation in the plan

Implementation

Each municipality and Broward County is responsible for implementing mitigation actions as prescribed in this plan. Under the direction of the LMS Executive Committee and the coordination of the Broward County Emergency Management Division, funding will be sought from a variety sources to implement mitigation projects in both pre-disaster and post-disaster environments. In addition, each municipality will be responsible for the integration of mitigation actions into the planning processes of their respective communities and providing mitigation input into their respective municipal capital improvement/risk management process. Broward County will act as a catalyst and facilitator to encourage this level of mitigation integration in the municipalities.

Mitigation actions will be integrated into other planning documents of the Broward County Emergency Management Division. Opportunities to integrate the requirements of this Plan into other planning mechanisms shall continue to be identified through future meetings of the Executive Committee and the 5-year review process described herein.

The Director of the Broward County Emergency Management Division, acting as the Local Mitigation Strategy Chairperson, has overall responsibility for implementing the LMS Plan and ensuring the all municipalities participate in the planning process as well as approval of plan updates and changes prior to State/Federal mandated 5 year update.

Monitoring

Periodic revisions of the LMS Plan will be monitored by the LMS Executive Committee. The LMS Executive Committee shall keep a detailed inventory and report of:

- Information, including high water marks, damage figures, and pictures, on disaster events impacting Broward County and its municipalities (residential/commercial/public buildings and infrastructure) during the year. The County shall work with the municipalities to collect this information post-event, where feasible, using a data collection worksheet
- Mitigation actions that have been completed including actions required by the County's property and casualty insurer (FM Global in 2012), actions that go beyond the insurer's requirements, and the actions funded by FEMA mitigation grant programs
- Record the date and timeframe of completion of each ELMS action
- Document any obstacles encountered and lessons learned from this experience
- Lessons learned from integrating mitigation into community planning and capital improvement processes
- Lessons learned in applying for and implementing federal mitigation grants
- Mitigation success stories (e.g., record information like high water marks or wind speeds at completed project sites for purposes of calculating a return on the investment)
- Projects currently in progress
- Use of Loss Estimation Tool to screen potential projects and an assessment of this process

- Projects/Activities unchanged or deferred (Status of projects are reflected in listing found in Appendix C)

The LMS Coordinator of the Broward Emergency Management Division will monitor and document hazard events, note changes in the risk environment, capture damage and loss data, and maintain and update hazard and vulnerability data on an ongoing basis.

The LMS Coordinator will organize meetings of the Executive Committee and coordinate committee meetings to address issues of interest, provide LMS members with meeting summaries and action items, and retain meeting results in LMS files. The LMS coordinator will monitor grant opportunities and advise LMS member organizations of deadlines and application requirements.

The above activities outline general plan maintenance during the 4 years leading up to the fifth year of the planning cycle. Beginning in the July before the revision year (the 4th year of the planning cycle), the Executive and Planning committees will lead a more intensive planning effort to update the Plan, obtain approvals, make necessary revisions, and complete the FEMA crosswalk for review and approval by the State and FEMA.

Evaluation

The LMS Plan, in parts or whole, will be evaluated annually to coincide with the Florida Administrative Code 27 P update and after significant disasters to review the effectiveness of its projects, programs, and policies. Areas needed for update will be noted for changes at the end of the year. As part of the annual review process, certain chapters will be identified by the LMS Chair and/or LMS Coordinator for review based on need. The LMS Working Group reviews the hazard mitigation goals to ensure that they continue to comply with County and municipal goals. The goals will also be reviewed to determine if changes are necessary.

The LMS Working Group will determine if any significant events have occurred in the County to warrant any considerable changes in the ELMS Plan. In the event of a disaster or when deemed necessary by its members, the LMS Working Group and its committees may meet more frequently.

Update/Enhancement

5 Year Plan Review

The Planning Committee will thoroughly review and analyze each Chapter of the LMS Plan during the 4th and 5th years of the 5 year Plan cycle to determine whether there have been any significant changes county-wide that would necessitate revisions in the types of mitigation actions proposed: 1) new development in identified hazard areas; 2) an increased exposure to hazards; 3) the increased or decreased capability to address hazards; 4) changes to county comprehensive planning and capital improvement funding policies; and 5) changes to federal or state legislation are examples of factors that may affect the necessary content of the Plan. The committee will also assess and consider recommended changes provided by the State and FEMA in the previous 5 year plan revision cycle. Input from each Committee will also be incorporated into the Plan.

During the 5 year Plan update cycle, the following process will occur to allow sufficient time for updating a plan of this size, for submitting for review by the State and FEMA, addressing State and FEMA comments, and adoption by all jurisdictions:

- At 2 years prior to Plan expiration, the LMS Planning Committee will identify areas that have modified and need to be updated per the identified responsibilities of this group outlined in Chapter 3. The LMS Planning Committee will identify the individual who will draft the Plan update. During this time, the Broward County Mitigation Coordinator will review Federal, State and local regulations and guidance to see if any appropriate changes need to be made.
- At 8 months prior to Plan expiration, the updated Broward County ELMS should be submitted to the State of Florida for review.

The plan review provides the LMS Working Group an opportunity to evaluate those actions that have been successful and to explore the possibility of documenting potential losses avoided due to the implementation of specific mitigation measures. The plan review also provides the opportunity to address mitigation actions that may not have been successfully implemented. The LMS Coordinator will be responsible for convening the Planning and executive Committees and conducting the 5-year review.

During the 5-year plan review process, the following questions will be considered as criteria for assessing the effectiveness and appropriateness of the Plan:

- Do the goals address current and expected conditions?
- Has the nature or magnitude of risks changed?
- Are current human and capital resources appropriate for implementing the Plan?
- Are there additional partnering opportunities for evaluating risk and implementing mitigation?
- Are there new opportunities to implement, fund or integrate mitigation?
- Are there implementation obstacles, such as social, technical, administrative, political, legal, economic environmental issues, or coordination issues?
- Have the outcomes occurred as expected?
- Did the identical departments, individuals, and/or other partners participate in the plan implementation process as volunteered or assigned?
- Are there potential mitigation actions that would require a longer time horizon to realize (10 to 20 years out) for which it is important to starting laying the groundwork?

Upon completion of the review and update process, the LMS Chairperson and the Executive Committee will do a final review of the revised Plan and approve the Plan to be submitted to the State Hazard Mitigation Officer at FDEM for final review and approval in coordination with FEMA.

After FEMA has approved the County Plan, the LMS Coordinator will submit it to the Board of County Commissioners for formal adoption. Once the Plan is formally adopted by the County, each of the 31 municipalities will follow suit.

Local Adoption

Once the LMS Plan is adopted by the County, all participating municipalities must also adopt the plan. Copies of resolutions must be submitted to the County LMS Coordinator for filing with the

State and FEMA, to ensure eligibility of mitigation grant programs administered by FEMA. Appendix F contains local adoptions.

Post-Disaster Review and Update

In the event of a disaster, findings from the damage assessments and damage data collection, success story reporting will be reported to the LMS Planning Subcommittee. These findings will in turn be reviewed and the plan will be updated to reflect lessons learned, or to address specific issues and circumstances arising from the event, regardless of the 5 year interval. Data collection worksheets, when collected, will be kept by the County. Any future revisions of the plan will be posted on the County's website.

Recommendations to Continually Enhance the 5-Year Plan Review Process

- Track and share mitigation successes and challenges
- Invite State and FEMA mitigation counterparts to periodic meetings to keep them informed on the County's actions, policies, coordination efforts and successes
- Use the LMS meetings as a forum to share best practices to increase the mitigation knowledge of municipalities
- Expand the reach of the LMS meetings with technology to continually increase participation from public and private sector
- Sharpen focus on what mitigation works well in the County (e.g., working with insurer, applying for FEMA grants, working with Climate Change groups)
- Communicate periodically with elected officials to inform them on policy changes and/or funding decisions that would better support mitigation
- Continually search for better sources of risk data to assist with demonstrating cost-effectiveness with proposed projects

Incorporation into Existing Planning Mechanisms

As part of the planning process, the Planning Committee identifies current plans, programs, policies/ordinances, and studies/reports that will augment or help support mitigation planning efforts. The LMS Working Group will be the mechanism for ensuring that entities integrate hazard mitigation into its future planning activities. The subsection below entitled "Plan Integration Efforts" describes the findings from the ELMS process in identifying additional opportunities to incorporate mitigation into existing planning mechanisms.

Presently, the ELMS is integrated into the Broward County Comprehensive Emergency Management Plan (CEMP). The LMS Coordinator will continue to ensure that policies, programs, and mitigation actions are consistent between the ELMS and the Broward County CEMP. Further, all jurisdictional CEMP's are required to be consistent with the County CEMP.

It should be noted that most municipalities have indicated that the vulnerability assessment section of the ELMS has been incorporated into the CEMP, and is also utilized in the same manner to help develop Continuity of Operations (COOP) Plans.

Broward County Comprehensive Plan

The Broward County Comprehensive Plan serves as the growth management planning document that guides development in Broward County. In the future, the ELMS will strive for greater integration into the Comprehensive Plan in terms of policies governing land uses and/or infrastructure that may be at significant risk (through all its Elements, such as the Future Unincorporated Area Land Use Element) and in terms of community priorities for investment, i.e. the Capital Improvements Element. The Plan Integration Efforts section below provides greater details on how this integration can be achieved for the Comprehensive Plan, the County Land Use Plan, and other important local plans.

Plan Integration Efforts

A major objective of the ELMS process is to integrate mitigation into other essential community planning processes, including post-disaster recovery. This section provides a summary of the efforts to record where other plans are consistent with the LMS and recommendations to integrate more completely.

Strategies to achieve greater mitigation incorporation into existing county-wide and regional planning mechanisms

Mitigation has already been incorporated into several existing county-wide and regional planning mechanisms. To achieve more consistency, integration, and effectiveness of mitigation into existing county-wide and regional planning mechanisms, the strategies listed in this section, a result of the ELMS process, are recommended. Also discussed is how mitigation can be integrated and incorporated into municipal plans following the lead of the County. The items below can be adopted as mitigation action items.

Comprehensive Emergency Management Plan

- Include a process and organizational structure for the Emergency Support Functions (ESFs) to transition into short and long term recovery functions to coordinate response, and short and long term disaster recovery decision making, including the identification for mitigation opportunities.

County Recovery Plan

- Include a timeline for when the various phases occur, and definitions for short- and long-term recovery.
- Identify what can realistically be accomplished during the timeframe for various phases, and key decision points.
- Include specific references to the ELMS for pre- and post-disaster mitigation goals and objectives, and project list.
- Refer to the Capital Improvement list for those projects that involve mitigation, for coordinated disaster recovery efforts.
- Develop Standard Operating Guidelines that identify stakeholders, organizational structure, and recovery guidelines.
- Identify which funding sources might be required for projects that involve mitigation, and identify the estimated timeline for receipt of funding. Some funding sources may be

received sooner (e.g., Public Assistance 406 Hazard Mitigation) than others (e.g., Hazard Mitigation Grant Program). The timeline will help to coordinate building/facility/infrastructure repair schedules.

- Include a list of potential 406 Mitigation projects and make each municipality aware of the timing for requesting 406 (part of the Public Assistance (PA) worksheet) in the recovery process
- Identify what needs to be documented for recovery projects that may be eligible for hazard mitigation funding (e.g., past non-declared disaster damages can be included in determining the benefit cost ratio, and some temporary repair measures can be included in repair versus replacement assessments). Refer to existing documents, as needed (e.g., Damage Assessment SOP).
- Continued mitigation participation Recovery Framework process to insert MAT team members into key processes like including mitigation measures on PA worksheets

County Comprehensive Plan

- Future Unincorporated Land Use Elements
    - Support the designation and implementation of Adaptation Action Areas, which will replace the current coastal high hazard area designations, in vulnerable communities to pursuing appropriations for adaptation infrastructure
    - Brief synopsis of Adaptation Action Areas (more information in Appendix H)
        - **Summary. "'**Adaptation action area' or 'adaptation area' is an optional comprehensive plan designation for areas that experience coastal flooding and that are vulnerable to the related impacts of rising sea levels for the purpose of prioritizing funding for infrastructure needs and adaptation planning. Local governments that adopt an adaptation action area may consider policies within the coastal management element to improve resilience to coastal flooding. Criteria for the adaptation action area may include:
            - Areas below, at, or near mean higher high water
            - Areas which have a hydrological connection to coastal waters
            - Areas designated as evacuation zones for storm surge"
        - Includes protection, accommodation, and retreat options.
        - **Relation to Hazard Mitigation. "**The actions a community will take to mitigate vulnerability to coastal flooding are very similar to those that a community might take in sea level rise adaptation. The main difference is that sea level rise adaptation assumes a longer time frame for impact and therefore a longer time frame for need and implementation. Sea level rise also assumes an increase in the vulnerability of areas already subject to coastal flooding and therefore adaptation projects take into account the increased vulnerability."
        - **Statutory Authority.**
            - Section 163.3164(1), Florida Statutes
            - Section 163.3177(6)(g)(10), Florida Statutes
    - That the DERD utilize the development review process to consider the impact of proposed land use plan amendments in flood hazard areas and Adaptation Action Areas.
    - Encourage a meeting between the County Commissioners, PRD, and Emergency Management to discuss how to better ensure that Comprehensive Plan policies

designed to minimize risk are effectively implemented and that the actual results are reaping the intended benefits. If not, outline corrective actions.
    - Include an inventory of historic structures and archaeological sites in the LMS vulnerability assessment, and the various components of the Recovery Framework and update it as structures are added to the Florida Master Site File or National Register of Historic Places.
    - Encourage the clustering of new development or redevelopment away from flood hazard areas.
- Drainage and Natural Aquifer Groundwater Recharge Element
    - Consider the use of freeboard to elevate hazard prone structures above the 100-year flood level or base flood elevation to prepare for future risk from sea level rise and potential higher rainfall caused by climate change. Consider going 1 to 2 feet above 500-year flood level.
- Housing Element
    - Provide outreach and education to encourage developers to include hazard mitigation measures for new construction and redevelopment.
    - Promote the acquisition or elevation of repetitive flood loss structures.
    - Continue CRS participation and encourage all jurisdictions to participate.
- Recreation and Open Space Element
    - Include the benefits of pervious surface and open space to mitigate flood hazard vulnerability.
    - Include a policy to review flood hazard areas included in the Land Use Element Map Series for LMS project identification and post-disaster redevelopment. Cross reference these maps in the LMS vulnerability assessment.
- Coastal Management Element
    - Establish a new definition for coastal evacuation areas that is consistent with storm surge evacuation vulnerability along the barrier islands.
    - Establish policy to limit development that will increase evacuation clearance times in the coastal evacuation areas.
    - Restore natural coastal vegetation at the Hillsboro Inlet Lighthouse to resist coastal erosion.
- Conservation Element
    - Include language in various policies to recognize the benefits of using conservation for hazard mitigation (e.g., flood).
- Urban Design Element
    - Encourage including hazard mitigation measures in architectural design for new structures and in redevelopment scenarios.
    - Expedite permitting for mitigation projects, as is done for 'green' (i.e., LEED) projects.
- Natural Disaster Component
    - Replace CHHA with coastal evacuation areas in Policies 11.1.2, 11.2, and 11.21
    - Review recommendations for including the Climate Change Plan referenced Adaptation Action Areas to reduce hazards vulnerability along the coast.

County Continuity of Operations Plan

- Identify the most critical facilities/functions, based on hazards vulnerabilities, for potential hazard mitigation measures. Include these on the ELMS and/or Capital Improvements project lists, and identify whether these are on multiple lists.
- Identify funding sources (e.g., capital improvements and grant opportunities).
- Identify critical lifelines (Supervisory Control and Data Acquisition (SCADA)) and IT system issues.
- Evaluate both primary facilities and alternate relocation facilities for potential mitigation options if these facilities/structures are vulnerable.
- Identify which primary and alternate facilities have been mitigated.
- Integrate damage assessment processes from (CEMP and Damage Assessment SOP) that are probably more sensitive to disaster mitigation funding to make sure the damage assessment for COOP takes these into consideration.
- Identify what kinds of temporary repairs can be made without jeopardizing hazard mitigation funding. If permanent repairs start before mitigation funding (e.g., PA 406 mitigation funds or HMGP) is approved, the funds cannot be used.
- Compose narratives documenting support for mitigation projects based on the need to protect facilities and functions.
- For buildings that house multiple departments, have them coordinate to help make the case for mitigating the building.
- Add the benefit cost analysis (BCA) component to show the loss of income/financial impact to services to help make argument for mitigation funding
- Identify assumptions/weak spots and ideas for mitigation (communications/electricity).
- Identify opportunities to submit mitigation grant requests that may need to be submitted in a bundled fashion (e.g., generators alone may not be selected for mitigation but when partnered with other items can be more likely to be selected).
- Work with other emergency management planning processes to identify mitigation actions. For example, the COOP identifies the vulnerability of the facility housing the host agency. The results of this vulnerability analysis may also identify a mitigation action that could mitigate that vulnerability.

Climate Change Action Plan

- Include a representative of the Broward County Climate Change Task Force in the review of the ELMS vulnerability assessment for flood and wind risks based on climate change to ensure consistency. [*completed in 2011-2012*] Also have the Task Force comment on the listed mitigation actions in the ELMS for consistency with the Task Force's efforts.
- Reference the Climate Change Action Plan in the ELMS, along with 2 additional reports: Southeast Florida Regional Compact Climate Change Plan, which provides updated scenarios and impacts on critical facilities, and the South Florida Water Management District (SFWMD) external report on projected Climate and Sea Level Trends, which has updated projection data.
- The SFWMD and the Southeast Florida Regional Climate Change Compact should participate in mitigation and preparedness exercises to discuss future risk scenarios.
- Discuss with the Climate Change Action Task Force how sustainability/climate change adaptation actions are considered, identified, prioritized, and funded. Have the Task Force consider adding multi-hazard mitigation considerations to this process (e.g., if the airport

terminal roof is being renovated, make it more energy efficient, and consider making it more wind resistant also).

- Continued coordination with the Broward County Government Operations Climate Change group, who is preparing modifications to the county comprehensive plan, including the Adaptation Action Areas, is a way to directly impact future growth and redevelopment via the comprehensive planning process.

Capital Improvement Plan

See "Link LMS to County and Municipal CIPs" below for additional information

- Include a map of Capital Improvement projects that has hazard overlays to determine if they are in hazard zones and could include hazard mitigation measures.
- Conduct a hazards analysis for Capital Improvement projects in hazard zones.
- Include the Capital Improvement project list by reference in the ELMS, for those projects that include hazard mitigation measures. Specify which projects are already underway.
- Analyze the Capital Improvement projects with the newly developed Loss Estimation Tool and prioritization matrix.
- Develop committee to review projects for hazard mitigation opportunities and have them coordinate with the existing Capital Improvement project review committee.
- Expand the criteria that are used for prioritizing Capital Improvement projects to include hazard mitigation considerations for each investment.
- CIP staff should participate in Broward County EMD exercises focused on how mitigation can better be incorporated into the short-term and long-term recovery process.
- Eliminate or modify Policy 14.2.1 regarding provision of infrastructure in CHHA.

Long-Range Transportation Plan

- Develop a process to explore potential mitigation opportunities whenever there is new construction, renovation, and repairs.
- Include the project list by reference in the ELMS, for those projects that include hazard mitigation measures. Specify which projects are already underway.
- Develop committee to review projects for hazard mitigation opportunities and have them coordinate with the existing transportation project review committee.
- Transportation staff should participate in Broward County EMD exercises focused on how mitigation can better be incorporated into the short-term and long-term recovery process.
- Include reference to the LMS and note that the official Broward County Risk Assessment is located in chapter 4 of the LMS.

BrowardNext

- Develop a process to explore potential mitigation opportunities for economic development projects.
- Have the members of the public private partnership participate in BC EMD exercises focused on how mitigation can better be incorporated into the short-term and long-term recovery process.

- Include reference in future economic development plans and note that the official Broward County Risk Assessment is located in chapter 4 of the LMS, which includes an economic vulnerability analysis.

Broward County Land Use Plan

- Divide Policy 8.08.02 into two policies and revise in the following manner:
  - Policy 8.08.02(a): Post-disaster redevelopment and hazard mitigation plans shall inventory hazard prone areas, including repetitive loss properties.
  - Policy 8.08.02(b): Local Broward County jurisdictional departments shall implement building codes and development regulations, such as risk-based setback provisions, structural connections, site controls, and overlay zones, to reduce future property damages and losses.

CRS Program

The LMS CRS Subcommittee/User Group should evaluate 2017 changes to the CRS program and identify areas where the County, and municipalities, can get more credit points based on existing activities and potential new ones. Some of the proposed changes have already been added to the ELMS (e.g., Capability Assessment and assessing the impacts of sea level rise and climate change). Below are a few suggested places to review:

- Flood library – 11 publications from FEMA (p.11 -2012 Manual Changes)
- Flood Insurance Promotion (p.14)
- Higher Study Standard – consider for future with sea level rise (p.17)
- Higher Regulatory Standards for South Florida standards already complied with (p. 22)
- Flood Data Maintenance – add flood information to GIS (p.30)
- Communities complete self-assessment checklist on CRS website (www.crs.2012.com)

Link LMS to County and Municipal CIPs

Since the CIPs are local project funding processes in multiple sectors of local government service, it is both important to first determine where mitigation is occurring (if at all) in current CIP projects. Second, and more importantly, it is critical to facilitate a process to more fully integrate the potential for mitigation in the full life cycle of the CIP selection and funding process.

The MAT tool process is one that can identify opportunities for proactive mitigation measures to be identified year round. This process is for considering the maximum practicable hazard mitigation protection for any county investment in retrofitting, repairing, upgrading, enhancing, or new construction for facilities or infrastructure. The County's insurer typically requires additional protection above and beyond code under its authority. This additional protection usually pertains to high wind protection to a Category 3 hurricane or greater but does not necessarily pertain to all other likely hazards, namely flood, which is the purview of the federal government.

The MAT tool process should identify additional mitigation opportunities above and beyond what is required under code and the County's insurer's authority. Parameters for investment include practical, cost-effective county investments during a construction process where a facility or infrastructure is being modified or built. Examples include protecting a county critical facility to a Category 5 wind speed and/or 1 foot of freeboard above the 500-year flood level. This process

will take into account future risk conditions, like climate change and sea level rise impacts, and an optimal time financially when the modification or new construction is being planned and constructed.

The MAT tool process will consider all potential funding sources but typically it is geared toward finance through County Capital Improvement funds. Therefore, it is essential that the identification process begin when capital improvement projects are first being considered in the CIP budgeting process. This typically occurs ten years in advance of when they are expected to be funded. The process will work roughly like this:

- When a new project is first considered in the CIP budget process at the Division Level (5-8 years in advance for a general project and 2-5 years in advance for a specific project), the MAT will review it for mitigation potential. If the team agrees that some form of mitigation is appropriate and cost-effective, it will provide a description of the mitigation idea with the scope of the CIP project and factor in the mitigation cost into the overall project cost. The MAT may use a worksheet with pre-identified actions to guide the process. The mitigation funding will likely be from the Alternative Financing process.
- As the date of actual funding and design gets close (1 to 2 years out), the MAT will help justify the need for the project to the County commission. The Finance team will help organize the alternative finance application. The MAT will also help draft the Request for Proposals (RFP) to make sure that the scope of services has a clear description of the mitigation measure.

The MAT tool process discussed above links the LMS's goals, principles, and strategies to the County Capital Improvement Plan. To provide a link between the LMS and the local CIPs, each municipality should consider replicating this process at the community level. Appendix E includes a survey developed during the ELMS process to coordinate with the community planners of the Broward County municipalities on how to better integrate mitigation into the municipal comprehensive plans. See Appendix O for more information on the MAT tool.

The Plan Integration/Mitigation into Recovery Kickoff Meeting was held during the June 24th, 2011 LMS meeting at the Broward County EOC. The draft Vision /Comprehensive Plan was provided to the attendees as well as a Mitigation Integration "Best Practices" handout (see Appendix H). Also in Appendix H is the "Broward County Hazard Mitigation Planning Integration Report".

Continued Public Involvement

Broward County and the LMS Working Group are dedicated to continued public involvement in the hazard mitigation planning and review process. As described earlier in this chapter, significant changes or amendments to this Plan shall require the public, as deemed appropriate, to participate in the planning process prior to formal adoption procedures. The 2nd Review Draft of the 2017 ELMS was placed on the Broward County Emergency Management ftp site during June and August of 2017. Instructions on access to the ftp site, which is ftp://eoc-ftp.bc-eoc.org, was distributed via normal communication channels and on the agendas at important meetings like the Emergency Coordinating Council (ECC) meetings held monthly.

As part of the ELMS process, dedicated webpages or websites were being developed for the following: 1) to provide the general public guidance materials on mitigation projects for their homes; and 2) to provide a secure website whereby subapplicants can submit LMS projects.

Additional efforts to involve the public in the Plan maintenance, evaluation, and revision process will be made as necessary. Per the Florida Sunshine Law, all LMS meetings are open to the public. Focused and continual public involvement efforts may include:

- Advertising meetings of the LMS Working Group with invitations for public participation
- Use technology to show LMS Meetings live on-line
- Conduct periodic webinars on single focus subjects
- Utilizing the Broward County website to advertise any maintenance and/or periodic review activities taking place
    - Consider the taping LMS meeting and other important events and make available on Broward County website
- Keeping available copies of the ELMS at the Broward Emergency Management Division
    - E.g., post updates and annual evaluations of plan on Broward County website
- Community Bulletin Boards
    - Post results of recent meetings and key ideas
- Participate in state, county and local conferences, workshops, and preparedness fairs as deemed appropriate
    - Present information on county plans as often as possible

Appendices

Appendix A – Project Prioritization Matrix

Appendix B – Proposed Mitigation Project Form

Appendix C – Mitigation Project List

Appendix C contains the latest update of Broward County's LMS Mitigation Project List. The list of projects is ever changing as projects completed through self-funding or with grant assistance are dropped and new proposed and planned projects are added. Jurisdictions and other potential project sponsors, particularly those not having projects on the current list, are encouraged to submit projects. The expectation is that all eligible applicants are represented on this list with projects that address identified local hazards, vulnerabilities, and mitigation strategies.

The status for each project is included.

Appendix D – LMS Membership List

Appendix E – Planning Process Support Documents

A binder containing this information is maintained at the Broward Emergency Management Division's office.

Appendix F – Resolutions

This appendix will contain the Resolution by the Broward County Board of County Commissioners adopting this Plan and all municipal resolutions supporting the ELMS Plan.

Appendix G – Discontinued ELMS Hazard Profiles

This appendix contains previous ELMS version Hazard Profiles that are no longer considered Hazards of Most Concern as a result of the 2017 Risk and Vulnerability Assessment Workshop.

Appendix H – Local Enhanced Plan and Mitigation Integration Summary

Appendix I – Critical Facilities

Appendix J – Housing Vulnerability and Coastal Residential Construction Recommendations

Appendix K – Hazards Summary Profile

Appendix L – Loss Estimation Tool

Appendix M – Grant Funding Sources Table

Appendix N – HSEEP Workshop Results