2016 Supplemental Summary

Statewide Regional Evacuation Study

This document contains summaries (updated in 2016) of the following chapters of the 2010 Volume One, Technical Data Report:

Chapter 1: Regional Demographics

Chapter 2: Regional Hazards Analysis

Chapter 4: Regional Vulnerability & Population Analysis

Funding Provided by the Florida Division of Emergency Management

Work completed by the Southwest Florida Regional Planning Council

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I. Regional Demographic Characteristics and Their Implications for Evacuation Dynamics

A. Small Area Dwelling Unit and Population Data

A Regional Evacuation Study and the associated transportation modeling is based upon a set of defined demographic characteristics assembled for each region of the State. This data is referred to as Small Area Data. The data is gathered for three time periods – 2010, 2015, and 2020.

The initial year, 2010, was developed using the 2010 Census and the 2008-2010 American Community Survey (ACS). This includes the occupied dwelling unit (single family and multi-family) and permanent population. Block group level data from the 2008-2010 ACS was used to gain general housing and population characteristics. The 2010 Census data, however, did not provide information regarding the proportion of single-family to multi-family dwelling unit types or site-built to mobile home unit types, as well as the number of vehicles that would be available to each type. This level of detail is found within the ACS. Using BEBR medium projections as the control variable for population (years 2015 and 2020), the number of projected housing units was calculated for the corresponding future years. A proportionate factor from 2010 was used to distribute dwelling units and population by block group. This method also established the percent of mobile and site-built homes.

The population in mobile homes in Southwest Florida increased by 7,858 (6.2%) since 2010. This population is expected to grow by 8.7% over the next 5 years. These increases are consistent with overall population growth over these time periods in the region.

The hotel/motel data comes from the Department of Business and Professional Regulation (DBPR) Lodging License Files. The data is available by zip code and is not available in GIS format. The hotel and motel data list was geo-coded in GIS by census block group for each county in the Region. DBPR estimates that SWFL's hotel/motel units have increased by 58,500 (232%) since 2010.

Table 1: Southwest Florida Demographic Characteristic Summary

County	Characteristic	Year		
		2010	2015	2020
Charlotte	Occupied site-built homes	65,788	68,860	72,433
	Population in site-built homes	143,211	149,906	157,675
	Occupied mobile homes	7,582	7,937	8,345
	Population in mobile home	13,755	14,404	15,146
	Hotel/motel units	1,499	5,105	8,782
Collier	Occupied site-built homes	125,148	134,913	149,019
	Population in site-built homes	295,065	318,220	351,535
	Occupied mobile homes	8,031	8,646	9,551
	Population in mobile home	21,909	23,600	26,154
	Hotel/motel units	6,880	24,725	43,547
Glades	Occupied site-built homes	2,106	2,128	2,245
	Population in site-built homes	5,137	5,186	5,443
	Occupied mobile homes	2,427	2,455	2,587
	Population in mobile home	6,264	6,343	6,712
	Hotel/motel units	146	174	252
Hendry	Occupied site-built homes	7,433	7,301	7,548
	Population in site-built homes	21,702	21,320	22,044
	Occupied mobile homes	4,592	4,512	4,659
	Population in mobile home	15,496	15,224	15,721
	Hotel/motel units	384	917	1,549
Lee	Occupied site-built homes	234,977	259,284	293,723
	Population in site-built homes	563,518	621,873	704,312
	Occupied mobile homes	24,841	27,318	30,925
	Population in mobile home	46,748	51,473	58,496
	Hotel/motel units	11,487	33,810	58,158
Sarasota	Occupied site-built homes	161,390	168,313	179,553
	Population in site-built homes	350,438	365,473	389,893
	Occupied mobile homes	14,356	14,964	15,958
	Population in mobile home	23,388	24,374	25,992
	Hotel/motel units	4,778	18,943	33,587

STATEWIDE REGIONAL EVACUATION STUDY PROGRAM

Southwest Florida

Site-Built Home Density

2016 Evacuation Study Summary Update

330000m.E 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520

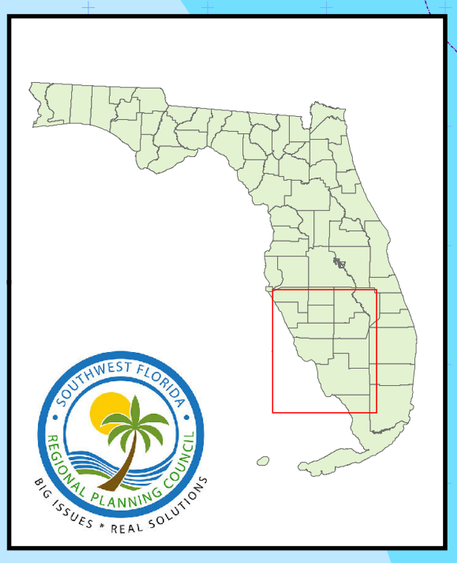
3050000m.N 3040 3030 3020 3010 3000 2990 2980 2970 2960 2950 2940 2930 2920 2910 2900 2890 2880 2870 2860 2850 2840 2830 2820000m.N

LL ML
LK MK

ML NL
MK NK

LK MK
LJ MJ

MK NK
MJ NJ



Map Legend

Category

- TS
- 1
- 2
- 3
- 4
- 5

TEZ

1 Dot = 75

SiteBuilt 2015

0 1 2 4 6 8 Miles

This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.

Sources: USGS, United States Census Bureau, Local MPOs, Florida Department of Transportation

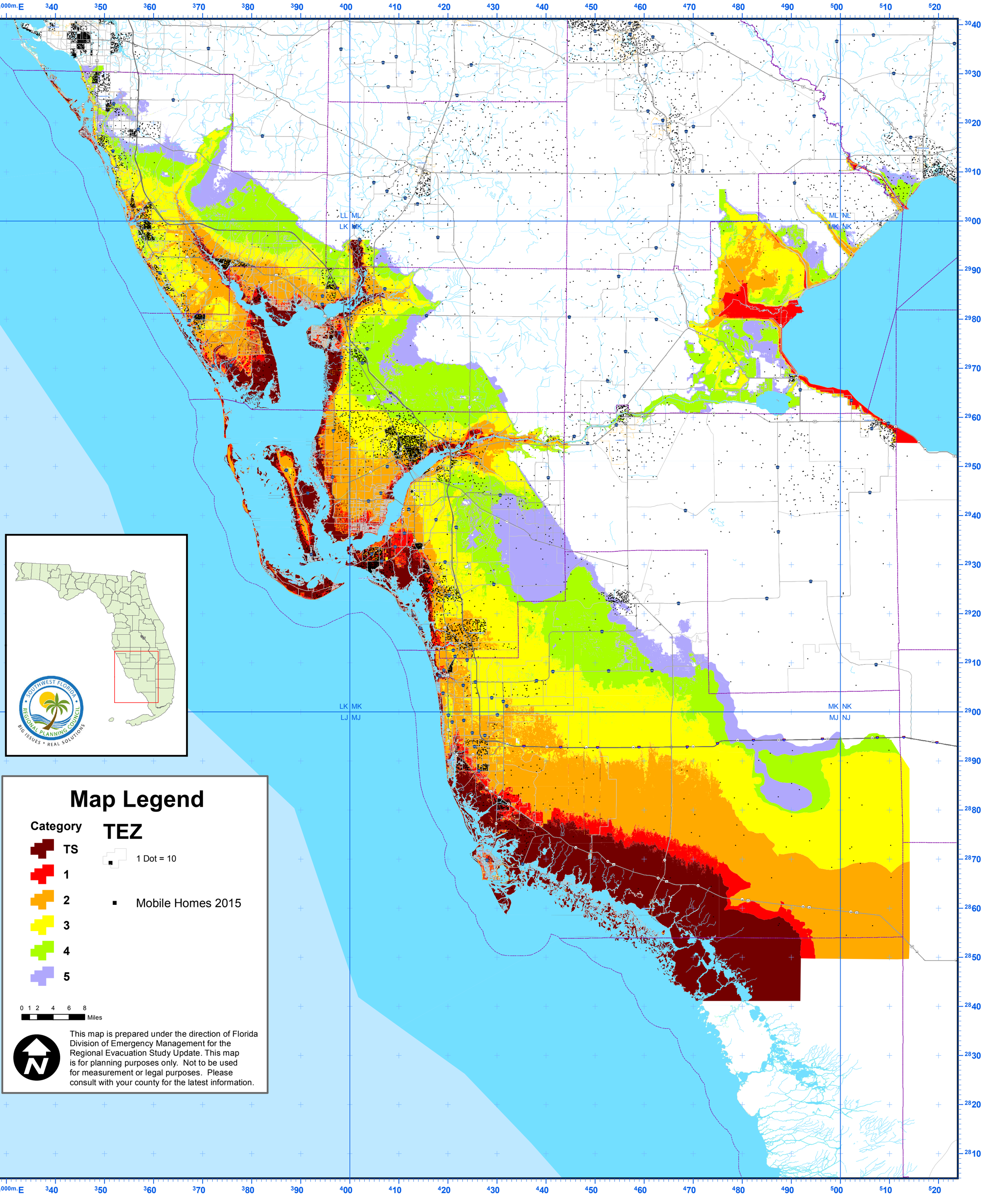
Map Printed: June, 2016

STATEWIDE REGIONAL EVACUATION STUDY PROGRAM

Southwest Florida

Mobile Home Density

2016 Evacuation Study Summary Update



Map Legend

Category

- TS
- 1
- 2
- 3
- 4
- 5

TEZ

1 Dot = 10

Mobile Homes 2015

0 1 2 4 6 8 Miles

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Sources: USGS, United States Census Bureau, Local MPOs, Florida Department of Transportation

Map Printed: June, 2016

B. Overall Population

The University of Florida's Bureau of Economic and Business Research (BEBR) estimated that the permanent resident population of the Southwest Florida Region on April 1, 2015 (Table 1) was 1,619,827, up from 1,531,724 in the 2010 Census, which represents an increase of 5.75%.

Table 2. Estimates of Population by County and City in Florida: April 1, 2015

County	April 1 2015 Population Estimate	April 1 2010 Census Population	Total Change
Charlotte	167,141	159,978	7,163
Collier	343,802	321,520	22,282
Glades	12,853	12,884	-31
Hendry	38,096	39,140	-1,044
Lee	665,845	618,754	47,091
Sarasota	392,090	379,448	12,642
REGION	1,619,827	1,531,724	88,103

Source: University of Florida's Bureau of Economic and Business Research (BEBR): Florida Estimates of Population 2015

STATEWIDE REGIONAL EVACUATION STUDY PROGRAM

Southwest Florida

Regional Population Density

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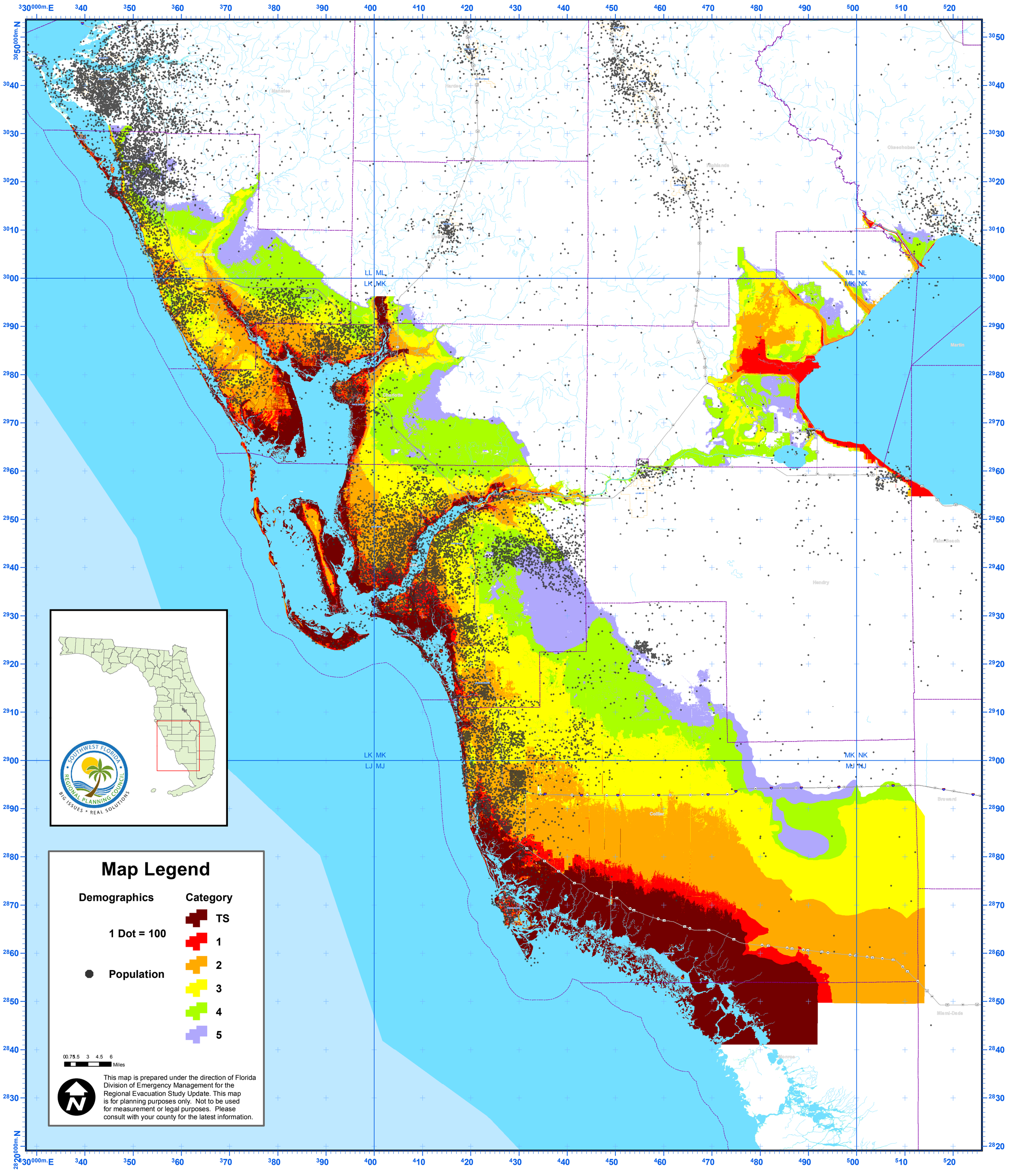

Map Legend

Demographics

1 Dot = 100

Population

Category

- TS
- 1
- 2
- 3
- 4
- 5

0 0.75 1.5 3 4.5 6 Miles

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Sources: USGS, United States Census Bureau, National Hurricane Center

Map Printed: June, 2016

C. Hotel/Motel Units

According to licensing records of the Florida Department of Business and Professional Regulation (Table 3), in 2015 there were 141 hotels with 16,540 rooms, 245 motels with 9,176 rooms, and 8 bed and breakfast inns with 39 rooms in Southwest Florida. These units house a portion of the seasonal population that is in addition to the permanent resident population estimated above. Considering that many of these units are in vulnerable areas, hotel/motel units that are occupied at any point in time will have an important impact on the total population that may participate in an evacuation.

Table 3. Licensed Public Lodging Facilities, 2015

Southwest Florida Lodging Facilities	Facilities	Rooms/Units
Hotels	141	16,540
Motels	245	9,176
Transient Apartments	94	848
Non-Transient Apartments	616	45,752
Bed and Breakfast Inns	8	39
Resort Condominiums - Single	72	274
Resort Condominiums - Group	164	7,390
Resort Condominiums - Collective	120	2,815
Resort Dwellings - Single	265	436
Resort Dwellings - Group	14	113
Resort Dwellings - Collective	163	2,277
Total	1,902	85,660

Source: Florida Department of Business and Professional Regulation, Division of Hotels and Restaurants: Count of Active Licenses, Fiscal Year 2014-2015 County Summary

D. Vehicles per Household

There were 35,511 households in Southwest Florida households in the year 2014 that had no vehicle (5.4% of all households) – most of these were renters (Table 4). This data represents a significant number of households that could need transportation assistance in the event of a major evacuation. However, as the number of vehicles per household increases, this may contribute to additional congestion on the highways in evacuation scenarios.

Table 4. Vehicles Available by Tenure

Households	Southwest Florida	
	Estimate	%
Owner occupied:	466,135	100.0%
No vehicle available	10,985	2.4%
1 vehicle available	199,798	42.9%
2 vehicles available	195,577	42.0%
3 vehicles available	47,000	10.1%
4 vehicles available	10,115	2.2%
5 or more vehicles available	2,660	0.6%
Renter occupied:	196,439	100.0%
No vehicle available	24,526	12.5%
1 vehicle available	96,490	49.1%
2 vehicles available	62,648	31.9%
3 vehicles available	10,771	5.5%
4 vehicles available	1,912	1.0%
5 or more vehicles available	92	0.0%
Total:	662,574	100.0%
No vehicle available	35,511	5.4%
1 vehicle available	296,288	44.7%
2 vehicles available	258,225	39.0%
3 vehicles available	57,771	8.7%
4 vehicles available	12,027	1.8%
5 or more vehicles available	2,752	0.4%

Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates, Tenure by Vehicles Available (B25044)

E. Age Composition

From 2010 to 2015 (Table 5), the elderly population in Southwest Florida had increased by 46,387, an 11.3% increase. During the same period, the number of children under 18 increased by only 6,550, a 2.3% increase.

The Elderly population is particularly vulnerable in an evacuation and has impacts on the sheltering needs within a county. Special considerations must be given during an evacuation to populations, like the elderly and the very young that could require assistance and additional resources.

Table 5. Resident Population by Age, April 1, 2010, Projections for 2015 and 2020

Southwest Florida	Absolute Number			% of Total Population		
Age Categories	**Census 2010**	**BEBR Projection 2015**	**BEBR Projection 2020**	**2010**	**2015**	**2020**
Age under 5 years	73,720	76,546	81,416	4.8%	4.7%	4.6%
Age 5 to 17 years	205,712	209,436	222,666	13.4%	12.9%	12.5%
Age 18 to 24 years	105,632	117,465	119,454	6.9%	7.2%	6.7%
Age 25 to 54 years	515,345	521,277	544,303	33.6%	32.2%	30.7%
Age 55 to 64 years	221,174	239,980	263,491	14.4%	14.8%	14.8%
Age 65 to 79 years	297,664	327,079	396,651	19.4%	20.2%	22.4%
Age 80 years and over	112,477	129,449	146,398	7.3%	8.0%	8.3%
Total	**1,531,724**	**1,621,232**	**1,774,379**	**100.0%**	**100.0%**	**100.0%**
Age under 18 years	279,432	285,982	304,082	18.2%	17.6%	17.1%
Age 65 years and over	410,141	456,528	543,049	26.8%	28.2%	30.6%

Source: University of Florida, Bureau of Economic and Business Research, Population Projections by Age, Sex Race…, 2015-2040

STATEWIDE REGIONAL EVACUATION STUDY PROGRAM

Southwest Florida

Aging Population Density

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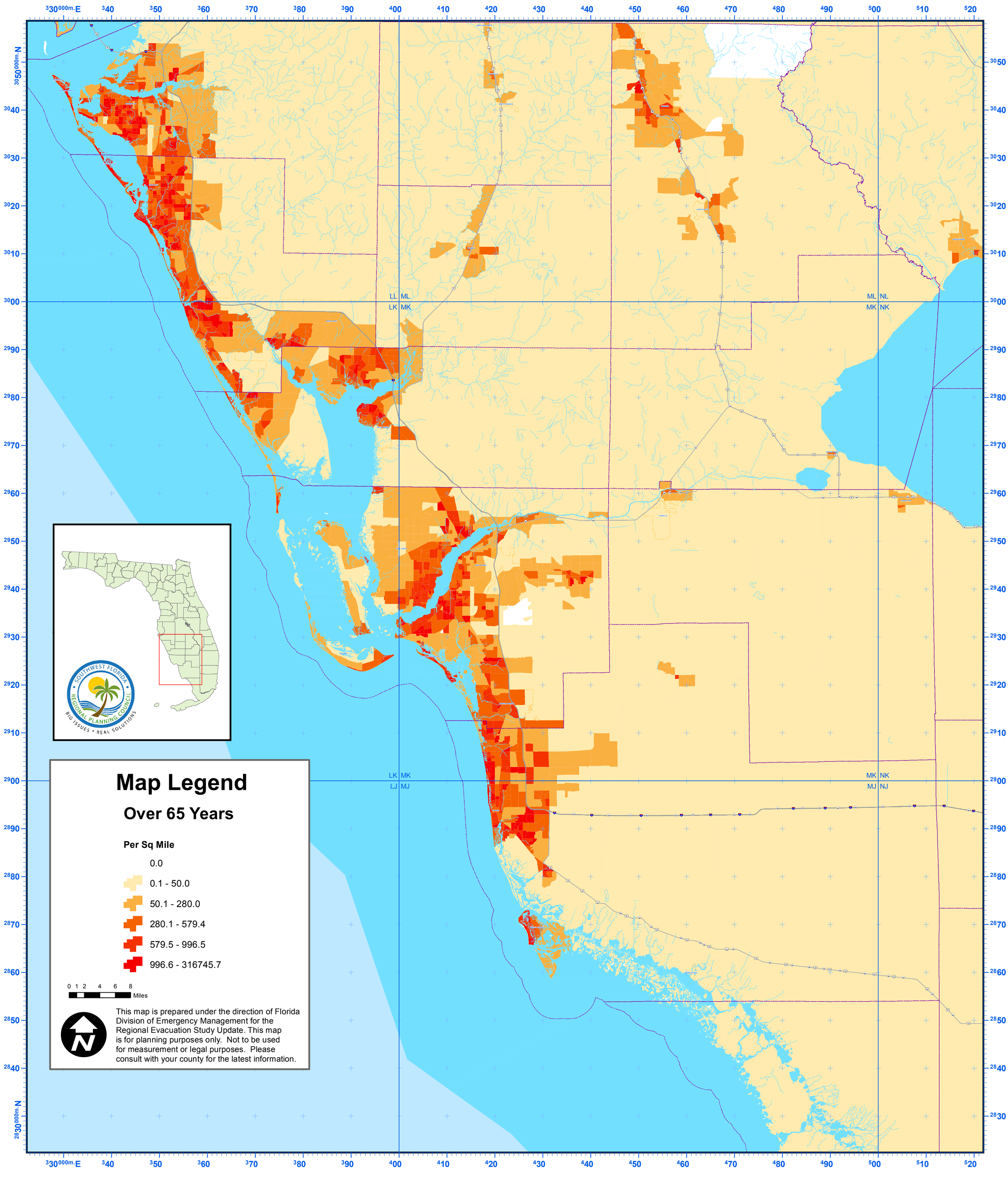

Map Legend

Over 65 Years

Per Sq Mile

- 0.0
- 0.1 - 50.0
- 50.1 - 280.0
- 280.1 - 579.4
- 579.5 - 996.5
- 996.6 - 316745.7

0 1 2 4 6 8 Miles

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Sources: USGS, United States Census Bureau, National Hurricane Center

Map Printed: June, 2016

F. Limited English Speaking Households (Previously Linguistic Isolation)

The phrase “linguistic isolation” is replaced with “No one 14 and over speaks English only or speaks a language other than English at home and speaks English ‘very well’” in the table names in 2010. As of 2013, the tables were modified from "Households in which no one 14 or over speaks English only or speaks a language other than English and speaks English less than very well" to "Limited English speaking households."

This dataset is important in evacuation planning as it helps to determine the types of evacuation orders that will be most effective in each county. Evacuation orders may need to be translated to several different languages and communicated in a variety of ways (television, print, radio, etc.).

Table 6. Southwest Florida – Limited English Speaking Households, 2014

Language Spoken	Total	Limited English	% Limited English
Total Households	631,062	28,595	4.5%
English Only	513,947		
Spanish	70,840	19,841	28.0%
Other Indo-European languages	37,958	6,847	18.0%
Asian and Pacific Island languages	5,878	1,471	25.0%
Other languages	2,439	436	17.9%

Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates, 2014 Limited English Speaking Households (S1602)

Map 5

Southwest Florida

Limited English Speaking Housholds

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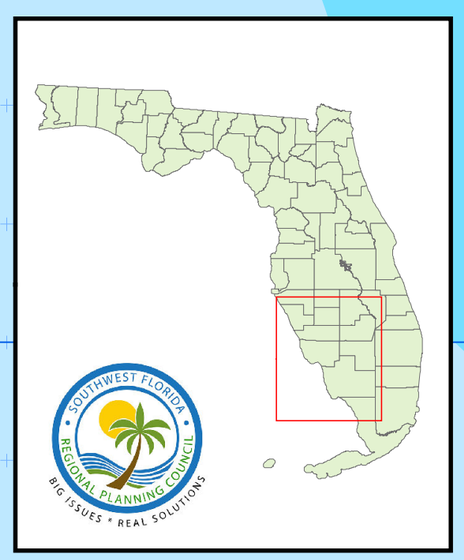
LL ML
LK MK

ML NL
MK NK

LK MK
LJ MJ

MK NK
MJ NJ



Map Legend

Speaks No English
Population Over 5

- 0.00
- 0.01 - 0.03
- 0.04 - 0.50
- 0.51 - 1.00
- 1.01 - 5.00
- 5.01 - 31.14

0 1 2 4 6 8
Miles

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Sources: USGS, United States Census Bureau

Map Printed: June, 2016

II. REGIONAL HAZARDS ANALYSIS

A. Hazards Identification and Risk Assessment

Traditionally, the regional evacuation studies in Florida have focused specifically on the hurricane hazard. Considering our vulnerability to tropical storms and hurricanes, as well as the complex nature of the evacuation and the emergency response and recovery, the priority of hurricane planning remains a necessity. However, history has also demonstrated a need to address other significant hazards, which have the potential for initiating major evacuations.

The Statewide Regional Evacuation Study (SRES), utilizing the ***Statewide Hazard Mitigation Plan*** (SHMP, 2013), identified the major hazards facing the state, and further focused on those hazards, which had the potential for initiating a multi-jurisdictional evacuation. A number of factors were considered in assessing the risk of each hazard event, including the frequency of occurrence, the severity of the event and the areas vulnerable to its impact.

Local Mitigation Strategies (LMS) are an important source of information regarding hazards specific to a County. Each of the 67 counties in Florida have in place an approved LMS document, which include detailed risk assessments for each County.

Eleven major natural hazards were identified including floods, tropical cyclones; severe storms and tornadoes; wildfire; drought; extreme heat; winter storms and freezes; erosion; sinkholes, landslides and seismic events; tsunamis; and solar storms. These hazards are detailed in the table below and include a summary of if the hazard may require a regional evacuation of the population affected.

For purposes of the SRES, the potential evacuation from (1) Tropical Cyclones, (2) Inland/Riverine floods (including related potential for dam failure) and (3) Wildfires and the Urban Interface will be analyzed in detail.

The hazards and vulnerability analysis shall identify the potential hazards to the region and shall include investigations of:

- General Information about each hazard (Hazards Profile);
- A geo-spatial analysis of the potential effects of the hazard, i.e. inundation areas, wind fields, dam locations, urban interface, etc.
- Human and social impacts including the identification of the population-at-risk, potential shelter and mass care demands, evacuee behavioral assumptions and the vulnerability of critical facilities.

Table 7: Hazards Identified in Florida[1]

Hazard	Methodology of Identification	Significant Concerns	Potential to Initiate a Regional Evacuation
Floods (including potential for dam failure and sea level rise)	Review of past disaster Declarations. Review of Federal Flood Insurance Rate Maps (FIRMs) Input from state floodplain manager. Identification of NFIP repetitive loss properties in the state. Research including new media and Internet resources	Florida is affected by flooding nearly every year. Floods have caused extensive damage and loss of life in the state in the past. There are a number of dams in the state, the breach or failure of which could impact the nearby population. Sea level rise could affect coastal structures and lead to higher water levels.	Yes; although more difficult to determine which areas are vulnerable to a particular event.
Tropical Cyclones	Review of past disaster declarations. Review of National Climatic Data Center (NCDC) Severe Storms Database. Review of National Oceanographic and Atmospheric Association (NOAA) climatology data Research including new media and the Internet Research including the National Hurricane Center	Hurricanes and coastal storms affect Florida every year. Hurricanes have caused extensive damage and loss of life across the state for the last 50 years. 12 out of the last 15 federally declared disaster events in Florida were tropical storms or hurricanes. The most recent federally declared disaster event in Florida (October 18, 2012) was Hurricane Isaac. Potential risk to offshore oil and gas exploration and production infrastructure.	Yes; this hazard requires the evacuation of coastal areas and mobile home residents, even in minor tropical storm events. Major hurricanes can have catastrophic impacts.
Severe Storms & Tornadoes	Review of past disaster declarations. Review of National Climatic Data Center (NCDC) Severe Storms Database. National Weather Service input and data. Public input including newspapers and media. Research including new media and Internet resources	Florida experiences a tornado nearly every year. Tornadoes have caused extensive damage and loss of life to county residents. The two most recent federally declared disaster events in Florida (May 27, 2009 and April 21, 2009) were severe storms with flooding, tornadoes and straight-line winds.	No; these events provide little to no warning and the specific areas cannot be determined prior to the event. Exceptions: Tornado warnings can send residents to safe rooms or mobile home parks' community centers, etc.

[1] ***Statewide Hazard Mitigation Plan*** (SHMP), 2013

Hazard	Methodology of Identification	Significant Concerns	Potential to Initiate a Regional Evacuation
Wildfire	Florida Forest Service statistics and input. USDA Florida Forest Service mapping of Fire, fuel, and Wildland Urban Interface (WUI). Input from DEM about wildfires and the EOC activations. Public input including newspapers and media.	Florida experiences wildfires every year. Development in much of the state is occurring at the Wildland-Urban Interface (WUI). Cyclical drought patterns result in increases of brush and other dry materials. This increases the overall risk for significant fires. As of May 29, 2012, there have been 2,032 wildfires affecting 93,338 acres on state and federal land during the 2012 calendar year.	Yes; while we can determine areas that may be more vulnerable and plan accordingly, it is difficult to predict where a wildfire may ignite.
Drought	National Weather Service data. National Oceanographic and Atmospheric Association (NOAA) paleoclimatology data. The US Drought Monitor Keetch Byram Drought Index (KBDI) Agricultural community throughout the state.	Significant drought trends during the last 10 years including the driest back to back calendar years in 2006-2007 Drought has a severe economic impact on the state due to the large amounts of citrus, agriculture and livestock.	No; this event does not typically initiate an evacuation.
Extreme Heat	National Weather Service data. Research including new media and Internet resources	Significant impact to the population From 1994-2003, on average more people died from excessive heat than hurricanes, flooding, tornadoes and lightning combined.	No; this event does not typically initiate an evacuation; although shelters may be opened.
Winter Storms and Freezes	Review of past disaster declarations. Review of NCDC Severe Storms Database. National Weather Service input and data. Public input including newspapers and media.	Florida is affected by winter storms cyclically Significant freezes particularly during the 1980s that affected the citrus industry There have been six federally declared disasters relating to winter storms and freezes since 1971 The population is unprepared for cold weather with many having inadequate heating capabilities.	No; this event does not typically initiate an evacuation; although cold weather shelters may be opened for homeless, citizens with special needs or those with no power.
Erosion	Coordination with the Florida Department of Environmental Protection – Bureau of Beaches and Coastal systems. SHMPAT interview and input. Evaluation of Erosion Hazards, the report from the Heinz Center that was presented to FEMA in April 2000. Looking at shoreline change maps Public input including newspapers and media.	Due to the gradual, long-term erosion, as many as one in four houses along the coast, could fall into the ocean in the next 60 years fifty-nine percent of Florida's beaches are currently experiencing erosion. Significant economic impact for the state due to property damages, loss of actual beach front real estate and effects on tourism	No; this event does not typically initiate an evacuation, but it may result in a retreat from the coast over long period of time or following a major coastal storm.

Hazard	Methodology of Identification	Significant Concerns	Potential to Initiate a Regional Evacuation
Sinkholes, Landslides and Seismic Events	Coordination with the Florida Geographical Survey The Florida Subsidence Incident Report (SIR) database Coordination with the Florida Department of Transportation Input from the Central United States Earthquake Consortium	Sinkholes are a common feature of Florida's landscape 3,378 sinkholes have been reported in the state since the 1940s, 175 of those developed because of Tropical Storm Debby. Issues arise as development continues in high-risk areas. Impact on the roads and physical infrastructure of the state Localized lowering of groundwater table for agricultural pumping can trigger sinkholes. Historical earthquake events impact Pensacola, FL previously.	Earthquake is considered a very low risk. Sinkholes, while prevalent, will not initiate an evacuation at a regional scale.
Tsunamis	Input from the NOAA Center for Tsunami Research Coordination with the Florida Division of Emergency Management Input from the United State Geological Survey	Tsunamis commonly occur in large bodies of water Almost all perimeters of Florida's boundaries are made up of large bodies of water Recent Tsunamis from around the world have caused widespread destruction Residential and commercial development along Florida's coastlines are at risk to the effects of Tsunamis Tsunami and rogue wave occurrence in Florida is rare with approximately four document events (1755,1886,1992,1995) Potential tsunamis generation is pollable by mass wasting events in the Canary and Cape Verde Islands based on geological evidence of their conjectured past impact on the east coast of the Bahamas.	This event has an extremely low probability of occurrence. If a Cumbre Vieja-related tsunami event were to occur, it could have a catastrophic impact on the east coast of Florida. A maximum of 6 hours would be available for evacuations. Typically, there is little to no warning.
Solar Storms	Coordination with Division of Emergency Management. Research including new media and Internet resources	Emerging threat, which could significantly interfere with the electrical grid and critical infrastructure functionality.	No; this event does not typically initiate an evacuation.
Technological	Coordination with the State Emergency Response Commission Interaction with the Local Emergency Planning Committees (LEPC) Coordination with the Nuclear Regulatory Commission (NRC) Communications with the FL Department of Environmental Protection	Numerous accidental hazardous material releases occur every year Potential for human and environmental impacts Threat of radiation from a nuclear related incident	Yes, these incidents may initiate evacuations, but it is impossible to predict precise location, extent, and timing. Nuclear power plant evacuation planning conducted w/NRC

Hazard	Methodology of Identification	Significant Concerns	Potential to Initiate a Regional Evacuation
Terrorism	Coordination with FEMA and Department of Homeland Security Coordination with the Florida Department of Law Enforcement (FDLE) Interaction with local law enforcement agencies	National priority with federal government requirements Potential for devastating impacts to life and infrastructure Protection for the citizens of Florida and the USA	Yes, these incidents may initiate evacuations, but it is impossible to predict precise location, extent and timing.
Mass Migration	Coordination with the US Citizens and Immigration Service (USCIS) Data from local law enforcement	Historic precedence for migration to Florida by boat Large amounts of unpatrolled coastlines	No; evacuation is not the problem.

1. Tropical Cyclones

Coastal Storms / Hurricane Hazard Profile

A hurricane is defined as a weather system with a closed circulation developing around a low pressure center over tropical waters. The winds rotate counterclockwise in the Northern Hemisphere (clockwise in the Southern Hemisphere). A tropical cyclone refers to any such circulation that develops over tropical waters. *Tropical cyclones act as a safety valve limiting the 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* (*Statewide Hazard Mitigation Plan*, SHMP 2013). Tropical cyclones are named when their winds reach tropical storm strength (sustained 39 mph).

- **Tropical Depression**: The formative stages of a tropical cyclone in which the maximum sustained (1-minute mean) surface wind is <38 mph.
- **Tropical Storm:** A warm core tropical cyclone in which the maximum sustained surface wind (1-minutes mean) ranges from 39 to <73 mph.
- **Hurricane:** A warm core tropical cyclone in which the maximum sustained surface wind (1 minute mean) is at least 74 mph.

The table below displays the Saffir-Simpson Scale used to define and describe the intensity of hurricanes. The central pressure of the hurricanes is measured in millibars or inches. The wind speed is also a significant indicator in determining the category of the storm. The wind speed is tied to both wind damage and potential storm surge and resulting coastal flooding damages.

It should be noted that the range of storm surge is highly dependent upon the configuration of the continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf or one that drops steeply from the shoreline and subsequently produces deep water in close proximity to the shoreline tends to produce a lower surge but higher and more powerful storm waves. This is the situation along the Atlantic Ocean side of the state. However,

the Gulf Coast of Florida has a long gently sloping shelf and shallow water depths and can expect a higher surge but smaller waves. South Dade County is an exception to these general rules due to Biscayne Bay (wide shelf and shallow depth). In this instance, a hurricane has a larger area to "pileup" water in advance of its landfall. Nowhere is the threat of storm surge more prevalent than in Apalachee Bay region. The Big Bend region of the state extends out into the Gulf of Mexico creating a naturally enclosed pocket. This area has some the highest computer projected storm surge heights in the entire nation.

Hurricanes Dennis, Katrina and Ike also demonstrated that the size of the hurricane can significantly impact the potential storm surge. These storms which had particularly large radii of maximum winds produced storm surge comparable to much more intense categories of storm if measured using only wind speeds. This storm characteristic will be modeled to determine its impact on the ultimate storm surge.

Table 8: Saffir-Simpson Hurricane Wind Scale

Category	Wind Speeds	Potential Damage
Category 1	(Sustained winds 74-95 mph)	Very dangerous winds will produce some damage
Category 2	(Sustained winds 96-110 mph)	Extremely dangerous winds will cause extensive damage
Category 3	(Sustained winds 111-130 mph)	Devastating damage will occur
Category 4	(Sustained winds 131-155 mph)	Catastrophic damage will occur
Category 5	(Sustained winds of 156 mph and above)	Catastrophic damage will occur

The storm surge is the abnormal rise in water level caused by the wind and pressure forces of a hurricane or tropical storm. Storm surge produces most of the flood damage and drowning associated with storms that make landfall or that closely approach the coastline. Of the hurricane hazards, the storm surge is considered the most dangerous as nine out of ten hurricane-related deaths are caused by drowning.

Storm Scenario Determinations

The SLOSH model is the basis for the "hazards analysis" portion of coastal hurricane evacuation plans. Thousands of hypothetical hurricanes are simulated with various Saffir-Simpson Wind categories, forward speeds, landfall directions, and landfall locations. An envelope of high water containing the maximum value a grid cell attains is generated at the end of each model run. These envelopes are combined by the NHC into various composites, which depict the possible flooding. One useful composite is the MEOW (Maximum Envelopes of Water) which incorporates all the envelopes for a particular category, speed, and landfall direction. Once surge heights have been determined for the appropriate grids, the maximum surge heights are plotted by storm track and tropical storm/hurricane category. These plots of maximum surge heights for a given storm category and track are referred to as Maximum Envelopes of Water (MEOWs). The

MEOWs or Reference Hurricanes are used in evacuation decision-making when and if sufficient forecast information is available to project storm track or type of storm (different land falling, paralleling, or exiting storms).

The MEOWs provide information to the emergency managers in evacuation decision making. However, in order to determine a scenario, which may confront the county in a hurricane threat 24-48 hours before a storm, is expected, a further compositing of the MEOWs into Maximums of the Maximums (MOMs) is usually required.

The MOM (Maximum of the Maximums) combines all the MEOWs of a particular category. The MOMs represent the maximum surge expected to occur at any given location, regardless of the specific storm track/direction of the hurricane. The only variable is the intensity of the hurricane represented by category strength (Category 1-5) and the type (land falling, paralleling, or exiting).

The MOM surge heights, which were furnished by the National Hurricane Center, were run at astronomical high tide. All elevations are now referenced to the NAVD88 datum. These surge heights were provided within the SLOSH grid system. The range of maximum surge heights for each county in the region based upon the model is provided for each category of storm on Table II-4. It should be noted again that these surge heights represent the maximum surge height recorded in the county including inland and back bay areas where the surge can be magnified dependent upon storm parameters.

In order to determine the inundation depth of surge flooding at a particular location, the ground elevation (relative to NAVD88) at that location must be subtracted from the potential surge height. It is important to note that one must use a consistent vertical datum when post-processing SLOSH storm surge values

Table 9: Potential Tide Height(s) ** By County
(In Feet above NAVD88)

*Storm Strength	Charlotte	Collier	Lee	Sarasota	Lake O 16ft	Lake O 20ft
Category 1	Up to 7.0’	Up to 8.2’	Up to 8.7’	Up to 6.9’	Up to 21.1’	Up to 25.0’
Category 2	Up to 17.0’	Up to 14.1’	Up to 15.5’	Up to 15.4’	Up to 26.6’	Up to 30.6’
Category 3	Up to 26.0’	Up to 19.5’	Up to 23.0’	Up to 26.0’	Up to 33.2’	Up to 35.5’
Category 4	Up to 32.3’	Up to 24.5’	Up to 27.6’	Up to 33.2’	Up to 36.4’	Up to 37.2’
Category 5	Up to 37.7’	Up to 41.9’	Up to 41.7’	Up to 35.4’	Up to 38.9’	Up to 40.0’

** Based upon the category of storm on the Saffir-Simpson Hurricane Wind Scale*
*** Surge heights represent the maximum values from SLOSH MOMs*

Variations to Consider

Variations between modeled versus actual measured storm surge elevations are typical of current technology in coastal storm surge modeling. In interpreting the data, emergency planners should recognize the uncertainties characteristic of mathematical models and severe weather systems such as hurricanes. The storm surge elevations developed for this study and presented in the Storm Tide Atlas should be used as guideline information for planning purposes.

Storm Surge & Wave Height

Regarding interpretation of the data, it is important to understand that the configuration and depth (bathymetry) of the Gulf bottom will have a bearing on surge and wave heights. A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water in close proximity to the shoreline, tends to produce a lower surge but a higher and more powerful wave. Those regions having a gently sloping shelf and shallower normal water depths, can expect a higher surge but smaller waves. The reason this occurs is that a surge in deeper water can be dispersed down and out – away from the hurricane. However, once that surge reaches a shallow gently sloping shelf, it can no longer be dispersed away from the hurricane. Consequently, water piles up as it is driven ashore by the wind stresses of the hurricane. Wave height is NOT calculated by the SLOSH model and is not reflected within the storm tide delineations.

Forward Speed

Under actual storm conditions, it may be expected that a hurricane moving at a slower speed could have higher coastal storm surges than those depicted from model results. At the same time, a fast-moving hurricane would have less time to move storm surge water up river courses to more inland areas. As an example, a minimal hurricane, or a storm further off the coast which stalls off the coast for several tidal cycles, could cause extensive beach erosion and move large quantities of water into interior lowland areas. In the newest version of the Northeast Florida SLOSH model, for each set of tracks in a specific direction, storms were run at forward speeds of 5, 10, 15, and 25 mph.

Astronomical Tide

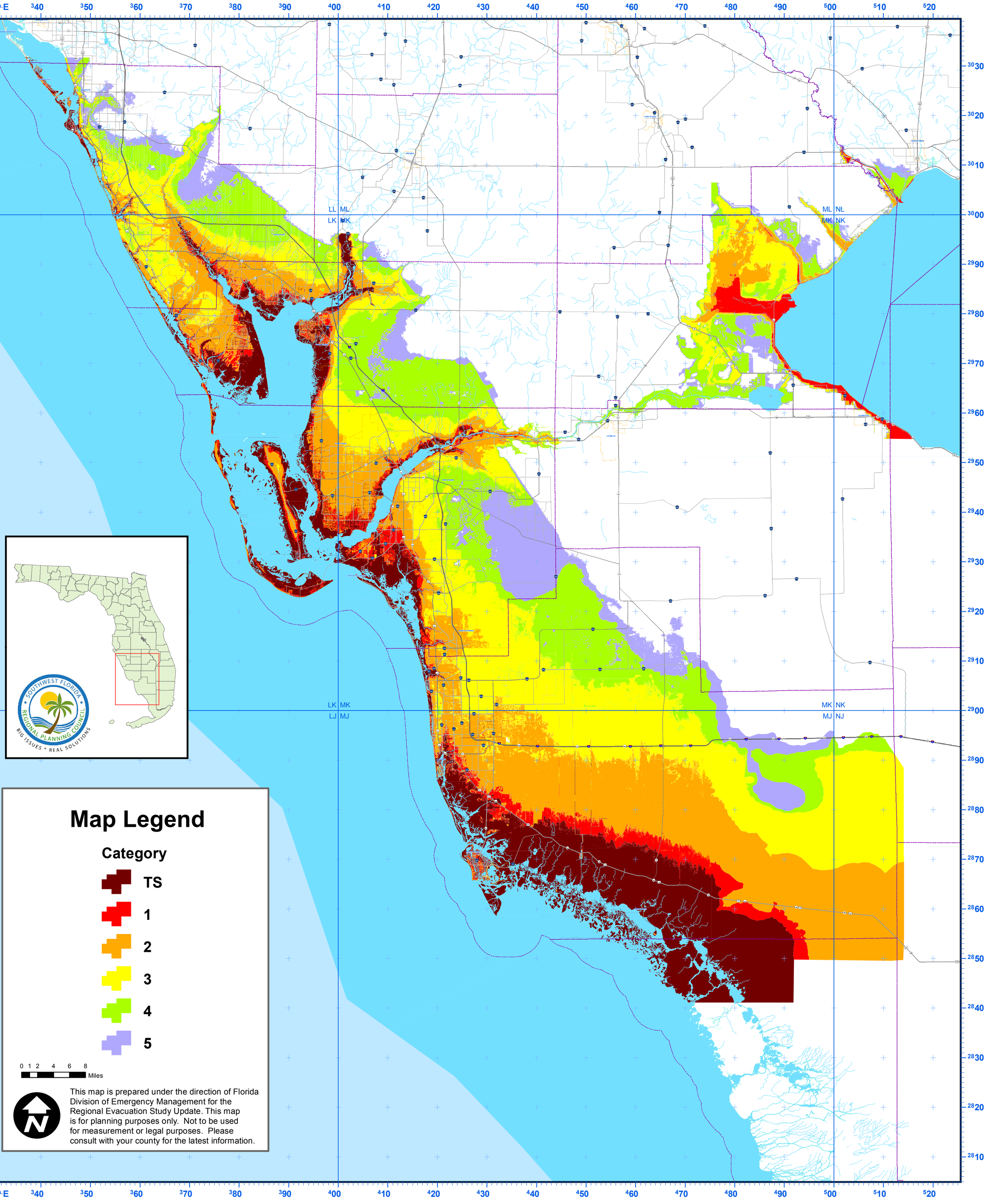
Surge heights were provided for high tide. The tide level is referenced to North American Vertical Datum of 1988. The storm tide limits reflect astronomical high tide in the region.

STATEWIDE REGIONAL EVACUATION STUDY PROGRAM

Southwest Florida

Storm Tide Surge Zones

2016 Evacuation Study Summary Update



Map Legend

Category

- TS
- 1
- 2
- 3
- 4
- 5

0 1 2 4 6 8 Miles

This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.

Sources: USGS, National Hurricane Center

Map Printed: June, 2016

Hurricane Vulnerability

Hurricane Evacuation Zones

The delineation of evacuation zones is an essential part of any hurricane evacuation plan for two reasons. First, the creation of zones allows for the assignment of population and vehicles for the transportation analysis. Secondly, the creation of zones operationally allows preparedness and response officials to identify areas predicted to receive storm surge that require an evacuation.

The **storm tide limits** were determined using the maximum surge from landfalling hurricanes (Categories 1, 2, 3, 4 and 5). County emergency management agencies delineate the **evacuation zones** based on several factors, including the storm tide limits. However, in order to relay this information to the public in a meaningful way, the emergency management agencies use roadways, waterways and familiar landmarks as boundaries for the evacuation areas. This is a very deliberate process. It requires knowledge of the area, the land use and population density. In determining evacuation zones, judgments must be made about the potential for isolation in areas which may not receive storm surge yet are surrounded by areas which will. Potential freshwater flooding is also a consideration in some cases.

The more detailed storm tide limits coupled with the desire to minimize any potential "over-evacuation" results in tighter more detailed evacuation areas in several counties in the region. This is especially true where the LiDAR elevation data provided very detailed topographic data and where, in such a densely populated county, over-evacuation could affect thousands of residents.

Conversely, the inability to forecast exact hurricane track, intensity, size and forward speed as well as the limitation of the SLOSH model, encourage many county emergency management officials to simplify the evacuation zone patterns. This more flexible concept allows a more generalized zone scheme which may be easier to convey to the public.

County Evacuation Zones in the Region are presented below on Map 7. The Evacuation Zones are also presented in the County Appendices.

Map 7

Southwest Florida

Regional County Evacuation Zones

2016 Evacuation Study Summary Update

330000m.E 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520

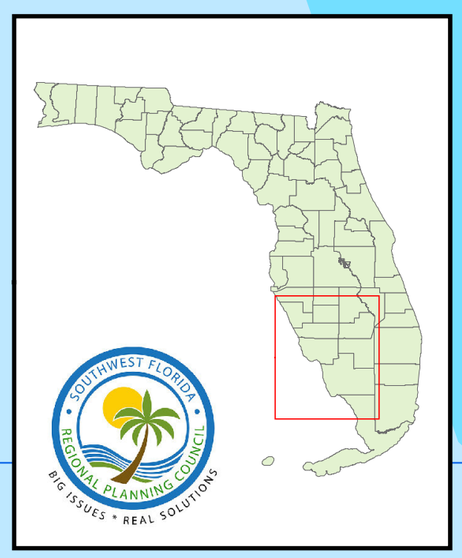
3040000m.N 3030 3020 3010 3000 2990 2980 2970 2960 2950 2940 2930 2920 2910 2900 2890 2880 2870 2860 2850 2840 2830 2820 2810

LL ML
LK MK

ML NL
MK NK

LK MK
LJ MJ

MK NK
MJ NJ



Map Legend
Evacuation Zones

Zone Level

- Level TS
- Level A
- Level B
- Level C
- Level D
- Level E

0 1 2 4 6 8 Miles

This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.

Sources: USGS, National Hurricane Center

Map Printed: June, 2016

Population-at-Risk (Vulnerable Population)

In order to quantify the hurricane evacuation times as well as hurricane response and recovery needs, it is essential to know how many persons must be evacuated from the hazards associated with a tropical storm or hurricane -- the **population-at-risk**.

Using a combination of the demographic data, behavioral assumptions, and evacuation zones, the vulnerable population in each county could be determined by evacuation level. For the purposes of the transportation analysis, the vulnerable population, or population-at-risk, is defined as the total population living within the county designated evacuation zones for each evacuation level. This population is living in an area that is at risk for severe flooding during a storm event.

The population-at-risk by hurricane evacuation level for the years 2015 and 2020 is presented on Table 10 and 11.

Table 10: Vulnerable Population in the Southwest Florida Region for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
Site-built Homes	30,919	84,890	28,602	3,556	113
Mobile/Manuf. Homes	3,655	5,651	2,066	2,556	32
TOTAL	34,574	90,541	30,667	6,112	145
Collier County					
Site-built Homes	69,979	144,597	82,683	6,492	4,332
Mobile/Manuf. Homes	7,500	7,112	929	709	2,191
TOTAL	77,479	151,709	83,612	7,200	6,524
Glades County					
Site-built Homes	441	273	541	696	193
Mobile/Manuf. Homes	205	392	450	883	285
TOTAL	646	666	991	1,578	478
Hendry County					
Site-built Homes	742	139	248	63	0
Mobile/Manuf. Homes	1,388	155	32	9	0
TOTAL	2,130	294	280	71	0
Lee County					
Site-built Homes	156,881	234,537	136,168	38,822	39,155
Mobile/Manuf. Homes	15,266	9,962	23,379	1,039	1,164
TOTAL	172,146	244,499	159,546	39,861	40,320
Sarasota County					
Site-built Homes	30,841	50,075	94,991	57,427	38,794
Mobile/Manuf. Homes	2,653	6,782	3,866	2,610	1,405
TOTAL	33,493	56,858	98,857	60,037	40,199

Note: Vulnerable population determined using SRESP small area and county provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the

lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

Table 11: Vulnerable Population in the Southwest Florida Region for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
Site-built Homes	32,515	89,286	30,083	3,750	119
Mobile/Manuf. Homes	3,847	5,946	2,172	2,679	34
TOTAL	36,362	95,232	32,255	6,429	153
Collier County					
Site-built Homes	77,283	159,736	91,349	7,179	4,785
Mobile/Manuf. Homes	8,325	7,893	1,035	777	2,424
TOTAL	85,608	167,629	92,384	7,956	7,209
Glades County					
Site-built Homes	463	287	570	723	198
Mobile/Manuf. Homes	218	414	474	941	307
TOTAL	681	702	1,045	1,664	504
Hendry County					
Site-built Homes	767	143	256	65	0
Mobile/Manuf. Homes	1,434	160	34	9	0
TOTAL	2,201	304	290	74	0
Lee County					
Site-built Homes	177,728	265,694	154,091	43,980	44,347
Mobile/Manuf. Homes	17,290	11,288	26,655	1,176	1,329
TOTAL	195,018	276,982	180,746	45,155	45,676
Sarasota County					
Site-built Homes	32,899	53,420	101,337	61,265	41,383
Mobile/Manuf. Homes	2,831	7,234	4,124	2,784	1,500
TOTAL	35,730	60,654	105,461	64,049	42,883

Note: Vulnerable population determined using SRESP small area data and county provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

Wind Vulnerability: Manufactured Housing, Mobile Homes & RVs

Manufactured, mobile homes and recreational vehicles are extremely vulnerable to hurricane force winds and severe weather. Statistics document that these types of housing stock receive a disproportionate share of the damage from severe weather, and residents are far more likely to be injured or killed in these structures compared to site built homes.[2]

Because of this vulnerability hurricane evacuation plans in Florida have called for the evacuation of all areas subject to potential storm surge (coastal flooding) and the complete evacuation of all mobile home/RV residents no matter where they are located within the county.

In the 2004 hurricane season it seemed new manufactured homes held up relatively well, even when compared to site-built homes. Since 1999, manufactured homes have been built and installed to tougher standards but not equivalent to the most recent codes for site-built structures. As required by HUD all manufactured homes sold in Florida's coastal counties since 1994 are engineered to withstand sustained winds of 110 mph and 3-second gusts of 130 to 150 mph. (http://www.builtstronger.com/history.html)

There are several additional factors to consider:

- Unless a structure is permanently attached to a foundation, there is no way to assume that the structure will remain "tied down" in hurricane force winds. With Florida's climate, salt air and sandy soils, tie-down systems would not be expected to perform optimally without constant vigilance.
- Currently, most manufactured homes in the region were built prior to 1999 and do not meet current standards for wind load or anchoring systems.
- Additions, such as carports, siding and cladding, and attached storage units did not perform well in hurricane conditions even on newer units.
- Newer manufactured homes would be at risk from flying debris from older units within the same mobile home park.
- It would be difficult, at best, to implement evacuation orders based on the age and maintenance of individual units.

In addition to residents vulnerable to storm surge, those residents vulnerable to hurricane force winds (74+ mph) must be evacuated in advance of the hurricane. Basically, residents of buildings without traditional structural foundations are more vulnerable to such wind speeds. In the Southwest Florida region, this includes residents of substandard housing, manufactured and

[2] For example, in February 1998, a tornado destroyed many site-built homes, mobile homes and RVs in the Kissimmee/Orlando central Florida area. There were 42 people killed: 34 resided in mobile homes, 7 in RVs and 1 was in an automobile. No one living in a site-built home died; although there were **more** traditional concrete block and stick-built homes destroyed (385) than mobile homes (373) yet without any fatalities.

mobile homes and visitors in recreational vehicles and travel trailers. Since hurricane force winds can extend inland many miles, all manufactured and mobile home residents and travel trailer/RV visitors must be evacuated, regardless of their location in the region.

38% of Southwest Florida's mobile home spaces are located in Lee County. An overwhelming majority of Lee County's mobile homes are located in Category 2 and 3 storm surge areas. Charlotte, Collier and, Sarasota Counties also have a significant proportion of their mobile homes in storm surge areas. Hendry and Glades Counties are inland counties, but do have a small amount of mobile homes located within Lake Okeechobee's storm surge area.

Table 12: Mobile Home/RV Parks in the Southwest Florida Region

County	# of MH/RV Parks	# of Mobile Homes Spaces	# of RV Unit Spaces	Sum # of Spaces
Charlotte	45	6,801	2,391	9,192
Collier	74	4,381	3,546	7,927
Glades	33	278	2,361	2,639
Hendry	30	1,140	1,439	2,579
Lee	139	17,226	10,612	27,838
Sarasota	78	15,598	3,757	19,355
Region	399	45,424	24,106	69,530

Source: Florida Department of Health, 2016

2. Freshwater Flooding: The 100-Year Flood Plain

Inland /Riverine Flooding Profile

Flooding refers to the general or temporary conditions of partial or complete inundation of normally dry land areas from the overflow of inland or tidal water and of surface water runoff from any source (Statewide Hazard Mitigation Plan, 2013). The State of Florida and the Southwest Florida Region are affected by a large number of weather systems that result in flooding.

Flooding can be divided into two major categories: Coastal and Riverine. As indicated previously, interrelated hazards, such as hurricanes and severe storms, can result in both types of flooding, sometimes in difference locations. Many areas of Florida are susceptible to flooding from both storm surge and watershed runoff.

Coastal flooding is usually the result of a severe weather system such as a tropical cyclone, hurricane, tropical storm, or "northeaster" which contains the element of wind. The damaging effects of coastal floods are caused by a combination of higher water levels of the storm surge, the winds, rains, erosion, and battering by debris. Loss of life and property damage are often more severe since it involves velocity wave action and accompanying winds.

Riverine flooding is associated with a river's watershed, which is the natural drainage basin that conveys water runoff from rain. Riverine flooding occurs when the flow of runoff is greater than the carrying capacities of the natural drainage systems. Rainwater not absorbed by soil or vegetation seeks surface drainage lines following natural topography lines. These lines merge to form a hierarchical system of rills, creeks, streams, and rivers. Generally, floods can be slow or fast rising depending on the size of the river or stream. The rivers in north Florida drain portions of Alabama and Georgia, and excessive rainfall in those states often causes flood conditions in Florida.

Flash floods are much more dangerous and flow much faster than riverine floods. They can result from tropical storms, dam failures or excessive rain and snow. Flash floods pose more significant safety risks because of the rapid onset, the high water velocity, the potential for channel scour, and the debris load.

In Florida, several variations of flooding occur due to the effects of severe thunderstorms, hurricanes, seasonal rain, and other weather-related conditions. The loss of life, personal property, crops, business facilities, utilities, and transportation are major impacts of flooding. Floodwaters present an additional hazard as a public health problem when they inundate drinking water facilities, chemical and waste storage facilities, wastewater treatment facilities, and solid waste disposal sites.

Probability of Flooding: FIRM Maps

The probability of freshwater flooding has been quantified by the Federal Emergency Management Agency (FEMA) through the National Flood Insurance Program. Areas subject to flooding, the Velocity Zone, 100-year flood plain and the 500-year floodplain, have been delineated on Flood Insurance Rate Maps (FIRMs) for every jurisdiction in the region. Moderate to low risk areas include zones B, C and X. High risk areas include zones A, AE, AH, AO, and AR. High risk coastal areas include the Velocity zones (Zones V, VE, V1-V30 and undetermined risk areas (Zone D).

Table 13: Definitions of NFIP Zones

AE	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. In most instances, base flood elevations (BFEs) derived from detailed analyses are shown at selected intervals within these zones.

X500 An area inundated by 500-year flooding; an area inundated by 100-year flooding with average depths of less than 1 foot or with drainage areas less than 1 square mile; or an area protected by levees from the 100-year flooding.

X Areas outside the 1-percent annual chance floodplain, areas of 1% annual chance sheet flow flooding where average depths are less than 1 foot, areas of 1% annual chance stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 1% annual chance flood by levees. No Base Flood Elevations or depths are shown within this zone. Insurance purchase is not required in these zones.

A Flood zone area with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths of base flood elevations are shown within these zones.

ANI An area that is located within a community or county not mapped on any published FIRM.

IN An area designated as within a "Special Flood Hazard Area" (or SFHA) on a FIRM. This is an area inundated by 100-year flooding for which no BFEs or velocity may have been determined. No distinctions are made between the different flood hazard zones that may be included within the SFHA. These may include Zones A, AE, AO, AH, AR, A99, V, or VE.

VE Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.

UNDES A body of open water, such as a pond, lake, ocean, etc., located within a community's jurisdictional limit that has no defined flood hazard.

AO River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.

D Areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk.

AH Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.

V Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. No base flood elevations are shown within these zones.

100IC An area where the 100-year flooding is contained within the channel banks and the channel is too narrow to show to scale. An arbitrary channel width of 3 meters is shown. BFEs are not shown in this area, although they may be reflected on the corresponding profile.

Source: FEMA Map Service Center, https://msc.fema.gov/webapp/wcs/stores/servlet/info?storeId=10001&catalogId=10001&langId=-1&content=floodZones&title=FEMA%2520Flood%2520Zone%2520Designations

The model used to determine the flood plain, like the SLOSH MEOWs or MOMs and the Inland Wind model, is a cumulative model. In other words, it is based on several storm events; no one storm will inundate all the areas within the flood zone. In addition, because there is a return interval (1% or greater chance of flooding in any given year) associated with the flood level; there is a basis for planning and cost-benefit analysis.

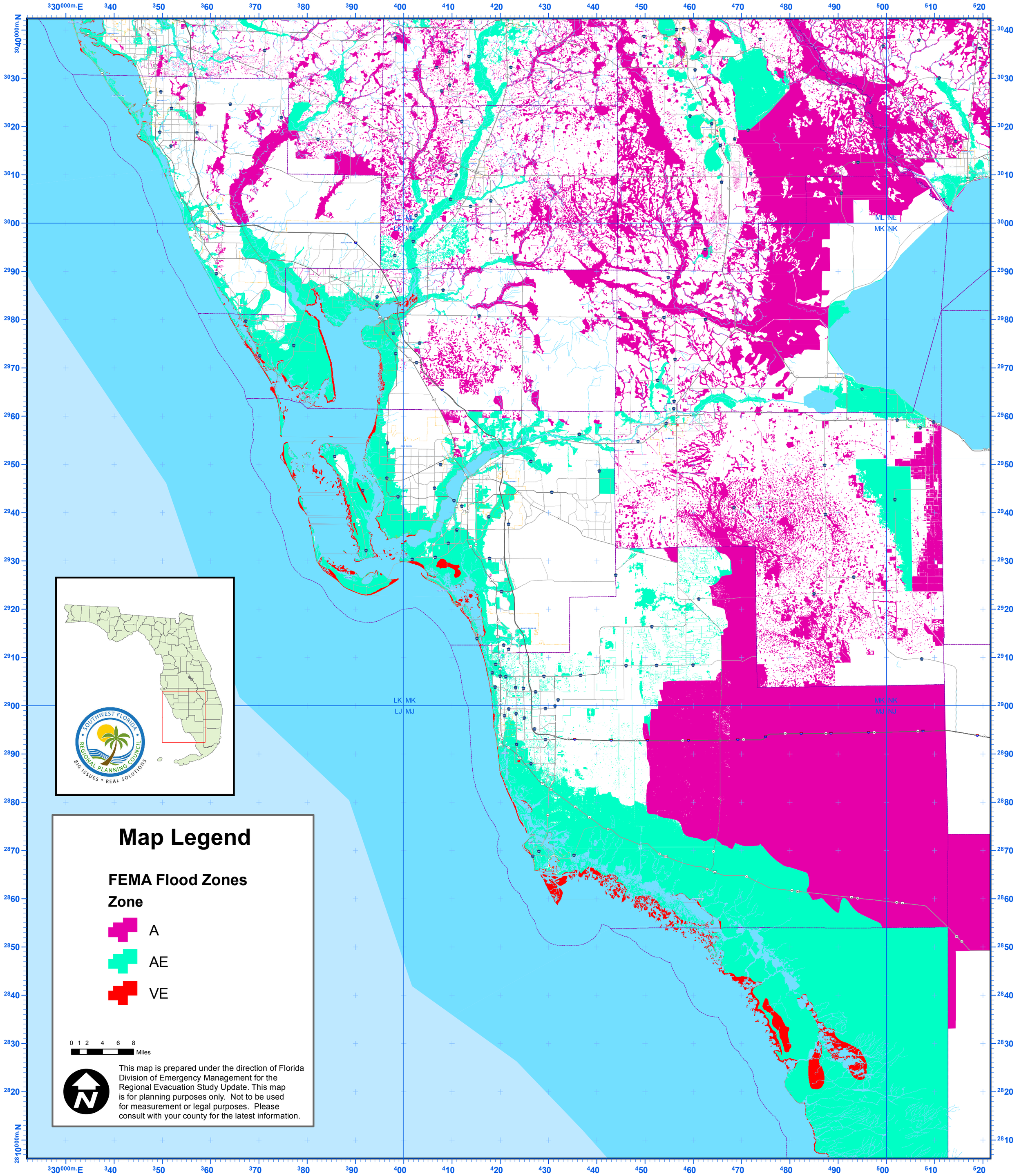
In order to identify the potential magnitude of inland flooding, the 100-year flood plain was delineated using FEMA's most recent digital files. County maps illustrating the 100-year flood plain are presented in the Maps sections of Chapter IV Appendices. Within the flood zone, it is recognized that there are areas that have sustained repeated damage from flooding and are extremely susceptible to flood damage. These local neighborhoods should be warned prior to hurricane events that flooding is very probable.

STATEWIDE REGIONAL EVACUATION STUDY PROGRAM

Southwest Florida

FEMA Flood Zones (FIRM)

2016 Evacuation Study Summary Update



Map Legend

FEMA Flood Zones

Zone

- A
- AE
- VE

0 1 2 4 6 8 Miles

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Sources: USGS, National Hurricane Center

Map Printed: **June, 2016**

Flood Plain Vulnerability

The total acreage within the 100-year flood plain by county is presented below, in Table 14. It was calculated using the total acreage as determined by the Census Bureau and the FEMA FIRM Maps as of 2009. Table 15 summarizes the population living in 100 year flood zones in each County in the Region.

Table 14:
100 Year Flood Plain Acreage by County
Southwest Florida Region

COUNTY	TOTAL ACREAGE	FLOOD PLAIN ACREAGE	PERCENTAGE OF ACREAGE IN FLOODPLAIN
CHARLOTTE	456,431	163,854	35.9%
COLLIER	1,297,095	1,036,364	79.9%
GLADES	630,630	358,696	56.9%
HENDRY	760,893	225,188	29.6%
LEE	523,836	344,464	65.8%
SARASOTA	369,874	77,539	21.0%

Source: Census 2000 SF3 (Land & Water Acreage); FEMA (Digital Inventory of Flood Plain Acreage), 2012.

Table 15: Population-at-Risk from Flooding, 2015 - 2020

County	Site Built Population 2015	Mobile / Manufactured Home Population 2015	Site Built Population 2020	Mobile / Manufactured Home Population 2020
Charlotte	73,431	7,290	77,227	7,675
Collier	114,406	10,187	126,370	11,297
Glades	2,281	2,172	2,405	2,289
Hendry	7,554	5,501	7,804	5,686
Lee	246,630	24,947	279,333	28,328
Sarasota	76,766	7,932	81,895	8,460

Source: FEMA, Southwest Florida Regional Council

3. Wildfires and the Urban Interface

Florida is home to millions of residents who enjoy the state's beautiful scenery and warm climate. However, few people realize that these qualities also create severe wildfire conditions. Each year, thousands of acres of wild land and many homes are destroyed by fires that can erupt at any time of the year from a variety of causes, including arson, lightning, and debris burning. Adding to the fire hazard is the growing number of people living in new communities built in areas that were once wild land. This growth places even greater pressure on the state's wild land firefighters. As a result of this growth, fire protection becomes everyone's responsibility (Florida Division of Emergency Management, 2008)
http://www.floridadisaster.org/bpr/EMTOOLS/wildfire/wildfire.htm

Wildfire Hazard Profile

Wildfire is defined by the Florida Forest Service (FFS) as any fire that does not meet management objectives or is out of control. Wildfires occur in Florida every year and are part of the natural cycle of Florida's fire-adapted ecosystems. Many of these fires are quickly suppressed before they can damage or destroy property, homes, and lives. (SHMP, 2013) There are four types of forest fires:

- Surface Fires: Burn along the forest floor consuming the litter layer and small branches on or near the ground.
- Ground Fires: Smolder or creep slowly underground. These fires usually occur during periods of prolonged drought and may burn for weeks or months until sufficient rainfall extinguishes the fire, or it runs out of fuel.
- Crown Fires: Spread rapidly by the wind, moving through the tops of the trees.
- Wild land/Urban Interface Fires: Fires occurring within the WUI in areas where structures and other human developments meet or intermingle with wild lands or vegetative fuels. Homes and other flammable structures can become fuel for WUI fires.

Approximately 80 percent of all wildfires in Florida occur within one mile of the WUI. Florida has a year round fire season with the most active taking place from April to July. The majority of wildfires in Florida (70-80 percent) are caused by humans with arson and escaped debris burning being the top two causes. The largest number of lightning-caused fires occurs in July. The drier months tend to be January, February and March but this is not always the case depending on drought conditions and frequency of frontal passages. Dry months, combined with low humidity and high wind have the highest number of fires reported.

Each wildfire, especially near development, can threaten human life, structures, and natural resources. Urban development has moved into wild land areas where the hazard is more severe and fire control is more difficult.

Wild land-Urban Interface (WUI)

The Florida Forest Service provides risk maps for wildfire. The web-based risk system produces maps for Level of Concern (LOC), Fuels, Wild land Fire Susceptibility Index (WFSI) and the likelihood of the number of fires per 1000 acres per year (FOA).

Methodology

The Wild land Fire Risk Assessment System (FRAS) combines indices of Wild land Fire Susceptibility and Fire Effects to generate a "Level of Concern" map. **Level of Concern (LOC)** is the best measure of wildland fire risk. The Level of Concern is calculated from the likelihood of an acre burning, called the **Wildland Fire Susceptibility Index** (WFSI), and the expected effects of the fire (Fire Effects Index).

LOC is a value between 0 and 100. It is calculated as the Wildland Fire Susceptibility Index (WFSI) times the Fire Effects Index (FEI). The LOC can be used to identify areas where mitigation options may be of value; allow agencies to work together and better define priorities; develop a refined analysis of a complex landscape and fire situations using GIS; and increase communication with local residents to address community priorities and needs.

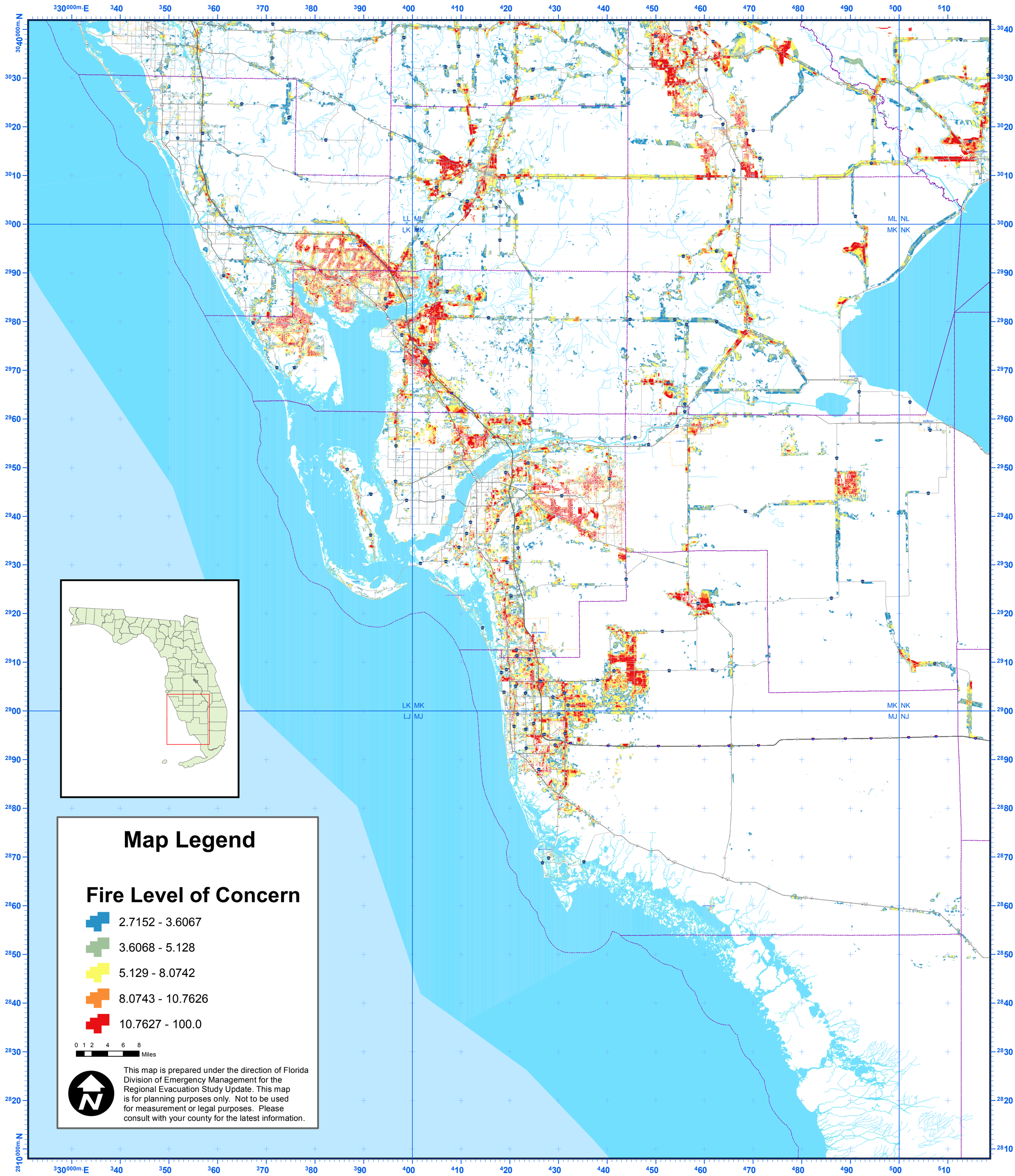
Map 9 illustrates the risk for wildfire within the region using the data provided by the Florida Forest Service.

STATEWIDE REGIONAL EVACUATION STUDY PROGRAM

Southwest Florida

Wildfire Level of Concern

2016 Evacuation Study Summary Update



Map Legend

Fire Level of Concern

- 2.7152 - 3.6067
- 3.6068 - 5.128
- 5.129 - 8.0742
- 8.0743 - 10.7626
- 10.7627 - 100.0

0 1 2 4 6 8 Miles

This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.

Sources: USGS, National Hurricane Center

Map Printed: June, 2016

Wildfire Vulnerability

Population-at-Risk

The population–at-risk from wildfires was calculated using the small area data to determine the population the high risk wildfire areas within each County. This analysis can help to identify, categorize and prioritize those communities where tactical analyses and community interaction may be necessary to reduce risk from wildfire.

The estimates for the population-at-risk for the Wildland Interface within each county for 2015 and 2020 are presented on Table 16.

Table 16: Population-at-Risk from Wildfire, 2015 – 2020

County	Site Built Population 2015	Mobile / Manufactured Home Population 2015	Site Built Population 2020	Mobile / Manufactured Home Population 2020
Charlotte	51,953	5,665	54,647	5,954
Collier	103,324	7,561	114,137	8,384
Glades	633	949	662	1,006
Hendry	3,007	1,049	3,109	1,083
Lee	112,948	15,644	127,892	17,783
Sarasota	43,174	2,908	46,058	3,102

Source: Florida Forest Service, Southwest Florida Regional Council

B. County Critical Facilities Vulnerability Assessment

As indicated previously, the Critical Facility Inventory (CFI) includes a Vulnerability Assessment from (1) Hurricanes and Tropical Storms, (2) evacuation zones and (3) Flood zones and (4) Wildfire risk. This assessment can be found in each County appendix to this document.