Florida Statewide Regional Evacuation Study Program

Evacuation Transportation Analysis

Volume 4-5

Florida Division of Emergency Management

Withlacoochee Regional Planning Council

Withlacoochee Region

2015

Includes Hurricane Evacuation Study

Statewide Regional Evacuation Study Program

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EVACUATION TRANSPORTATION ANALYSIS

VOLUME 4-5

WITHLACOOCHEE REGION

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Withlacoochee Regional Planning Council
Florida Division of Emergency Management

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August 2015

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EXECUTIVE SUMMARY

The evacuation transportation analysis discussed in this volume documents the methodology, analysis, and results of the transportation component of the Statewide Regional Evacuation Study Program (SRESP). Among the many analyses required for the SRESP study, transportation analysis is probably one of the most important components in the process. By bringing together storm intensity, transportation network, shelters, and evacuation population, transportation analysis explicitly links people's behavioral responses to the regional evacuation infrastructure and helps formulate effective and responsive evacuation policy options. Due to the complex calculations involved and numerous evacuation scenarios that need to be evaluated, the best way to conduct the transportation analysis is through the use of computerized transportation simulation programs, or transportation models.

A. Background and Purpose

Over the years, different planning agencies have used different modeling approaches with varying degrees of complexity and mixed success. Some have used full-blown conventional transportation models such as the standard Florida model FSUTMS; others have used a combination of a simplified conventional model and a spreadsheet program, such as the Abbreviated Transportation Model (ATM). These models have different data requirements, use different behavioral assumptions, employ different traffic assignment algorithms, and produce traffic analysis results with different levels of detail and accuracy. These differences make it difficult for planning agencies to share information and data with each other. They also may produce undesirable conditions for staff training and knowledge sharing.

One of the objectives of the SRESP is to create consistent and integrated regional evacuation data and mapping, and by doing so, to facilitate knowledge sharing between state, regional, county, and local partners. To achieve this objective, it is important for all Regional Planning Councils to adopt the same data format and to use the same modeling methodologies for their transportation analyses. The primary purpose of the transportation component of the SRESP is to develop a unified evacuation transportation modeling framework that can be implemented with the data collected by the Regional Planning Councils.

B. Study Area

The study area for this analysis includes the five county Withlacoochee Regional Planning Council area. The transportation modeling methodology includes some processes that are performed at the statewide level, in order to determine the impacts of evacuations from other regions impacting the evacuation clearance times in the Withlacoochee region. While the impact of other regions is included in the Withlacoochee analysis, it is important to note that the results of the transportation analysis presented in this document are only reported for the five counties included in the Withlacoochee RPC. Transportation analysis results for other regions and counties are reported in the corresponding Volume 4 report for those regions.

C. Input and Coordination

The development of the transportation methodology and framework required coordination and input from all eleven regional planning councils in Florida, along with the Division of Emergency Management, Department of Transportation, Department of Economic Opportunity, and local county emergency management teams. At the statewide level, the transportation consultant, CDM Smith Associates, participated in SRESP Work Group Meetings which were typically held on a monthly basis to discuss the development of the transportation methodology and receive feedback and input from the State agencies and RPCs.

At the local and regional level, CDM Smith Associates conducted a series of four regional meetings to coordinate with and receive input from local county emergency management, the regional planning council, local transportation planning agencies and groups, as well as other interested agencies.

D. Study Comparisons

It is important to note that this study contains significant updates and revisions in comparison to the 2010 SRESP study for the Withlacoochee region. These revisions include updates to population projections based on the 2010 census, modifications to the roadway network due to recently completed and planned construction projects, and changes to the location and size of available shelters. These revisions have significant impacts on evacuating vehicle behavior for the region and caused changes to the calculated clearance times in each county. These updates and revisions make comparisons to the previous 2010 study difficult.

E. Evacuation Modeling Methodology and Framework

The evacuation modeling methodology and framework was developed during 2008 and 2009 in coordination with all eleven Regional Planning Councils and the Division of Emergency Management. The methodology used in the Withlacoochee RPC Evacuation Transportation Analysis is identical to the methodology used for all eleven Regional Planning Councils and includes the following components:

- **Behavioral Assumptions** – In 2008, the Statewide Regional Evacuation Study Program (SRESP) commissioned a survey of Florida residents. The purpose of this survey was to develop an understanding of the behavior of individuals when faced with the prospect of an impending evacuation. These data were used to develop a set of "planning assumptions" that describe the way people respond to an order to evacuate and are an important input to the SRESP Evacuation Model. The behavioral data provides insights into how people respond to the changing conditions leading up to and during an evacuation. The primary application of the survey data was to help anticipate how people would respond with respect to five behaviors:

    - How many people would evacuate?
    - When they would leave?
    - What type of refuge they would seek?
    - Where they would travel for refuge?
    - How many vehicles would they use?

These evacuation behaviors are distinguished based on several descriptive variables as listed below:

- Type of dwelling unit (site-built home versus mobile home);
- The evacuation zone in which the evacuee reside; and,
- The intensity of the evacuation that has been ordered.

- **Zone System and Highway Network** - The SRESP evacuation model relies upon data that covers the entire State of Florida as well as areas covering the States of Georgia, Alabama, Mississippi, South Carolina, North Carolina, and Tennessee. While the primary focus of the model is with evacuation behavior within Florida, areas outside of the state had to be considered in order to allow a more precise routing of evacuation traffic. This allows the model to measure the flow of traffic across the state line if needed.

  The data included in this system contain the demographic information crucial to modeling evacuation traffic. The demographic information is labeled as "small area data". These data provide population and dwelling unit information that will identify where the individuals in the region reside. The planning assumptions developed from the behavioral analysis conducted for this study were applied to these demographic data. The result is a set of evacuation trips generated by the evacuation model. The number of these trips will vary depending on the hazard conditions that prompt the evacuation. Small area data geographies were aggregated into larger units known as Traffic Evacuation Zones (TEZ). These TEZ form the basic unit of analysis in the evacuation model. The final TEZ system for the State of Florida has 17,328 zones. This number provides sufficient detail to accurately accommodate the assignment of evacuation trips onto an evacuation network.

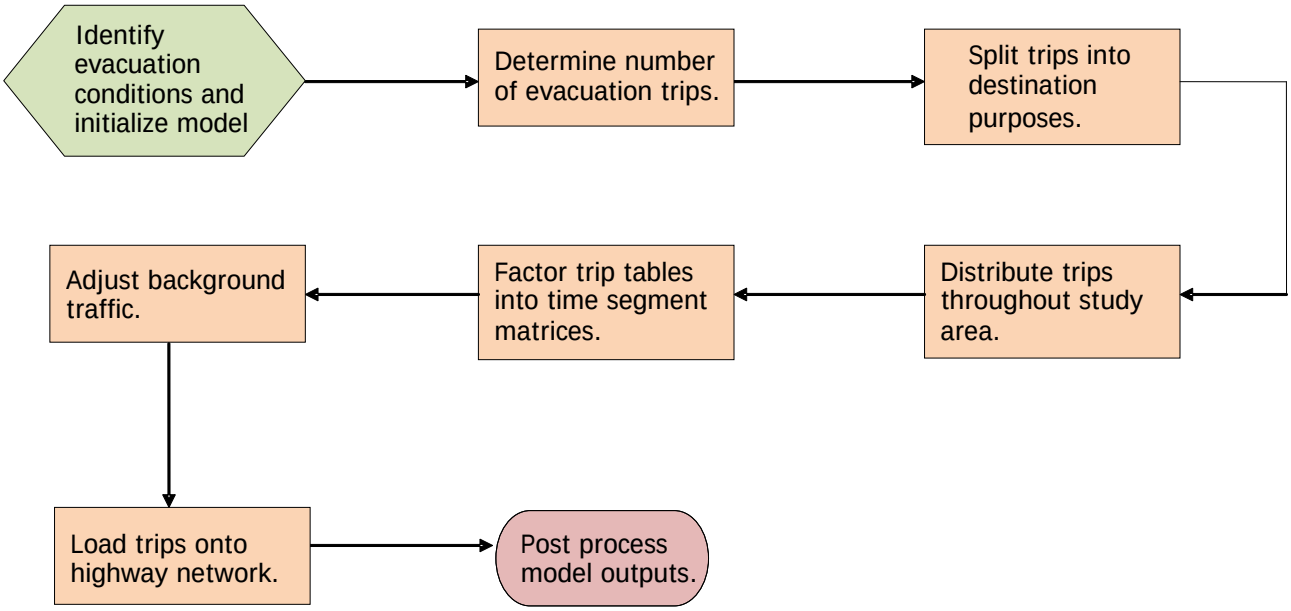
- **Background Traffic** - The traffic that consumes the roadway capacity of a transportation system during an evacuation can be divided into two groups. The first group is the evacuation traffic itself. Once the evacuation demand is determined, this information is converted into a number of vehicles evacuating over time. These evacuation trips are then placed on a representation of the highway network by a model. The model determines the speed at which these trips can move and proceeds to move the evacuation trips accordingly. The result is a set of clearance times.

  The second group of traffic is known as background traffic. Background traffic, as its name implies, is not the primary focus of an evacuation transportation analysis and is accounted for primarily to impede the movement of evacuation trips through the network. These trips represent individuals going about their daily business mostly unconcerned with the evacuation event. For the most part, background traffic represents trips that are relatively insensitive to an order to evacuate and are thus said to be occurring in the "background." Even though background traffic is relatively insensitive to evacuation orders, it is important to account for background traffic since it can have a dramatic impact on available roadway capacity. This in turn can severely affect evacuation clearance times.

- **Evacuation Traffic** - The model flow for the evacuation model is divided into a total of eight modeling steps. The following eight steps are represented graphically in the flowchart in Figure ES-1:

1. Identify evacuation conditions and initialize model;
2. Determine number of evacuation trips;
3. Split trips into destination purposes;
4. Distribute trips throughout study area;
5. Factor trip tables into time segment matrices;
6. Adjust background traffic;
7. Load trips onto highway network; and,
8. Post process model outputs.

Figure ES-1 - General Model Flow



- **Dynamic Traffic Assignment** - Dynamic traffic assignment (DTA) was utilized in the evacuation methodology because it is sensitive to individual time increments. DTA works by assigning a certain number of vehicles to the highway network in a given interval of time. The model then tracks the progress of these trips through the network over the interval. Another set of vehicles is assigned during the following time interval. The model then tracks the progress of these trips through the network along with the progress of the trips loaded in the previous time interval. As vehicles begin to arrive at the same segments of roadway, they interact with one another to create congestion. When vehicles that were loaded to the network in subsequent intervals of time arrive at the congested links, they contribute to the congestion as well. This results in a slowing down of the traffic and eventually spill-backs and queuing delays. It is this time dependent feature of DTA that makes it well suited to evacuation modeling. By dynamically adjusting the travel times and speeds of the vehicles moving through the network as they respond to congestion the model is able to do the following:

    - The evacuation model is able to estimate the critical clearance time statistics needed for this study;

- The model takes into account the impact of compounded congestion from multiple congestion points;
- The model is able to adjust the routing of traffic throughout the network as a function of congestion as it occurs throughout the evacuation; and,
- The model is capable of adjusting its capacities from time segment to time segment, making it possible to represent such phenomena as reverse lane operations and background traffic.

- **Prototype Model Development** - CDM Smith Associates developed a prototype model to test the modeling methodology used to calculate evacuation clearance times. The prototype model demonstrated the viability of the methodology developed for this study. This included the use of dynamic traffic assignment, background traffic curves, regional sub-area trip balancing, the use of survey rates, the use of 100% participation rates, response curves, and county-by-county phasing of evacuations. The prototype model served as the backbone for all regional evacuation models that have been developed for this study. The models implemented for each RPC use a structure similar to the prototype with identical methodology.

F. Regional Model Implementation

The regional model developed for the Withlacoochee Region used a series of input data provided by the RPC, including the following:

- **Regional Model Network** - The regional model network consists of the RPC designated evacuation routes as well as a supporting roadway network that facilitates movement of evacuation traffic. The 2005 Florida Department of Transportation (FDOT) Statewide Model Network was used as a basis for developing the regional model network, while the evacuation routes were obtained from the Withlacoochee RPC. The RPC relied on the emergency managers of its constituent counties to provide it with information on which roads were to be included as evacuation routes. The resulting model network was updated to 2010 conditions and is referred to as the base model network. **Figure ES-2** identifies the model network and evacuation routes for the WRPC. County level details of the regional model network are provided in the Volume 5-5 report. The regional model network for the Withlacoochee region includes key roadways within the five county region, including I-75, Florida's Turnpike, Suncoast Parkway, US 19, US 98, US 27, US 301, US 19, US 41, SR 24, SR 40, SR 44, and SR 50.

- **Regional Zone System** - The regional zone system is based on Traffic Evacuation Zones (TEZ) and contains the regional demographic information, which includes housing and population data that is essential to modeling evacuation traffic. There are 363 TEZs located within the five county Withlacoochee region, as illustrated in **Figure ES-3**. In the Withlacoochee region, Marion County has the largest number of TEZs with 151, and Hernando follows with 71 TEZs. Sumter County has 60 TEZs, while Citrus and Levy Counties have the lowest number of TEZs within the RPC with 55 and 26 zones, respectively. The larger number of TEZs generally reflect counties with denser urban structure and higher population densities.

- **Regional Demographic Characteristics** - Demographic data were developed for the following years: 2010, 2015, and 2020. A snapshot of the key demographic data for

each county in the Withlacoochee RPC for 2010, 2015 and 2020 is summarized in **Table ES-1**. The tables list the number of occupied dwelling units for site built homes, the permanent population in site-built homes, as well as the number of occupied dwelling units for mobile homes and the permanent population in mobile homes. The mobile home category includes RVs and boats and the permanent population in those housing options. The demographic characteristics summary also includes hotels and motels because many of these units are in vulnerable areas, and the proportion of seasonal units and 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.

Figure ES-1 Withlacoochee Regional Model Network

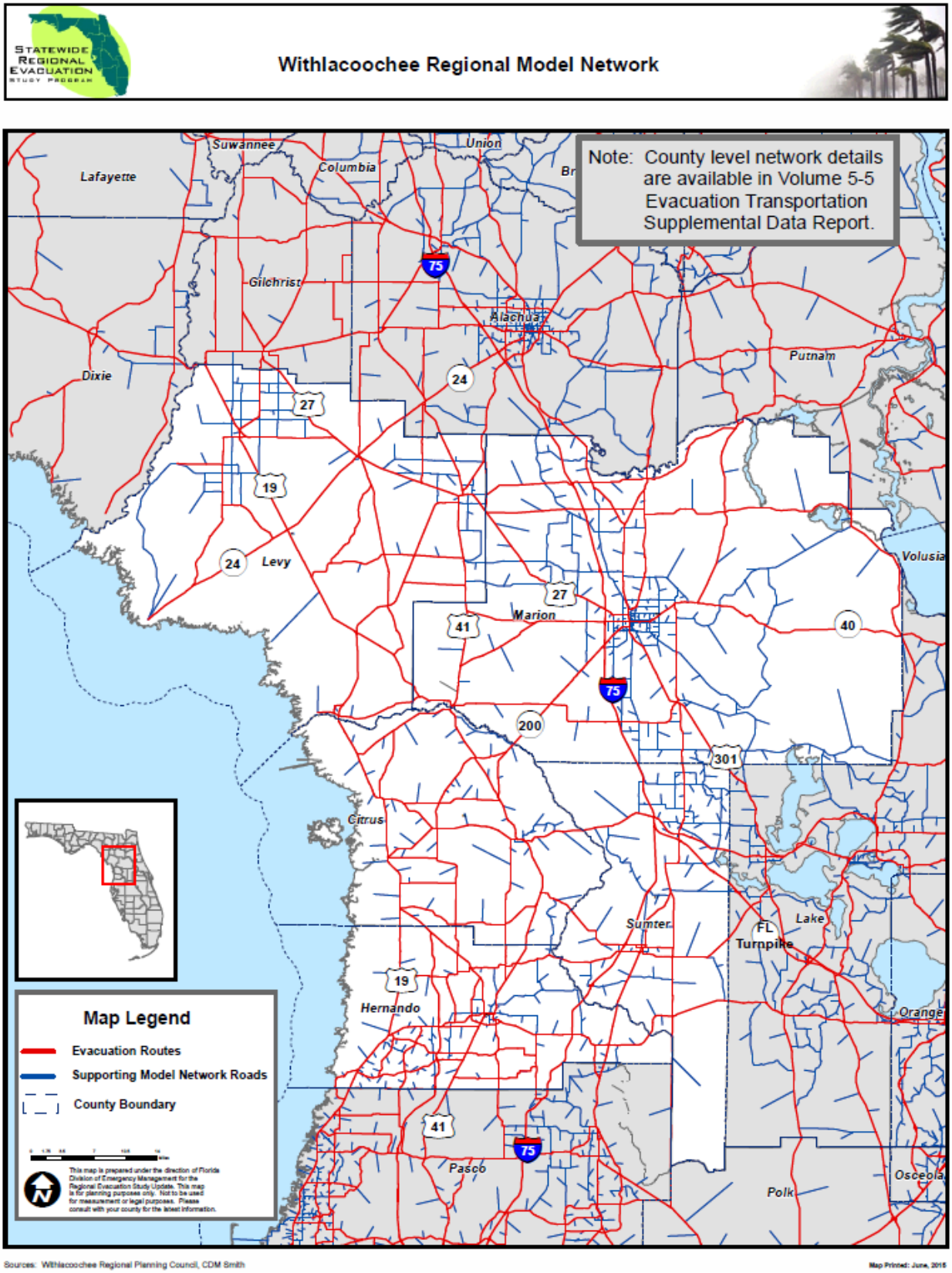
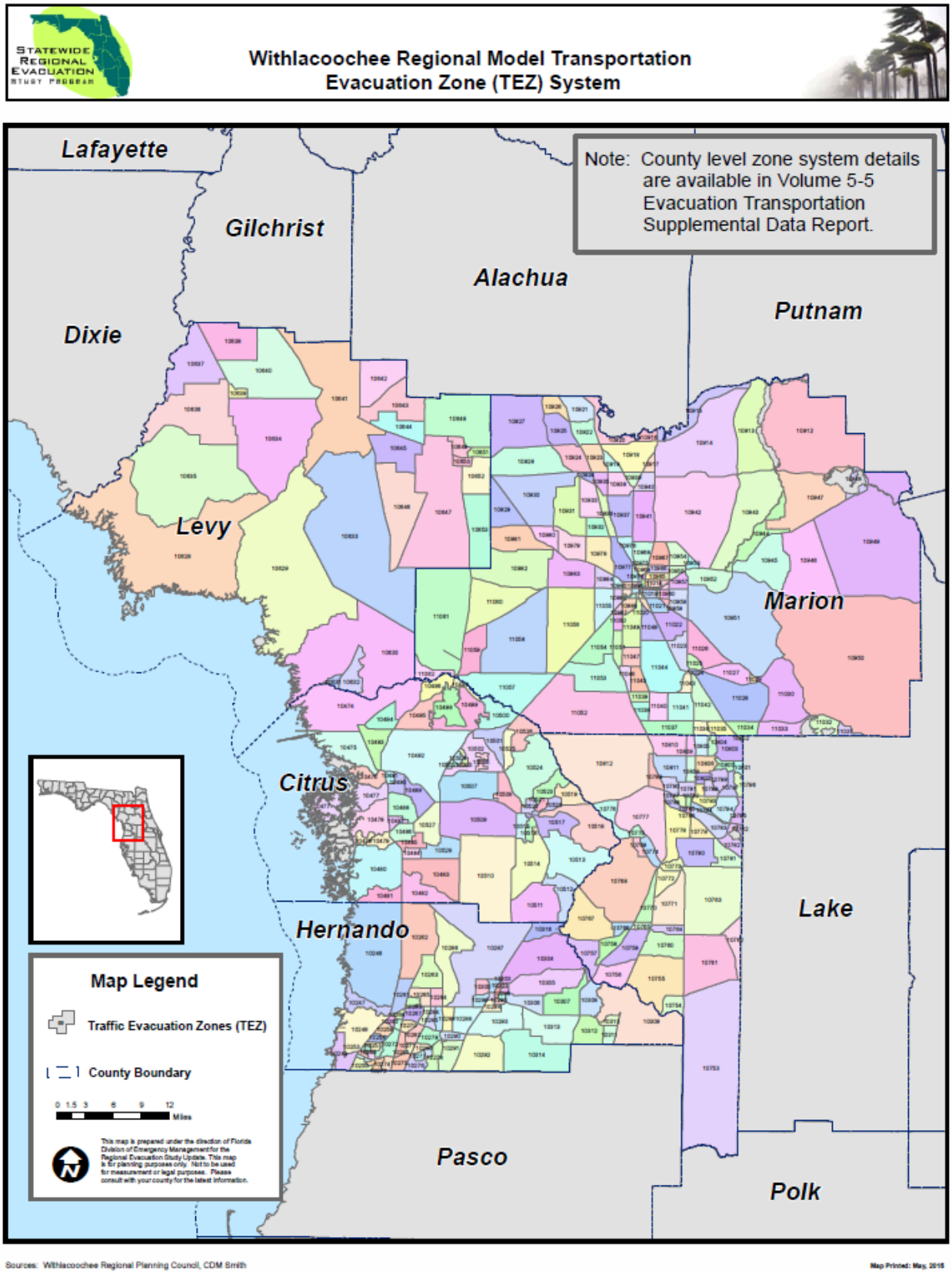


Figure ES-2 Withlacoochee Regional Model Traffic Evacuation Zone Map



Marion County has the largest population in the region during all three time periods. The county is expected to reach approximately 400,000 people by 2020. Hernando County has the second largest population in the region is forecasted to have almost 200,000 people by 2020. Citrus is projected to have the third largest population in the region, exceeding 150,000 by 2020. Sumter County falls just below Citrus at almost 120,000. Of all the counties, Levy County has the smallest population for all three time periods and may reach more than 43,000 people by 2020.

Marion County has the highest number of mobile homes followed by Citrus and Hernando. Levy County has the smallest number of mobile homes in the Withlacoochee region, but these homes, in fact, make up 46% of the total homes in the county.

Table ES-1 – Withlacoochee Demographic Characteristic Summary

County	Characteristic	Year		
		2010	2015	2020
Citrus	Occupied site-built homes	48,570	50,073	53,715
	Population in site-built homes	104,237	107,457	115,243
	Occupied mobile homes	14,734	15,186	16,296
	Population in mobile homes	34,748	35,824	38,474
	Hotel/motel units	2,155	2,185	2,218
Hernando	Occupied site-built homes	59,704	63,012	69,461
	Population in site-built homes	145,546	153,599	169,294
	Occupied mobile homes	12,041	12,707	14,006
	Population in mobile homes	25,404	26,822	29,591
	Hotel/motel units	3,090	3,102	3,116
Levy	Occupied site-built homes	8,823	9,020	9,595
	Population in site-built homes	21,053	21,520	22,890
	Occupied mobile homes	7,581	7,753	8,243
	Population in mobile homes	19,113	19,547	20,786
	Hotel/motel units	944	950	957
Marion	Occupied site-built homes	108,660	114,869	126,249
	Population in site-built homes	256,001	270,594	297,420
	Occupied mobile homes	29,066	30,730	33,769
	Population in mobile homes	67,058	70,901	77,919
	Hotel/motel units	12,327	12,627	12,936
Sumter	Occupied site-built homes	34,402	40,875	48,748
	Population in site-built homes	70,026	83,212	99,236
	Occupied mobile homes	6,959	8,271	9,867
	Population in mobile homes	14,442	17,160	20,475
	Hotel/motel units	1,748	1,784	1,819

Source: Withlacoochee Regional Planning Council

- **Planned Roadway Improvements** - To correspond to the three different sets of demographic data, three model networks were ultimately developed. The base 2010 network and two future year networks to correspond to the 2015 demographic data and the 2020 demographic data. The 2010 base model network was updated to reflect roadway capacity improvement projects completed between 2010 and 2015 to create the 2015 network. The 2015 network was then updated to reflect planned roadway capacity improvement projects expected to be implemented between 2016 and 2020 to create the 2020 network.

  The planned roadway improvements that were added to the network generally include only capacity improvement projects such as additional through lanes. **Table ES-2** identifies capacity improvement projects completed between 2010 and 2015 that were included in the 2015 network. Likewise, **Table ES-3** identifies capacity improvement projects planned for implementation between 2016 and 2020. The tables identify each roadway that will be improved as well as the extent of the improvement. For example, by the end of 2015 in Citrus County, CR 486 from SR 44 to Ottawa Ave will be widened to 4 lanes.

  It is important to note that Table ES-2 is not intended to be all inclusive of every transportation improvement project completed within the region. The table only identifies key capacity improvement projects that impact the evacuation model network and are anticipated to have an impact on evacuation clearance times.

- **Behavioral Assumptions** - For the Withlacoochee Region, three of the counties within the region have evacuation zones corresponding to five categories of storm surge. Evacuation rates for site-built homes and mobile/manufactured homes are provided by county and summarized in **Figure ES-4** through **Figure ES-9**. Other rates, such as out of county trip rates, vehicle use rates, public shelter use rates, friend/relative refuge use rates, hotel/motel refuge use rates, and other refuge use rates, are detailed by county, storm threat, and evacuation zone in Volume 5-5.

  A review of the evacuation rates for the Withlacoochee region illustrates that evacuation participation rates increase as the evacuation level increases, and participation rates for persons living in mobile/manufactured homes are generally higher than for persons living in site-built homes. It should be noted that a certain percentage of the population evacuates, even when they are not living in an area that is ordered to evacuate. These people are commonly referred to as shadow evacuees. Shadow evacuation rates are also included in Figure ES-4 through Figure ES-9.

- **Shelters** - In order for the transportation model to accurately assign public shelter trips to the correct location, a complete list of available public shelters needs to be available. The shelters were categorized as either primary or other, with primary indicating that the shelter is compliant with American Red Cross standards for a shelter and other indicating all other shelters. In the five county region there are a total of 124 shelters, including 27 in Citrus County, 41 in Marion County, 20 in Hernando County, 22 in Sumter County, and 14 in Levy County. All together, the 124 shelters located within the five county region can host over 29,000 persons during an evacuation event. Detailed lists of the available public shelters by county are included in Volume 5-5.

Table ES-2 – Withlacoochee Roadway Improvements, 2015

County	Roadway	From	To	Number of Lanes
Citrus	CR 486	SR 44	Ottawa Ave	4
	US 19 (SR 55)	W Cornflower Dr	W Foss Grove Path	6
Hernando	SR 50 (Cortez Blvd)	US 19 (SR 55)	W of Mariner Blvd	6
	I-75 (SR 93)	N of SR 50	Hernando/Sumter County Lines	6
	I-75 (SR 93)	S of US 98/SR 50/Cortez	N of US 98/SR 50/Cortez	6
	I-75 (SR 93)	Pasco/Hernando County Lines	S of US 98/SR 50/Cortez	6
	SR 50 (Cortez Blvd)	W of Mariner Blvd	SR 589 (Suncoast Pwy)	6
Marion	SW 42nd St	Overpass from SR 200	SW 27th Ave	2
	SR 40	CR 328	SW 80th Ave	4
	SR 35 (Baseline Rd)	S CR 464 (Maricamp Rd)	SR 40	4
	SR 500 (US 27)	N of CR 464B	N of CR 225A	4
Sumter	SR 35 (US 301)	N of CR 466A	CR 214	4
	CR 468	CR 466A	CR 466	4
	Turnpike at CR 468			N/A
	I-75/Turnpike Interchange (SR 44)			8
	I-75 (SR 93)	N of SR 50	Hernando/Sumter County Lines	6

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Withlacoochee Regional Planning Council
Note: Projects included in this table are roadway improvement projects completed between 2010 and 2015 on roadways that are included in the regional transportation model network. Only projects which added roadway capacity, such as additional through lanes, were included. The list is not intended to be all inclusive of every transportation improvement project completed within the region. A list of historical projects completed during the last five years was included in this report because the base regional network developed for the study, along with the base demographic data, is for the year 2010.

Table ES-1 Withlacoochee Planned Roadway Improvements, 2020

County	Roadway	From	To	Number of Lanes
Citrus	US 19 (SR 55)	W Green Acres St	W Jump Ct	6
	US 19 (SR 55)	W Jump Ct	W Fort Island Trl	6
Hernando	Suncoast Pkwy	US 98	Hernando/Citrus County Lines	4
	SR 50	Lockhart Rd	E of Remington Rd	6
Sumter	I-75	CR 470	SR 91 (Turnpike)	6
	I-75	Hernando County Line	CR 470	6

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Withlacoochee Regional Planning Council
Note: Projects included in this table are roadway improvement projects planned for completion between 2016 and 2020 on roadways that are included in the regional transportation model network. Only projects which are planned to add roadway capacity, such as additional through lanes, were included. The list is not intended to be all inclusive of every transportation improvement project planned for completion within the region.

Figure ES-3 Evacuation Participation Rates: Citrus County - Site-Built Homes

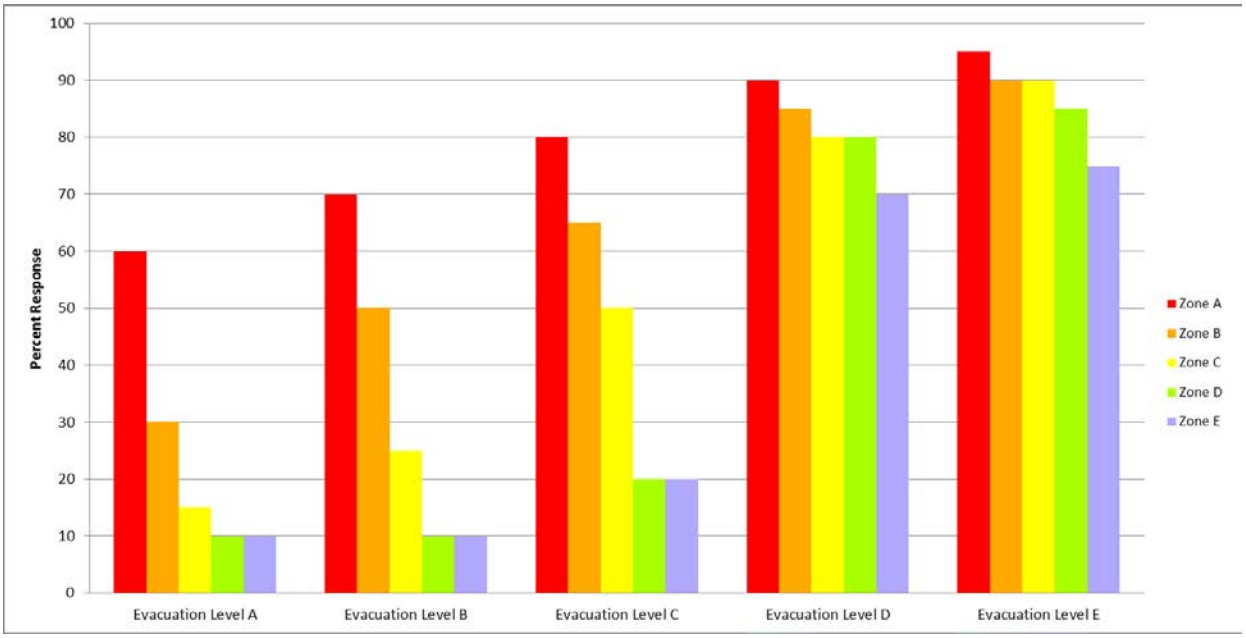


Figure ES-4 Evacuation Participation Rates: Citrus County - Mobile Homes

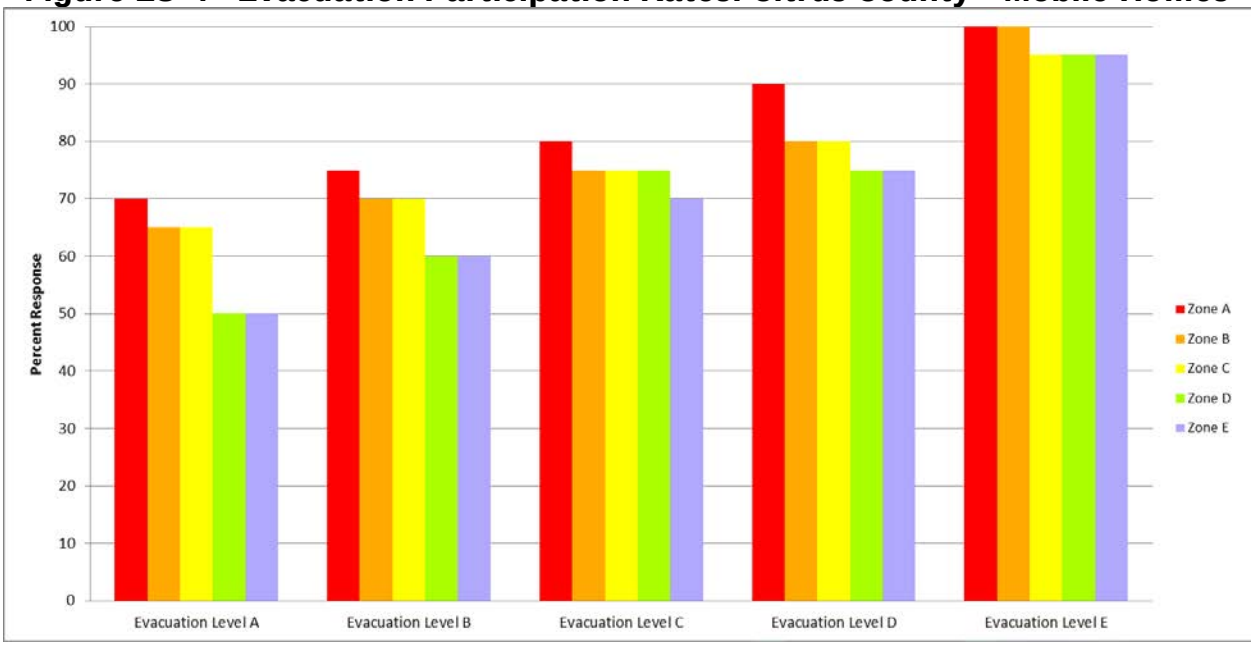


Figure ES-5 Evacuation Participation Rates: Hernando County - Site Built Homes

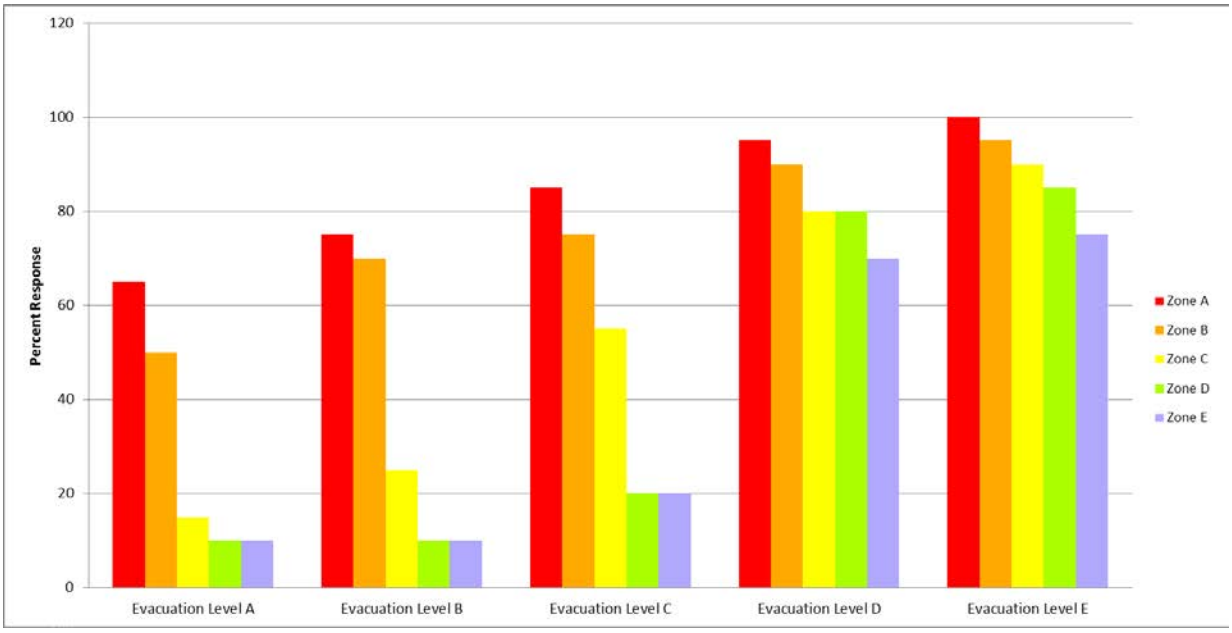


Figure ES-6 Evacuation Participation Rates: Hernando County - Mobile Homes

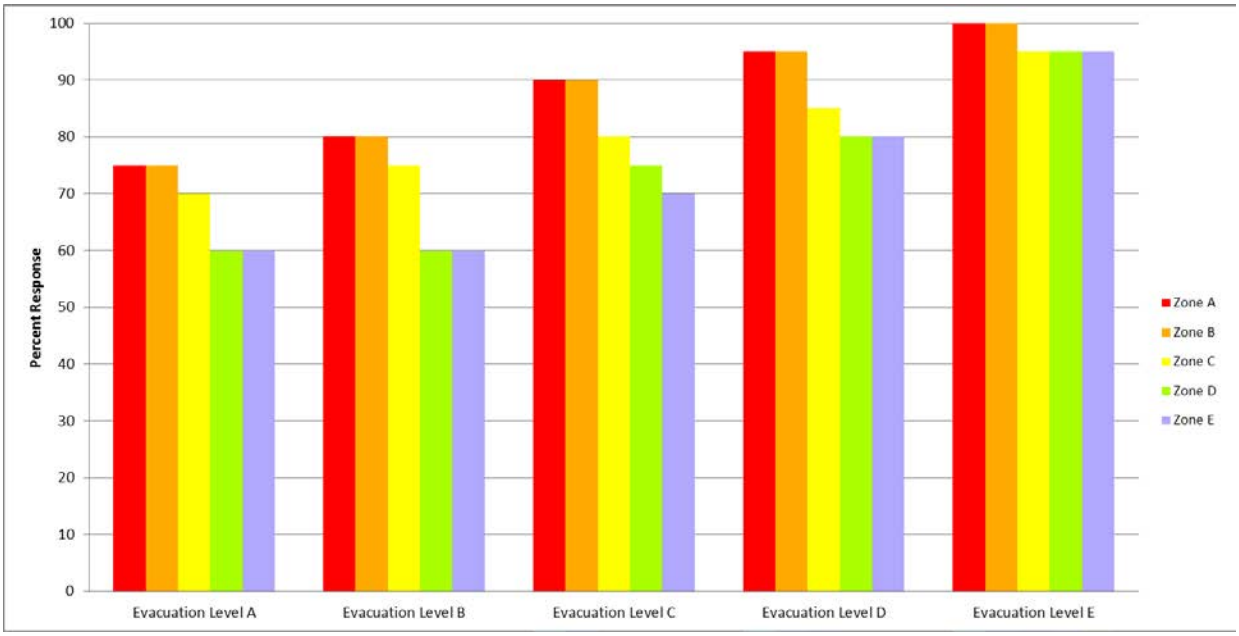


Figure ES-7 Evacuation Participation Rates: Levy County - Site Built Homes

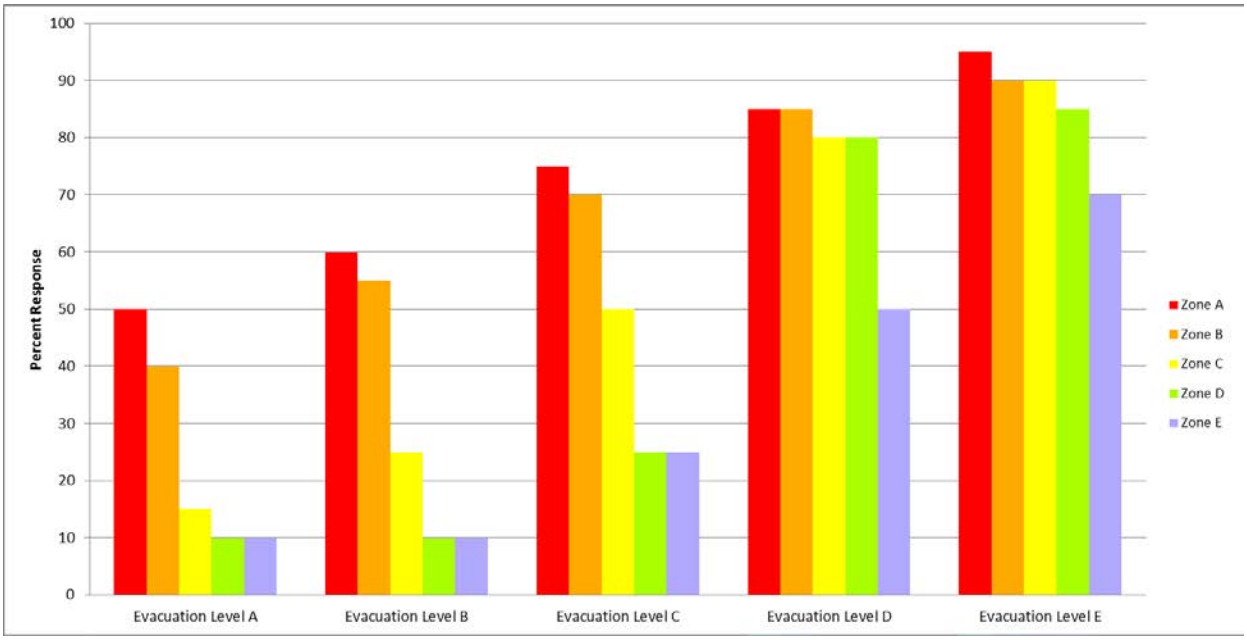
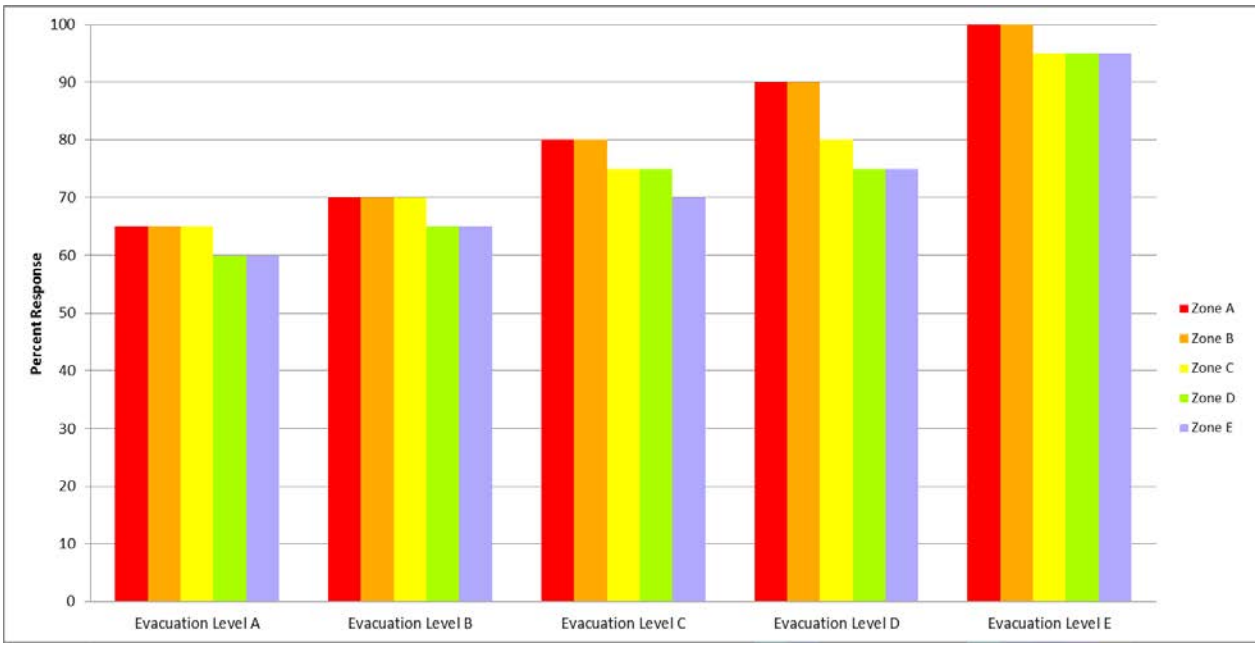


Figure ES-8 Evacuation Participation Rates: Levy County - Mobile Homes



- **Evacuation Zones** - The final input variable that is needed to complete the transportation evacuation model is the delineation of evacuation zones for all coastal counties. Local county emergency managers have the responsibility of identifying and defining evacuation zones for their county. Citrus, Hernando, and Levy Counties within the Withlacoochee region had established their evacuation zones based on the results of the new data and information collected as part of the SRESP in 2010. County level evacuation zones are included in Volume 5-5.

G. TIME User Interface

CDM Smith Associates developed the Transportation Interface for Modeling Evacuations (TIME) to make it easier for RPC staff and transportation planners to use the model and implement the evacuation methodology. The TIME interface is based on an ArcGIS platform and is essentially a condensed transportation model, which provides a user friendly means of modifying input variables that would change the clearance times for various evacuation scenarios.

The evacuation model variables include a set of distinguishing characteristics that could apply to evacuation scenarios as selection criteria. These following variables may be selected using the TIME interface and allow the user to retrieve the best results from various evacuation alternatives:

- Analysis time period;
- Highway network;
- Behavioral response;
- One-way evacuation operations;
- University population;
- Tourist occupancy rates;
- Shelters;
- Counties evacuating;
- Evacuation level;
- Response curve hours; and,
- Evacuation Phasing.

H. Vulnerable Population

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 vulnerable population for the Withlacoochee Region for 2015 is identified in **Table ES-4**, summarized by evacuation zone and split between site-built homes and mobile/manufactured homes. Vulnerable population for 2020 is summarized in **Table ES-5**.

Table ES-2 Vulnerable Population in the Withlacoochee Region for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Citrus County					
Site-built Homes	13,058	7,446	1,309	4,131	2,234
Mobile/Manuf. Homes	5,726	4,815	959	1,139	916
TOTAL	18,784	12,261	2,268	5,271	3,149
Hernando County					
Site-built Homes	4,235	1,836	3,097	8,001	32,410
Mobile/Manuf. Homes	511	136	316	1,224	1,906
TOTAL	4,746	1,972	3,413	9,225	34,315
Levy County					
Site-built Homes	1,493	1,111	446	320	1,398
Mobile/Manuf. Homes	1,031	1,047	701	382	1,616
TOTAL	2,523	2,158	1,147	702	3,014

Note: Vulnerable population determined using SRESP behavioral 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.

Table ES-3 Vulnerable Population in the Withlacoochee Region for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Citrus County					
Site-built Homes	14,009	7,987	1,403	4,429	2,393
Mobile/Manuf. Homes	6,141	5,168	1,030	1,226	986
TOTAL	20,150	13,155	2,433	5,655	3,379
Hernando County					
Site-built Homes	4,668	2,024	3,415	8,819	35,721
Mobile/Manuf. Homes	563	149	347	1,349	2,103
TOTAL	5,231	2,174	3,761	10,168	37,824
Levy County					
Site-built Homes	1,589	1,181	475	341	1,488
Mobile/Manuf. Homes	1,095	1,113	745	405	1,717
TOTAL	2,684	2,294	1,219	746	3,205

Note: Vulnerable population determined using SRESP behavioral 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.

In addition, based again on the demographic data, behavioral assumptions, and evacuation zones, the planned destinations of vulnerable population in each county could be determined by evacuation level. Destinations include friends and family, hotel/motel, public shelter, and other locations. Vulnerable population destinations for the Withlacoochee Region are identified in **Table ES-6** for 2015 and in **Table ES-7** for 2020.

The vulnerable shadow population is provided in **Table ES-8** for both 2015 and 2020. The vulnerable shadow population was determined using the behavioral assumptions for evacuating shadow population and is based on evacuation level (storm category), not evacuation zone.

Table ES-4 Vulnerable Population by Destination for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Citrus County					
To Friends and Family	11,923	7,729	1,426	3,369	2,001
To Hotel/ Motel	2,531	1,598	292	791	472
To Public Shelter	1,226	854	201	387	224
To Other Destination	3,104	2,080	349	724	451
Hernando County					
To Friends and Family	3,085	1,282	2,218	5,996	22,305
To Hotel/ Motel	712	296	512	1,384	5,147
To Public Shelter	288	112	279	762	2,783
To Other Destination	661	282	403	1,082	4,080
Levy County					
To Friends and Family	1,336	1,134	596	367	1,577
To Hotel/ Motel	430	376	207	124	533
To Public Shelter	178	160	150	89	382
To Other Destination	579	487	194	121	522

Note: Vulnerable population destinations determined using SRESP behavioral 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.

Table ES-5 Vulnerable Population by Destination for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Citrus County					
To Friends and Family	12,790	8,292	1,530	3,614	2,147
To Hotel/ Motel	2,715	1,715	313	848	507
To Public Shelter	1,315	916	215	416	241
To Other Destination	3,330	2,232	374	777	484
Hernando County					
To Friends and Family	3,400	1,413	2,445	6,609	24,586
To Hotel/ Motel	785	326	564	1,525	5,674
To Public Shelter	318	124	308	840	3,068
To Other Destination	728	311	444	1,193	4,497
Levy County					
To Friends and Family	1,422	1,206	633	390	1,677
To Hotel/ Motel	457	400	220	132	567
To Public Shelter	189	170	159	95	406
To Other Destination	616	518	207	129	555

Note: Vulnerable population destinations determined using SRESP behavioral 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.

Table ES-6 Vulnerable Shadow Evacuation Population

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2015					
Citrus County	42,489	35,806	39,118	46,416	51,889
Hernando County	42,346	41,868	50,012	73,954	60,351
Levy County	21,218	19,891	20,174	21,741	21,976
Marion County	111,434	124,958	138,482	152,006	152,006
Sumter County	29,617	33,772	37,927	42,081	46,236
2020					
Citrus County	45,569	38,383	41,935	49,751	55,616
Hernando County	46,709	46,164	55,148	81,537	66,495
Levy County	22,522	21,103	21,406	23,072	23,320
Marion County	122,448	137,312	152,176	167,040	167,040
Sumter County	35,328	40,282	45,235	50,189	55,143

Note: Vulnerable shadow population determined using SRESP behavioral data and county provided evacuation zones.

I. Evacuation Model Scenarios

There are literally thousands of possible combinations of variables that can be applied using the evacuation transportation model, which will result in thousands of possible outcomes. For the purposes of this analysis, two distinct sets of analyses were conducted using the SRESP evacuation transportation model, including one set of analysis for growth management purposes and one set of analysis for emergency management purposes. The two sets of analysis include the following:

- **Base Scenarios** – The base scenarios were developed to estimate a series of worst case scenarios and are identical for all eleven RPCs across the State. These scenarios assume 100 percent of the vulnerable population evacuates and includes impacts from counties outside of the RPC area. These scenarios are generally designed for growth management purposes, in order to ensure that all residents that choose to evacuate during an event are able to do so. The base scenarios for the North Central region are identified in **Table ES-9**; and,

- **Operational Scenarios** – The operational scenarios were developed by the RPCs in coordination with local county emergency managers and are designed to provide important information to emergency management personnel to plan for different storm events. These scenarios are different from region to region and vary for each evacuation level. The operational scenarios for the North Central region are identified in **Table ES-10**.

Because of the numerous possible combinations of variables that can be applied in the model, the evacuation transportation model is available for use through the Withlacoochee RPC to continue testing combinations of options and provide additional information to emergency managers.

J. Clearance Time Results

Each of the ten base scenarios and ten operational scenarios were modeled for the Withlacoochee Region using the regional evacuation model. Results were derived from the model to summarize the evacuating population, evacuating vehicles, clearance times, and critical congested roadways. Detailed results are discussed in Chapter IV. Clearance times are presented in this executive summary since the determination of clearance time is one of the most important outcomes from the evacuation transportation analysis.

Calculated clearance times are used by county emergency managers as one input to determine when to recommend an evacuation order. This calculation can include the population-at-risk, shadow evacuees, as well as evacuees from other counties anticipated to pass through the county. Clearance time is developed to include the time required for evacuees to secure their homes and prepare to leave, the time spent by all vehicles traveling along the evacuation route network, and the additional time spent on the road caused by traffic and road congestion. Clearance time does not relate to the time any one vehicle spends traveling along the evacuation route network, nor does it guarantee vehicles will safely reach their destination once outside the County. The four clearance times that are calculated as part of the evacuation transportation analysis include the following:

Table ES-7 Base Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C 2015	Scenario 4 Level D 2015	Scenario 5 Level E 2015
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco
	Scenario 6 Level A 2020	**Scenario 7 Level B 2020**	**Scenario 8 Level C 2020**	**Scenario 9 Level D 2020**	**Scenario 10 Level E 2020**
Demographic Data	2020	2020	2020	2020	2020
Highway Network	2020	2020	2020	2020	2020
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco

Table ES-8 Operational Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C 2015	Scenario 4 Level D 2015	Scenario 5 Level E 2015
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	None	None	None
University Population	Default	Default	Default	Default	Default
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	All	All	All
Response Curve	6-hour, except Marion and Sumter with 12-hour	12-hour	12-hour, except Dixie, Hernando, Citrus, at 6-hour and Levy, Manatee, Pasco, Pinellas at 9-hour	12-hour	6-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Citrus Hernando Levy Marion Sumter Hillsborough Manatee Pasco Pinellas	Citrus Hernando Levy Marion Sumter Hillsborough (C) Manatee (C) Pasco (C) Pinellas (C) Lake Orange Osceola Polk	Citrus Hernando Levy Marion Sumter Manatee (A) Pasco (B) Pinellas (B) Dixie (B) Lake (B) Alachua (B) Gilchrist (B)	Citrus Hernando Levy Marion Sumter Hillsborough Manatee Pasco Pinellas Alachua (B) Lake (B) Polk (B)	Citrus Hernando Levy Marion Sumter Dixie (D) Hillsborough (D) Manatee (B) Pasco (D) Pinellas (D) Alachua (D) Gilchrist (D) Lake (C) Orange (B)
	Scenario 6 Level A 2020	**Scenario 7 Level B 2020**	**Scenario 8 Level C 2020**	**Scenario 9 Level D 2020**	**Scenario 10 Level E 2020**
Demographic Data	2020	2020	2020	2020	2020
Highway Network	2020	2020	2020	2020	2020
One-Way Operations	None	None	None	None	None
University Population	Default	Default	Default	Default	Default
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	All	All	All
Response Curve	6-hour, except Lake, Marion, Orange, Polk, and Sumter at 9-hour	6-hour, except Marion and Sumter at 12-hour	6-hour, except Alachua, Lake, Marion, Polk, and Sumter at 12-hour	12-hour, except Lake, Marion, Orange, Osceola, Polk, and Sumter at 18-hour	12-hour, except Alachua, Gilchrist, Lake, Marion, Polk, and Sumter at 18-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Citrus Hernando Levy Marion Sumter	Citrus Hernando Levy Marion Sumter	Citrus Hernando Levy Marion Sumter	Citrus Hernando Levy Marion Sumter	Citrus Hernando Levy Marion Sumter

	Hillsborough Manatee Pasco Pinellas Lake Orange Polk	Hillsborough Manatee Pasco Pinellas	Hillsborough Manatee Pasco Pinellas Lake (A) Alachua (A) Polk (A)	Hillsborough (E) Manatee (E) Pasco (E) Pinellas (E) Lake (C) Orange (B) Osceola (B) Polk (C)	Dixie Hillsborough Manatee Pasco Pinellas Alachua (D) Gilchrist (D) Lake (C) Polk (C)

- **Clearance Time to Shelter** - he time necessary for all in-County trips to have reached their destination within the County. This does not mean all traffic movement in the County has ended; rather it means that everyone going to a point of safety AND that point is in the County, has reached their shelter. While this is primarily a growth management number, it gives emergency managers information about how long it will take for shelters to fill-up once an evacuation order is given. Key points to remember for clearance time to shelter include:
  - All in-county trips reach their destination within the county; and,
  - This definition does not include any out of county trips.

- **In-County Clearance Time** - The time necessary for all in-County trips to have reached their destination AND all out of county trips have left the Evacuation Zone AND traffic originating from outside the County that passes through the Evacuation Zone has also cleared the Zone. This does not mean all traffic movement in the County has ended; rather it means that everyone going to a point of safety AND that point is in the County, has reached their shelter AND the Evacuation Zone is clear. This gives you vital planning information regarding how long it will take to clear the most vulnerable zones once an evacuation order is given. Key points to remember for in-county clearance time include:
  - All in-county trips reach their destination within the county;
  - All out of county trips exit the evacuation zone, but may still be located in the county; and,
  - This definition does not include out-of-county pass-through trips from adjacent counties, unless they evacuate through an evacuation zone.

- **Out of County Clearance Time** - The time necessary for all in-County trips to have reached their destination AND all out of county trips have left the County AND traffic originating from outside the County that pass through the County has also cleared the County. This does not mean all traffic movement in the County has ended; rather it means that everyone going to a point of safety has reached their shelter or left the County. Key points to remember for out of county clearance time include:
  - The roadway network within the county is clear;
  - All out of county trips exit the county, including out of county pass-through trips from adjacent counties; and,
  - All in-county trips reach their destination.

- **Regional Clearance Time** - he time that is the highest time for any County Clearance time in the designated region. Calculated from last vehicle assigned an external destination exits the region. Key points to remember for regional clearance time include:
  - The roadway network within the RPC is clear;

- All out of county trips exit the RPC, including out of county pass-through trips from adjacent counties;
- All in-county trips reach their destination; and,
- Regional clearance time is equal to the largest out of county clearance time for a given scenario for any of the counties within the RPC, since the out of county clearance time includes out of county pass through trips from adjacent counties.

Calculated clearance times are used by county emergency managers as one input to determine when to recommend an evacuation order. Clearance times for each of the base scenarios are summarized in **Table ES-11** and **ES-12**, while clearance times for each of the operational scenarios are summarized in **Table ES-13** and **Table ES-14.** Clearance time includes several components, including the mobilization time for the evacuating population to prepare for an evacuation (pack supplies and personal belongs, load their vehicle, etc.), the actual time spent traveling on the roadway network, and the delay time caused by traffic congestion.

Base Scenarios

In-county clearance times for the base scenarios range from 12.5 hours in Hernando County for evacuation level A to 30 hours in Citrus County for evacuation level E in 2015. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 12.5 hours for evacuation level A in Sumter and Hernando Counties to 16.5 hours for evacuation level E in Citrus and Sumter Counties in 2015.

In 2020, in-county clearance times for the base scenarios remain consistent, between 12.5 hours for the evacuation level A in Hernando County and 29.5 hours in Levy County for evacuation level E. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 12.5 hours in Hernando and Sumter Counties for evacuation level A, to 16.5 hours in Citrus and Sumter Counties for evacuation level E in 2020.

Out of county clearance times for the 2015 base scenarios range from 15 hours in Levy County for the base evacuation level A scenario to 36 hours in Marion County for the evacuation level E scenario. Out of county clearance times for the 2020 base scenarios range from 15 hours in Levy County for the base evacuation level A scenario to 39 hours in Marion County for the evacuation level E scenario.

Regional clearance time for the five county WRPC region ranges from 22 hours to 36 hours in 2015. This time increases to between 23 and 39 hours in 2020.

Operational Scenarios

In-county clearance times for the 2015 operational scenarios range from 7.5 hours to 33.5 hours depending upon the scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the operational scenarios ranging from 6.5 hours to 26.5 hours depending upon the county and the scenario.

In 2020, in-county clearance times for the operational scenarios vary from 8 hours to 54 hours for the level E evacuation. The 2020 level D and E scenarios include vehicle trips evacuating from Tampa for a large storm event (approximately 1.45 million evacuating vehicles in the model network), which cause a large increase in clearance times. Clearance Time to Shelter shows a similar pattern to the 2015 scenarios, with clearance times for the base scenarios ranging from 6.5 hours to 49.5 hours depending upon the scenario.

Out of county clearance times for the 2015 operational scenarios range from 14.5 hours to 35.5 hours, depending upon the scenario. Out of county clearance times show a similar pattern in 2020 to between 15 and 56 hours depending upon the scenario. Regional clearance time for the five county Withlacoochee region ranges from 18 hours to 39.5 hours in 2015. This time increases to between 19 and 56 hours in 2020.

Table ES-9 2015 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
Citrus County	13.0	13.0	14.0	15.0	16.5
Hernando County	12.5	13.0	13.0	13.0	14.0
Levy County	13.0	13.0	13.0	13.0	13.0
Marion County	13.0	13.0	13.0	13.0	13.5
Sumter County	12.5	12.5	12.5	15.0	16.5
In-County Clearance Time					
Citrus County	14.0	17.0	23.0	28.0	30.0
Hernando County	12.5	16.0	22.5	23.5	25.5
Levy County	14.0	17.0	23.5	24.5	27.0
Marion County	13.5	13.5	13.5	13.5	26.0
Sumter County	13.0	13.0	13.0	15.5	17.0
Out of County Clearance Time					
Citrus County	21.0	24.0	31.5	33.0	35.0
Hernando County	15.0	17.5	24.0	25.0	27.0
Levy County	22.0	26.0	32.5	34.0	36.0
Marion County	21.5	25.0	32.0	33.5	35.5
Sumter County	17.5	23.5	31.5	33.0	34.5
Regional Clearance Time					
Withlacoochee	22.0	26.0	32.5	34.0	36.0

Table ES-10 2020 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
Citrus County	13.0	13.0	13.5	16.0	16.5
Hernando County	12.5	13.0	13.0	13.5	14.5
Levy County	13.0	13.0	13.0	13.0	13.0
Marion County	13.0	13.0	13.5	13.5	13.5
Sumter County	12.5	12.5	12.5	14.5	16.5
In-County Clearance Time					
Citrus County	14.0	17.5	23.0	25.0	29.0
Hernando County	12.5	17.0	22.5	24.5	28.0
Levy County	14.0	17.5	23.0	25.0	29.5
Marion County	13.5	13.5	14.0	14.0	29.0
Sumter County	13.0	13.0	13.0	15.0	17.0
Out of County Clearance Time					
Citrus County	21.5	22.0	31.0	33.0	38.0
Hernando County	22.0	25.0	31.5	34.0	38.0
Levy County	15.0	18.5	24.0	26.0	29.5
Marion County	23.0	26.0	32.5	35.0	39.0
Sumter County	22.5	25.5	32.0	34.5	38.5
Regional Clearance Time					
Withlacoochee	23.0	26.0	32.5	35.0	39.0

Table ES-11 2015 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Citrus County	10.5	22.5	11.0	22.5	26.5
Hernando County	7.5	15.5	8.0	21.0	26.5
Levy County	6.5	13.0	10.0	13.0	7.0
Marion County	14.0	16.0	15.5	15.5	10.0
Sumter County	14.5	17.5	19.0	19.0	10.0
In-County Clearance Time					
Citrus County	12.5	24.0	18.5	28.5	33.5
Hernando County	7.5	19.0	14.0	26.0	26.5
Levy County	13.0	24.5	19.5	27.5	34.5
Marion County	14.5	16.5	16.0	16.0	33.5
Sumter County	15.0	18.0	19.5	19.5	10.5
Out of County Clearance Time					
Citrus County	14.5	27.0	20.5	32.5	33.5
Hernando County	14.5	27.5	18.5	33.5	27.0
Levy County	16.5	29.5	24.5	36.5	34.5
Marion County	18.0	32.0	25.5	39.5	35.5
Sumter County	15.0	28.0	22.5	34.0	34.5
Regional Clearance Time					
Withlacoochee	18.0	32.0	25.5	39.5	35.5

Table ES-12 2020 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Citrus County	13.5	13.5	14.0	21.5	27.5
Hernando County	8.0	9.0	11.5	32.0	49.5
Levy County	6.5	6.5	7.0	13.0	13.0
Marion County	14.5	16.5	16.5	22.0	21.5
Sumter County	12.5	16.5	17.0	28.5	27.0
In-County Clearance Time					
Citrus County	15.0	15.5	25.0	42.0	53.5
Hernando County	8.0	13.0	17.0	32.0	49.5
Levy County	15.5	16.0	27.5	42.5	54.0
Marion County	15.0	17.0	17.0	22.5	53.5
Sumter County	13.0	17.0	17.5	29.0	27.5
Out of County Clearance Time					
Citrus County	17.0	17.0	27.0	43.5	55.0
Hernando County	15.0	17.0	23.5	40.5	53.5
Levy County	18.0	20.0	28.0	44.0	54.5
Marion County	19.0	20.0	28.0	46.5	56.0
Sumter County	15.5	18.0	26.5	44.0	55.0
Regional Clearance Time					
Withlacoochee	19.0	20.0	28.0	46.5	56.0

K. Maximum Evacuating Population Clearances

From an emergency management standpoint, it is important to get an understanding of the maximum proportion of the evacuating population that can be expected to evacuate at various time intervals during an evacuation. Should storm conditions change during an evacuation, emergency managers will need to be able to estimate what portion of the evacuating population is estimated to still remain within the county trying to evacuate.

Using the base scenarios, which assume 100% of the vulnerable population is evacuating, along with shadow evacuations and evacuations from adjacent counties, an estimate was made of the evacuating population actually able to evacuate out of each county by the time intervals of 12, 18, 24, and 36 hours. The estimated maximum evacuating population by time interval for 2015 is identified in **Table ES-15** and for 2020 in **Table ES-16**.

It is important to note that these estimates take into account many variables, including roadway

capacity, in-county evacuating trips, out of county evacuating trips, evacuating trips from other counties, and background traffic that is impeding the evacuation trips. For this reason, the maximum evacuation population by time interval will vary slightly between evacuation level and either increase or decrease from one evacuation level to the next.

L. Sensitivity Analysis

As discussed previously, there are literally thousands of possible combinations of variables that can be applied using the evacuation transportation model, which will result in thousands of possible outcomes. As part of the analysis process, a sensitivity analysis was conducted using the prototype model to evaluate the effect of different response curves on the calculated evacuation clearance times. Calculated clearance times will never be lower than the designated response time, since some evacuating residents will wait to evacuate until near the end of the response time window. For example, using a 12-hour response curve in the analysis means that all residents will begin their evacuation process within 12-hours, and some residents will choose to wait and begin evacuating more than 11.5 hours from when the evacuation was ordered. This will generate a clearance time of more than 12 hours.

The sensitivity analysis identified that clearance times will vary by scenario and by any of the numerous parameters that can be chosen in a particular scenario model run (demographics, student population, tourist population, different counties that are evacuating, response curve, phasing, shadow evacuations, etc.). A few general rules of thumb did emerge from the sensitivity analysis that can provide some guidance to the region regarding the sensitivity of the response curve to the calculated clearance times:

- For low evacuation levels A and B, clearance time will vary by as much as 40 percent depending on the response curve. Low evacuation levels A and B have fewer evacuating vehicles that can be accommodated more easily on the transportation network. In most cases, clearance times typically exceed the response curve by one to two hours. Thus, a 12 hour response curve may yield a clearance time of 13 or 14 hours while an 18 hour response curve may yield a clearance time of 19 or 20 hours. This leads to a higher level of variability than larger evacuations;

Table ES-13 Maximum Evacuating Population by Time Interval for 2015

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Citrus County					
12-Hour	42,016	34,137	27,593	30,909	32,564
18-Hour	61,273	51,205	41,389	46,364	48,846
24-Hour		66,851	55,186	61,818	65,128
36-Hour			72,431	85,000	93,622
Estimated Evacuating Population Clearing Hernando County					
12-Hour	26,910	24,293	22,911	33,931	39,093
18-Hour	40,365	36,440	34,367	50,896	58,639
24-Hour	47,092	48,586	45,822	67,861	78,186
36-Hour			60,142	93,309	114,021
Estimated Evacuating Population Clearing Levy County					
12-Hour	18,993	16,849	13,001	13,570	14,008
18-Hour	23,741	24,572	19,502	20,354	21,013
24-Hour			26,002	27,139	28,017
36-Hour				28,270	31,519
Estimated Evacuating Population Clearing Marion County					
12-Hour	60,782	57,673	51,132	53,649	50,669
18-Hour	91,173	86,509	76,698	80,474	76,003
24-Hour	111,434	115,346	102,264	107,298	101,337
36-Hour		124,958	138,482	152,006	152,006
Estimated Evacuating Population Clearing Sumter County					
12-Hour	16,530	16,211	14,223	15,074	15,629
18-Hour	24,796	24,316	21,334	22,611	23,444
24-Hour	29,617	32,421	28,445	30,148	31,258
36-Hour		33,772	37,927	42,081	46,236

Note: These estimates take into account many variables, including roadway capacity, in-county evacuating trips, out of county evacuating trips, evacuating trips from other counties, and background traffic that is impeding the evacuation trips. For this reason, the maximum evacuation population by time interval will vary between evacuation level and either increase or decrease from one evacuation level to the next.

Table ES-14 Maximum Evacuating Population by Time Interval for 2020

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Citrus County					
12-Hour	36,680	39,103	30,067	33,143	31,701
18-Hour	55,021	58,654	45,100	49,715	47,552
24-Hour	65,719	71,688	60,134	66,287	63,403
36-Hour			77,673	91,144	100,388
Estimated Evacuating Population Clearing Hernando County					
12-Hour	28,331	25,713	25,262	36,307	39,680
18-Hour	42,496	52,120	37,893	54,461	59,520
24-Hour	51,940	49,447	50,524	72,615	79,360
36-Hour		53,568	66,313	102,871	125,653
Estimated Evacuating Population Clearing Levy County					
12-Hour	20,165	16,918	13,802	13,854	13,615
18-Hour	25,206	25,377	20,703	20,780	20,422
24-Hour		26,082	27,604	27,707	27,229
36-Hour				30,016	33,469
Estimated Evacuating Population Clearing Marion County					
12-Hour	63,886	63,375	56,188	57,271	51,397
18-Hour	95,829	95,062	84,282	85,906	77,095
24-Hour	122,448	126,750	112,376	114,542	102,794
36-Hour		137,312	152,176	167,040	167,040
Estimated Evacuating Population Clearing Sumter County					
12-Hour	18,842	18,956	16,963	17,457	17,187
18-Hour	28,262	28,434	25,445	26,186	25,781
24-Hour	35,328	37,912	33,926	34,914	34,375
36-Hour		40,282	45,235	50,189	55,143

Note: These estimates take into account many variables, including roadway capacity, in-county evacuating trips, out of county evacuating trips, evacuating trips from other counties, and background traffic that is impeding the evacuation trips. For this reason, the maximum evacuation population by time interval will vary between evacuation level and either increase or decrease from one evacuation level to the next.

- For mid-level evacuations such as C and sometimes D, clearance time varied by as much as 25 percent during the sensitivity analysis. The number of evacuating vehicles is considerably higher than for levels A and B, and lower response curves tend to load the transportation network faster than longer response curves. The variability in clearance times is less in these cases than for low evacuation levels; and,

- For high-level evacuations such as some level D evacuations and all E evacuations, clearance time variability is reduced to about 10 to 15 percent. Large evacuations involve large numbers of evacuating vehicles, and the sensitivity test identified that clearance times are not as dependent on the response curve as lower level evacuations since it takes a significant amount of time to evacuate a large number of vehicles.

The counties within the Withlacoochee Region are encouraged to test additional scenarios beyond what has been provided in this study. Each model run will provide additional information for the region to use in determining when to order an evacuation. Due to advancements in computer technology and the nature of the developed transportation evacuation methodology, this study includes a more detailed and time consuming analysis process than used in previous years studies. Counties interested in testing various response curves for each scenario can easily do so using the TIME interface to calculate clearance times for different response curves.

M. Summary and Conclusions

Through a review of the results of the 20 different scenarios (10 base and 10 operational), several conclusions could be reached regarding the transportation analysis, including the following:

- Critical transportation facilities within the WRPC region include I-75, US 19, US 301, and portions of SR 200 and US 41. For large storm events, such as level D and E evacuations, other State facilities also play an important role in evacuations;

- During the level A and B evacuation scenarios, the roadway segments with the highest vehicle queues are primarily concentrated along the major Interstate and State Highway system. During these levels of evacuation, State and County officials should coordinate personnel resources to provide sufficient traffic control at interchanges and major intersections along these routes;

- In contrast, for the higher level C, D, and E evacuation scenarios, many other roadway facilities, both within and outside of the region, will require personnel resources for sufficient traffic control at interchanges and major intersections;

- The WRPC counties, in coordination with the State, should continue public information campaigns to clearly define those that are vulnerable and should evacuate verses those who choose to evacuate on their own. During large storm events, evacuations by the vulnerable population are impacted by shadow evacuations occurring in other parts of the region;

- WRPC counties play a major role even when evacuations occur in other parts of the State, especially with Tampa Bay area storm events. For example, for the 2020 operational scenarios for level D and level E which include a major Tampa Bay region evacuation, total evacuating vehicles along I-75 in Sumter County totaled to around 81,000 vehicles. WRPC counties should continue their coordination efforts with the State and provide assistance even when WRPC counties are not evacuating;

- The Florida Department of Transportation should continue to work with local counties on implementing intelligent transportation system (ITS) technology, which will provide enhanced monitoring and notification systems to provide evacuating traffic with up to date information regarding expected travel times and alternate routes;

- The State can use the data and information provided in this report (specifically the evacuating vehicle maps in Volume 5-5) to estimate fuel and supply requirements along major evacuation routes to aid motorists during the evacuation process;

- For major evacuation routes that have signalized traffic control at major intersections, traffic signal timing patterns should be adjusted during the evacuation process to provide maximum green time for evacuating vehicles in the predominate north and west directions; and,

- The counties within the Withlacoochee Region are encouraged to test additional transportation scenarios beyond what has been provided in this study. Each model run will provide additional information for the region to use in planning for an evacuation. Counties interested in testing various response curves for each scenario can easily do so using the TIME interface to calculate clearance times for different evacuation conditions, such as different evacuation levels, different behavioral response assumptions, and different response curves.

CHAPTER I
INTRODUCTION

The evacuation transportation analysis discussed in this volume documents the methodology, analysis, and results of the transportation component of the Statewide Regional Evacuation Study Program (SRESP). Among the many analyses required for the SRESP study, transportation analysis is probably one of the most important components in the process. By bringing together storm intensity, transportation network, shelters, and evacuation population, transportation analysis explicitly links people's behavioral responses to the regional evacuation infrastructure and helps formulate effective and responsive evacuation policy options. Due to the complex calculations involved and numerous evacuation scenarios that need to be evaluated, the best way to conduct the transportation analysis is through the use of computerized transportation simulation programs, or transportation models.

A. Background and Purpose

Over the years, different planning agencies have used different modeling approaches with varying degrees of complexity and mixed success. Some have used full-blown conventional transportation models such as the standard Florida model FSUTMS; others have used a combination of a simplified conventional model and a spreadsheet program, such as the Abbreviated Transportation Model (ATM). These models have different data requirements, use different behavioral assumptions, employ different traffic assignment algorithms, and produce traffic analysis results with different levels of detail and accuracy. These differences make it difficult for planning agencies to share information and data with each other. They also may produce undesirable conditions for staff training and knowledge sharing.

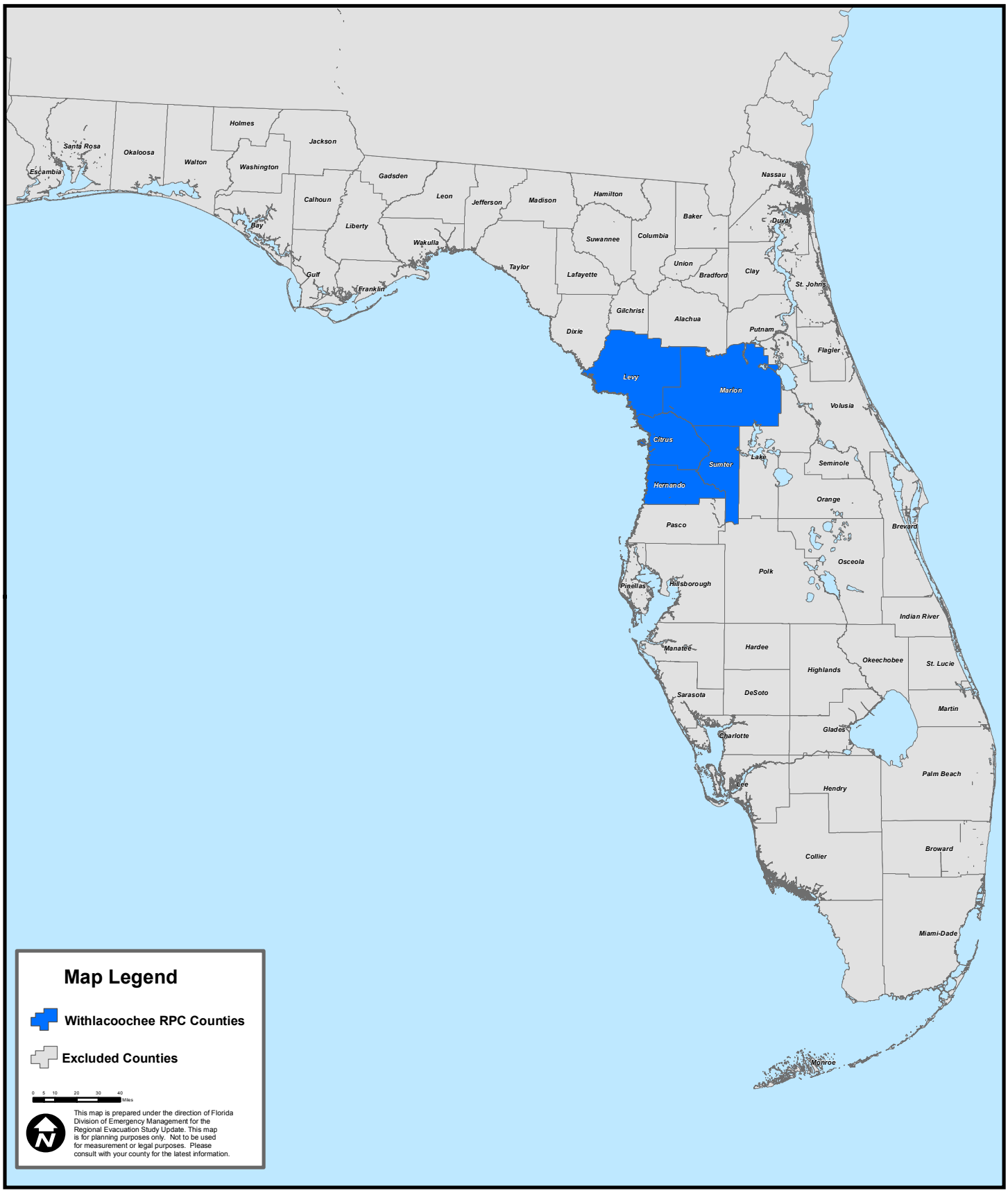
One of the objectives of the SRESP is to create consistent and integrated regional evacuation data and mapping, and by doing so, to facilitate knowledge sharing between state, regional, county, and local partners. To achieve this objective, it is important for all Regional Planning Councils to adopt the same data format and to use the same modeling methodologies for their transportation analyses. The primary purpose of the transportation component of the SRESP is to develop a unified evacuation transportation modeling framework that can be implemented with the data collected by the Regional Planning Councils.

B. Study Area

The study area for this analysis includes the five county Withlacoochee Regional Planning Council area, as illustrated in **Figure I-1**. The transportation modeling methodology includes some processes that are performed at the statewide level, in order to determine the impacts of evacuations from other regions impacting the evacuation clearance times in the Withlacoochee region. While the impact of other regions is included in the Withlacoochee analysis, it is important to note that the results of the transportation analysis presented in this document are only reported for the five counties included in the Withlacoochee RPC. Transportation analysis results for other regions and counties are reported in the corresponding Volume 4 report for those regions.

Figure I-1

Withlacoochee Regional Planning Council



Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: June, 2015

C. Input and Coordination

The development of the transportation methodology and framework required coordination and input from all eleven regional planning councils in Florida, along with the Division of Emergency Management, Department of Transportation, Department of Economic Opportunity, and local county emergency management teams. At the statewide level, the transportation consultant, CDM Smith Associates, participated in SRESP Work Group Meetings which were typically held on a monthly basis to discuss the development of the transportation methodology and receive feedback and input from the State agencies and RPCs.

At the local and regional level, CDM Smith Associates conducted a series of regional meetings for the 2010 study to coordinate with and receive input from local county emergency management, the regional planning council, local transportation planning agencies and groups, as well as other interested agencies. For the 2015 update to the transportation study, CDM Smith Associates led a webinar and teleconference with County emergency management from the Withlacoochee region:

Regional Meeting – Transportation Analysis Meeting

The regional meeting for the Withlacoochee region was held on August 24, 2015 at 10:00 AM. The purpose of the transportation analysis meeting was to review the draft results of the transportation analysis and receive feedback for the draft final report.

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CHAPTER II
EVACUATION MODELING METHODOLOGY AND FRAMEWORK

The evacuation modeling methodology and framework was developed during 2008 and 2009 in coordination with all eleven Regional Planning Councils and the Division of Emergency Management, and updated in 2012 to incorporate F evacuation zones. The methodology used in this Northeast Florida Region Evacuation Transportation Analysis was updated to accommodate new versions of Cube Voyager and Cube Avenue software and is summarized in the following sections.

A. Behavioral Assumptions

In 2008, the Statewide Regional Evacuation Study Program (SRESP) commissioned a survey of Florida residents. The purpose of this survey was to develop an understanding of the behavior of individuals when faced with the prospect of an impending evacuation. These data were used to develop a set of "planning assumptions" that describe the way people respond to an order to evacuate and are an important input to the SRESP Evacuation Model. The behavioral data provides insights into how people respond to the changing conditions leading up to and during an evacuation.

The primary application of the survey data was to help anticipate how people would respond with respect to five behaviors:

- How many people would evacuate?
- When they would leave?
- What type of refuge they would seek?
- Where they would travel for refuge?
- How many vehicles would they use?

These evacuation behaviors are distinguished based on several descriptive variables as listed below:

- Type of dwelling unit (site-built home versus mobile home);
- The evacuation zone in which the evacuee reside; and,
- The intensity of the evacuation that has been ordered.

How many people?

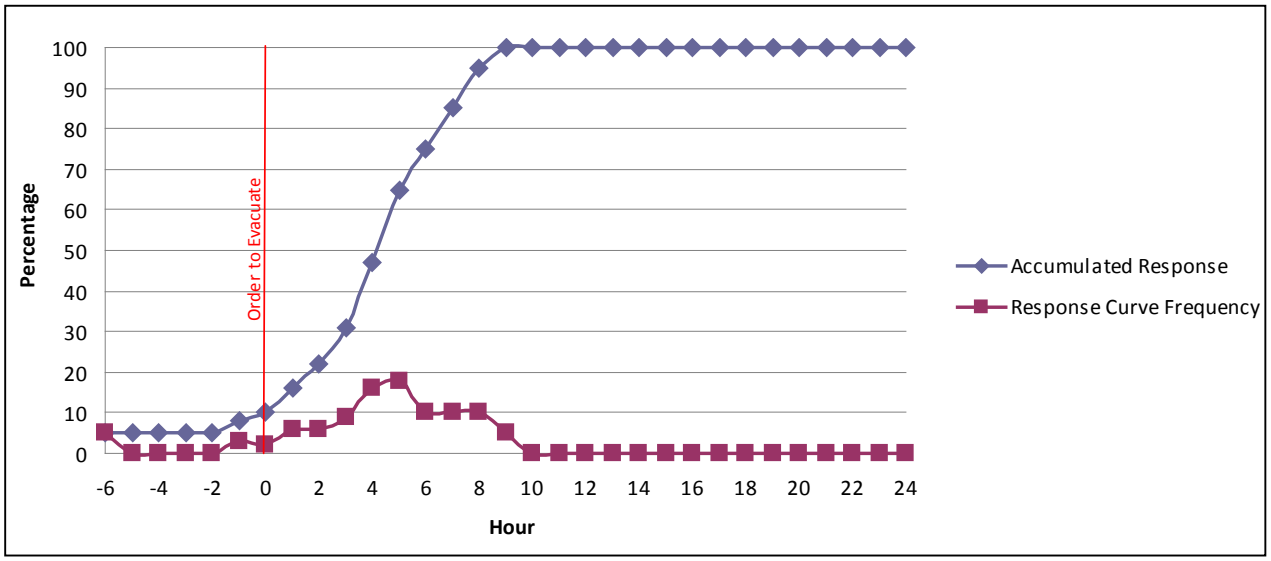
The evacuation rate indicates the percent of residents who will leave their homes to go someplace safer in each storm threat scenario. The evacuation rates are based on the following assumptions: that the storm track passes very close to the area being evacuated; and officials order evacuation for surge evacuation zones corresponding to storm category. Under the 100 percent response scenario, this rate will default to 100 percent.

When will they leave?

Consistent with behavior observed in past evacuations, evacuees do not begin their journey toward safety all at the same time. Rather, evacuees each begin their trips at different times based on their unique characteristics and constraints. Some individuals will prefer to evacuate soon after an order is given. Others may need to spend time securing personal property or seeing to the welfare of their relatives before they feel comfortable evacuating. Yet others will underestimate the threat posed to them by an oncoming storm and may not evacuate until very late. A set of evacuation response curves show the proportion of evacuation by increment of time for evacuation orders that were issued.

Each curve represents a different assumption on the amount of time it will take for an evacuating population to fully mobilize. The curves reflect the sense of urgency with which the population perceives the impending evacuation. Faster curves represent more urgent circumstances and slower curves represent less urgent circumstances. These curves are used by the model to divide the total number of evacuating trips into segments representing each hour that evacuating trips begin their journey. For example, a nine hour curve will place a certain number of evacuating trips in the first segment. These trips will represent those evacuees leaving in the first hour of an evacuation. The curve will then place another number of trips in the second segment representing the number of people leaving in the second hour of an evacuation. This process continues until all evacuees have begun their journey, which in a nine hour curve occurs during the ninth segment. All of the curves developed for the SRESP assume that some portion of the evacuating population leave before an order to evacuate is given. Typically, this is ten percent of the evacuating population. The nine hour response curve used in the model is depicted in **Figure II-1**. Response curves are available in the model to evaluate six, nine, twelve, eighteen, twenty-four, and thirty-six hour responses.

Figure II-1 – Nine Hour Response Curve



What type of refuge would be sought?
The survey data identified four types of refuge sought by evacuees. Specific rates were developed that identified the number of evacuees seeking shelter at each of these following different types of refuge:

- Friends and family;
- Hotel or motel;
- Public shelter; and,
- Other types of refuge not covered elsewhere in the list including, but not limited to, office space, churches, civic organization halls, and club houses.

Where will they travel?
The behavior survey distinguishes between trips that leave the county where an evacuation journey begins and trips that stay within the county. The out-of-county trip rate indicates the percent of evacuees who will seek refuge outside their county of residence. The in-county trip rate will determine how many of the evacuating trips are destined to remain within the county.

How many vehicles are used?
The vehicle use rate indicates the percentage of vehicles available to the evacuating household(s) that will be used in evacuation in each storm threat scenario. This rate ultimately determines the number of vehicles on the highways during an evacuation.

B. Zone System and Highway Network

The SRESP evacuation model relies upon data that covers the entire State of Florida as well as areas covering the States of Georgia, Alabama, Mississippi, South Carolina, North Carolina, and Tennessee. While the primary focus of the model is with evacuation behavior within Florida, areas outside of the state had to be considered in order to allow a more precise routing of evacuation traffic. This allows the model to measure the flow of traffic across the state line if needed.

Zone System
The data included in this system contain the demographic information crucial to modeling evacuation traffic. The demographic information is labeled as “small area data”. These data provide population and dwelling unit information that will identify where the individuals in the region reside. The planning assumptions developed from the behavioral analysis conducted for this study were applied to these demographic data. The result is a set of evacuation trips generated by the evacuation model. The number of these trips will vary depending on the hazard conditions that prompt the evacuation.

The Northeast Florida Regional Council developed their small area data by utilizing Census 2010 geography. Data were developed for the following years: 2010, 2015, and 2020.

Traffic Evacuation Zones (TEZ)
Small area data geographies were aggregated into larger units known as Traffic Evacuation Zones (TEZ). These TEZ form the basic unit of analysis in the evacuation model similar to how traffic analysis zones form the basic unit of analysis in a standard travel demand model. The TEZ system was developed so that the small area geographies will nest completely within one TEZ or another. This eliminates any potential for split data and will ensure that data in the TEZ system can always be updated with relative ease.

The final TEZ system for the State of Florida has 8,829 zones. This number provides sufficient detail to accurately accommodate the assignment of evacuation trips onto an evacuation network. Furthermore, additional roadway segments have been included in the model's highway network to facilitate the movement of evacuation trips onto and off of the evacuation network. Each TEZ has a unique identification number that will be used by the model to connect evacuation trip generation to the evacuation highway network.

Highway Network

A highway network is used to represent the roads that evacuees travel along as they journey toward safety. Various datasets were used to develop the highway network database as follows:

- Florida Statewide Model Network – The 2005 base year statewide model (latest model available) was used as a basis for developing the evacuation model. The statewide model was obtained from the Florida Department of Transportation (FDOT) Systems Planning Office;

- Evacuation Routes – Evacuation routes in each Regional Planning Council (RPC) area were obtained from the RPCs themselves. The RPCs relied on their constituent counties to provide them with information on which roads were to be included as evacuation routes;

- Florida Highway Data Software (FHD) – The 2006 Florida Highway Data software was obtained from FDOT. This software was used to view and query data extracted from the Roadway Characteristics Inventory (RCI) which includes number of lanes, facility types, speed limits, etc.;

- FDOT Quality/Level of Service Handbook – The 2002 FDOT Quality/Level of Service Handbook (QLOS) and the 2007 LOS Issue Papers (2002 FDOT QLOS addendum) were obtained from the FDOT Systems Planning Office website. The QLOS handbook and the LOS tables were used to establish roadway capacities for evacuation purposes; and,

- Microsoft and Google aerials and maps – These aerial maps were used to identify and clarify roadway alignments. Whenever questions concerning the existence of particular facilities, their characteristics, or their alignments arose, aerials were referenced.

Changes to the Florida Statewide Model Network

Some modifications to the Florida Statewide Model network were necessary in order to make the data usable for evacuation modeling purposes:

- The original database, which was coded for a 2005 base year, was updated to 2010 conditions to correspond to the SRESP base year;
- Additional facilities had to be added to the network to accommodate evacuation traffic behavior;
- Many attributes from the original data set were removed and new ones were added specifically tailored for trip activity for evacuation modeling purposes;
- Based on RPC input, any missing facilities instrumental for evacuations were coded into the highway network database;
- The highway network database was extensively reviewed for the correct coding of one-

way links;
- The 2006 FHD software was used to verify the highway network database number of lanes for the state roads, US highways, and major county roads. For other roads Microsoft and Google aerial maps were used;
- The area type and facility type attributes for each roadway segment were verified for their consistency with existing conditions; and,
- The network attributes were modified to the specific needs of evacuation modeling and reporting purposes. The evacuation routes designated by the RPC were flagged for reporting purposes. The County name attribute and the RPC number attributes were checked and modified accordingly.

Capacities

Network capacities for the evacuation model are based on facility type and area type. The network facility type classification and the area type classification were retained from the existing Florida Statewide Model highway network database.

FDOT's 2002 Quality/Level of Service (QLOS) generalized level of service volume tables were used for estimating the link capacity for each combination of functional class and area type. The generalized level of service volume tables were generated from conceptual planning software which is based on the 2000 edition of the Highway Capacity Manual (HCM). Using statewide default values for each of these roadway characteristics, the generalized LOS volume tables were developed from the conceptual planning software.

The peak hour volume represents the most critical period for traffic operations and has the highest capacity requirements. Many urban routes are filled to capacity during each peak hour, and variation is therefore severely constrained. The peak hour directional volumes at LOS E, closely represent the maximum volume (capacity) that can be accommodated through a given roadway. In some cases the Peak Hour Two-Way LOS tables do not show the maximum services volumes at the LOS E. For example, the four-lane Class I arterial service volumes are only shown from LOS A to LOS D, This indicates that the maximum volume thresholds (capacity) are reached at LOS D and these volumes represent the capacity of the roadway.

A lookup table was created with facility type, area type, number of lanes, and capacities by comparing model network characteristics to the roadway characteristics in the QLOS manual. The lookup table is shown in **the Transportation Supplemental Data Report**. The capacity attribute in the network was automatically assigned for any given link with a specific facility type, area type and number of lanes during the network preparation process.

Speeds

The existing highway network database link speeds were verified for their reasonableness and their suitability for evacuation modeling purpose. The speed values of the existing statewide model database were reasonable and therefore retained in for evacuation modeling.

Roadway Attributes

The roadway attributes contain the highway characteristics for each link in the highway network. Some of the attributes like DISTANCE, FTYPE, ATYPE, etc., were retained from the highway network database and other attributes like DENSITY and EVAC_RTE are specific to the evacuation modeling and were included in the network.

Reverse Lane Operations

Additional changes were also made in order to accommodate reverse lane operations in an evacuation scenario. Most of the facilities that would be subject to a reverse lane operations scenario were coded as a pair of one-way links. Additional attributes were added to the network in order to allow for the correct calculation of capacity in the reverse lane direction. The configurations of reverse lane facilities reflect the reverse lane operations plans established by the State.

C. Background Traffic

The traffic that consumes the roadway capacity of a transportation system during an evacuation can be divided into two groups. The first group is the evacuation traffic itself. Once the evacuation demand is determined, this information is converted into a number of vehicles evacuating over time. These evacuation trips are then placed on a representation of the highway network by a model. The model determines the speed at which these trips can move and proceeds to move the evacuation trips accordingly. The result is a set of clearance times.

The second group of traffic is known as background traffic. Background traffic, as its name implies, is not the primary focus of an evacuation transportation analysis and is accounted for primarily to impede the movement of evacuation trips through the network. These trips represent individuals going about their daily business mostly unconcerned with the evacuation event. For the most part, background traffic represents trips that are relatively insensitive to an order to evacuate and are thus said to be occurring in the "background." Even though background traffic is relatively insensitive to evacuation orders, it is important to account for background traffic since it can have a dramatic impact on available roadway capacity. This in turn can severely affect evacuation clearance times.

Methodology used to Account for Background Traffic

There are two dynamics at work when evacuation traffic and background traffic interact with one another. The first is the effect of background traffic displacing evacuation traffic as background traffic attempts to use the same roads as the evacuation traffic. The second is the effect of evacuation traffic displacing background traffic. As vehicles move along the network and try to get onto certain roads they leave less room for other vehicles to use those same roads. As background traffic builds up there is less room for evacuation traffic to move, and vice versa. While the effect that evacuation traffic has on background traffic may be of some interest to those who are concerned with disruptions in daily trip making behavior during an evacuation event, for the purposes of this study we are much more interested in the effect that background traffic has on evacuation clearance times.

The effect that background traffic has on evacuation traffic can be stated in terms of available capacity. The more background traffic there is on a segment of road, the less capacity is available for evacuation traffic to use. Following this logic, it becomes apparent that by causing the available capacity to fluctuate throughout the evacuation event, one is able to sufficiently account for the impact of background traffic. FDOT's Florida Traffic Information DVD was used to develop average peaking characteristics for various functional classes of roadways throughout the state. These characteristics were analyzed to determine how much capacity is available throughout a given day during an evacuation.

Two sets of curves were developed, one for coastal evacuating counties that represent lower

background traffic and one for all other counties representing greater background traffic. The model then adjusts capacities up and down consistent with these curves as it simulates the evacuation.

Figure II-2 illustrates the set of curves showing the percentage of available capacity throughout a 24 hour period for a coastal evacuating county after the model accounts for background traffic. **Figure II-3** illustrates the set of curves showing the percentage of available capacity throughout a 24 hour period for all other counties after the model accounts for background traffic.

Figure II-2 – Percent of Available Capacity for Coastal Counties

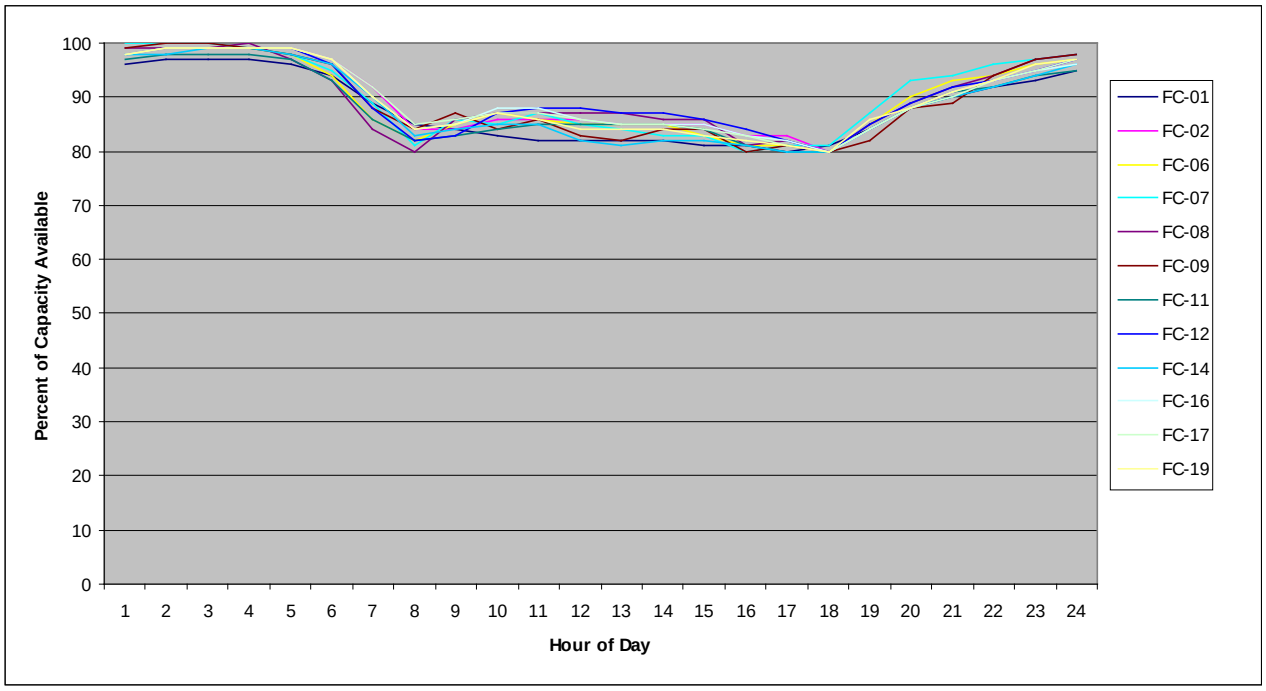
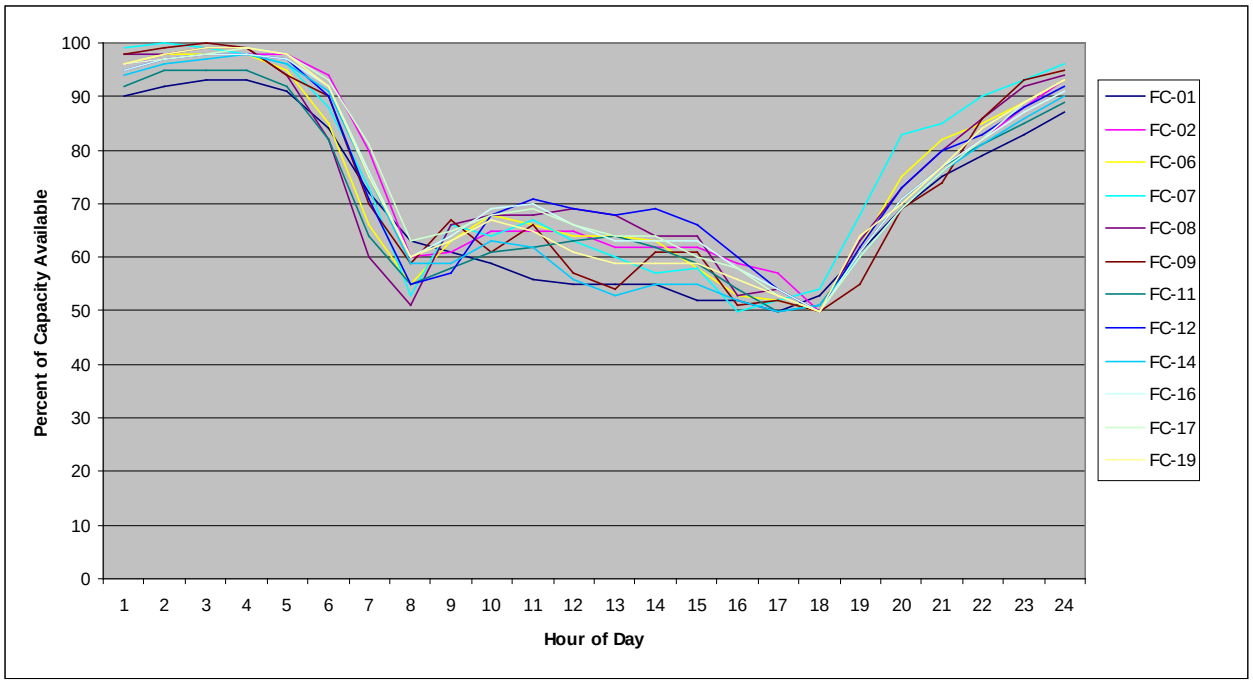


Figure II-3 – Percent of Available Capacity for Other Counties

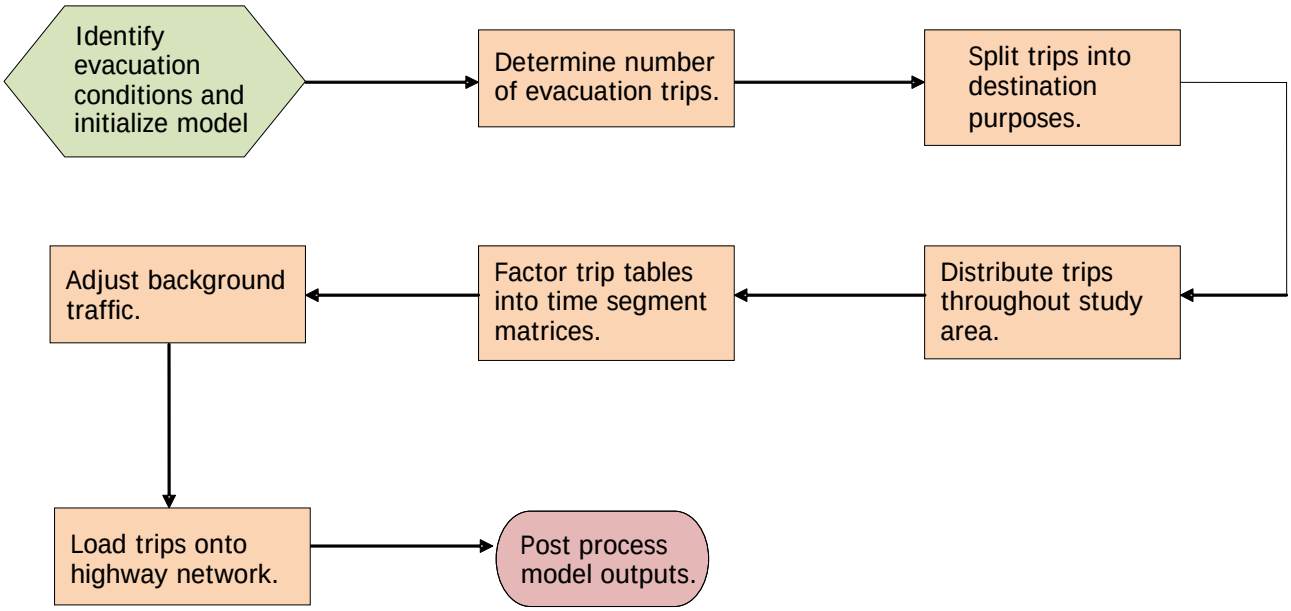


D. Evacuation Traffic

The model flow for the evacuation model is divided into a total of eight modeling steps. The following eight steps are represented graphically in the flowchart in **Figure II-4**:

1. Identify evacuation conditions and initialize model;
2. Determine number of evacuation trips;
3. Split trips into destination purposes;
4. Distribute trips throughout study area;
5. Factor trip tables into time segment matrices;
6. Adjust background traffic;
7. Load trips onto highway network; and,
8. Post process model outputs.

Figure II-4 - General Model Flow



Initializing the Model

At the beginning of the model flow, the model will need to determine the hazard conditions representing the particular scenario that will be analyzed. This will allow the model to accurately identify the areas that will be subject to evacuation and to determine the intensity of the evacuation event. This process will then establish the appropriate rates that will be used to determine the number of evacuation trips that will be generated.

Number of Evacuating Trips

After the model has finished initializing it will begin to calculate the number of evacuation trips that are generated. Estimating an appropriate number of trips is essential to ensuring that the behavior expressed on the highway network during trip assignment is reflective of likely conditions during a real world evacuation event.

The planning assumptions developed by the behavioral analysis were translated into a master rates file that can be referenced by the model in order to determine the number of evacuation trips that a particular scenario can be expected to generate.

Production Ends

Every trip has two ends. One end represents where a trip begins its journey and is typically referred to as the production end. The other end represents where a trip finishes its journey and is typically referred to as the attraction end. The calculation of the production end of each evacuation trip in the model is driven by the master rates file mentioned above.

Attraction Ends

The other end of an evacuation trip, the attraction end, is calculated using a much more simplified methodology. Public shelters have clearly defined capacities. For hotels and motels, each room

will be designated as an attraction. Trips destined to shelter with friends and family or in other unspecified destinations will have an attraction generated at each non-evacuating household in the model. This will ensure that these trips are evenly distributed around the area with some clumping occurring in highly residential areas.

Splitting Trips into Destination Purposes

Once the number of evacuation trips has been determined it will be necessary to divide the trips into various trip purposes. These purposes are based on the type of destination that an evacuee is headed to and the relative location of that destination. There are four types of destinations and two relative locations for a total of eight trip purposes, as identified below:

- Friends & Family – In County;
- Public Shelter – In County;
- Hotel/Motel – In County;
- Other – In County;
- Friends & Family – Out of County;
- Public Shelter – Out of County;
- Hotel/Motel – Out of County; and,
- Other – Out of County.

The same behavioral analysis that establishes the evacuation and vehicle use rates used to determine the number of evacuation trips that are being generated by the model is also a source of data for determining the various destinations where these evacuation trips are heading.

Trip End Balancing

Once the model has finished splitting the trip ends into their respective purposes, it will commence the process of balancing trip ends. The balancing of trip ends is critical so that the trip distribution process which is to follow this step will be able to tie every trip production to every trip attraction. A surplus or deficit of one trip end or the other may cause complications in the evacuation model that can lead to overestimating the model, underestimating the model, or aborting the model process.

In County Balancing - The trip balancing procedure begins by considering each purpose individually. If the trip purpose under consideration is an In County purpose the model compares the number of productions to the number of attractions. If the number of attractions is greater than the number of productions, the model will simply apply a universal adjustment of all attraction trip ends in the county down to the number of productions. The end result should be an equal number of In County productions and attractions.

If, on the other hand, the productions should exceed attractions the excess productions are shifted over to the corresponding Out of County purposes. For example, if the model estimates using the behavioral planning assumptions that there will be 3,000 evacuees destined In County to Hotel/Motel destinations, but there are only 2,500 Hotel/Motel attraction ends available in the county, the excess 500 trips will become Out of County Hotel/Motel trips.

Out of County Balancing - If the purpose under consideration is an Out of County purpose the model will balance the attractions regionally. Using data derived from the behavioral study, a certain percentage of each out of county trip will be destined to a particular region. If a particular

region is prohibited by the model from receiving evacuation trips, the model will reallocate the portion of evacuation trips originally destined for that regional equally among all other regions. **Table II-1** identifies the percentages of out of county trips destined from each region and to each region. When the model has finished balancing the evacuation productions and attractions, the model will then proceed with trip distribution.

Table II-1 – Out of County Trip Destinations by Region

From \ To	Apalachee	Central	East Central	North Central	Northeast	South	Southwest	Tampa Bay	Treasure Coast	West	Withla-coochie	Out-of-State
Apalachee	31.2%	0.1%	1.1%	2.3%	2.1%	0.0%	0.1%	0.7%	0.3%	3.5%	0.8%	57.8%
Central	5.9%	9.8%	13.0%	4.4%	4.7%	0.0%	4.2%	5.9%	5.4%	0.7%	1.7%	44.2%
East Central	2.5%	1.7%	27.1%	5.4%	5.9%	1.5%	2.6%	6.7%	0.8%	1.4%	3.1%	41.2%
North Central	5.2%	0.7%	3.6%	15.2%	6.3%	0.3%	0.3%	3.1%	0.2%	1.3%	2.0%	61.8%
Northeast	3.7%	0.7%	4.2%	6.6%	10.3%	0.6%	0.6%	1.8%	0.2%	1.9%	2.0%	67.4%
South	2.0%	3.4%	20.9%	2.1%	3.4%	24.5%	5.7%	2.1%	9.0%	0.5%	3.1%	23.4%
Southwest	1.4%	5.2%	15.9%	3.9%	3.3%	4.6%	11.0%	8.4%	3.2%	0.8%	5.4%	37.0%
Tampa Bay	3.2%	3.7%	14.1%	2.8%	4.5%	2.2%	1.3%	15.7%	2.0%	0.5%	7.3%	42.6%
Treasure Coast	2.8%	1.5%	22.8%	3.0%	4.4%	4.5%	4.0%	9.4%	11.5%	0.2%	2.0%	34.0%
West	6.3%	0.2%	2.1%	0.9%	3.5%	0.4%	0.1%	0.3%	0.3%	8.7%	0.8%	76.4%
Withla-coochee	2.4%	1.7%	12.4%	7.4%	3.3%	1.0%	0.7%	6.5%	0.5%	1.2%	15.0%	48.0%

Source: Derived from SRESP Behavioral Data and Planning Assumptions

Trip Distribution

After the model has determined how many evacuation trips there will be in a given scenario, split those trips into purposes, and balanced the trip ends for those purposes, it will be necessary for the model to perform a trip distribution. The trip distribution step in the model connects each production end to a unique attraction end. The end result is a trip table containing origins and destinations for each trip in the model. Typically, origin zones are referred to by the letter I and destination zones are referred to by the letter J. An Origin-Destination matrix, also known as an OD matrix, is one of the principal inputs into trip assignment. This matrix tells the model where each trip is coming from and where it is going to.

The trip distribution process begins by looping through each trip purpose and determining whether the purpose is In County or Out of County. In County trips are restricted to destination TEZs within the same county as the trip origin. Out of County trips are restricted to TEZs not in the same county as the trip origin. The trip distribution is conducted using a gravity model that relies on distances as the chief measure of impedance.

Time Segmentation

The final step of the model prior to initiating the trip assignment sequence is to segment the trip table into discreet time periods. This segmentation determines at what point in time each trip begins its evacuation. The model is set up to process a set of evacuation response curves with a period resolution of one-half hour. The model uses a set of factors developed from the behavioral response curves to divide the evacuation trip tables into the different segments.

The model makes the following assumptions. Due to limitations in the model, these assumptions cannot be adjusted. The analyst should keep these assumptions in mind when using results developed by the model:

- All evacuations begin when an order to evacuate has been issued;
- All evacuations begin during the first hour of daylight, approximately 7:00 AM;
- All evacuations begin during an average weekday;
- Some portion of evacuation trips, typically ten percent, leaves prior to the beginning of an evacuation; and,
- Those evacuation trips that leave prior to the beginning of an evacuation leave no later than the previous evening and have already cleared the network by the time an evacuation order is given.

E. Dynamic Traffic Assignment

Dynamic traffic assignment (DTA) was utilized because it is sensitive to individual time increments. DTA works by assigning a certain number of vehicles to the highway network in a given interval of time. The model then tracks the progress of these trips through the network over the interval. Another set of vehicles is assigned during the following time interval. The model then tracks the progress of these trips through the network along with the progress of the trips loaded in the previous time interval. As vehicles begin to arrive at the same segments of roadway, they interact with one another to create congestion. When vehicles that were loaded to the network in subsequent intervals of time arrive at the congested links, they contribute to the congestion as well. This results in a slowing down of the traffic and eventually spill-backs and queuing delays.

It is this time dependent feature of DTA that makes it well suited to evacuation modeling. By dynamically adjusting the travel times and speeds of the vehicles moving through the network as they respond to congestion the model is able to do the following:

- The evacuation model is able to estimate the critical clearance time statistics needed for this study;
- The model takes into account the impact of compounded congestion from multiple congestion points;
- The model is able to adjust the routing of traffic throughout the network as a function of congestion as it occurs throughout the evacuation; and,
- The model is capable of adjusting its capacities from time segment to time segment, making it possible to represent such phenomena as reverse lane operations and background traffic.

Parameters of the Evacuation Assignment

The DTA for the evacuation model makes use of certain parameters which dictate how the assignment will function. The parameters that were established are:

- **Capacity -** The SRESP evacuation model uses hourly lane capacities derived from the Florida Department of Transportation Quality/Level-of-Service Handbook. These capacities are initially set to represent Level-of-Service E conditions. These capacities are then further increased by an additional 20 percent for freeway links and 10 percent for non-freeway links.

These increases in capacity are meant to reflect high volume usage typically found during an evacuation, optimal green timing of traffic signals and traffic control typically controlled during an evacuation by law enforcement personnel, and the use of shoulder and emergency lanes;

- **Storage -** Storage determines how many vehicles can remain standing on a length of roadway at any moment in time. The evacuation model assumes that storage is set to 250 vehicles per lane per mile. This assumes approximately 21 feet of space are "occupied" by any given vehicle. Given the mix of vehicles on a roadway network (including compacts, SUVs, trailers, and trucks) this spacing appears to be reasonable for stand-still traffic;

- **Time Intervals -** In order to properly implement a DTA model, the assignment process needs to be segmented according to a set of time intervals. Half-hour intervals provide sufficient detail to satisfy the planning needs of both emergency management and growth management concerns. The model calculates vehicle assignments over 192 such intervals for a 96 hour model period. This is sufficient to capture all evacuation activity during an event and allows sufficient time for the evacuation traffic to clear at both the county and regional level; and,

- **One-Way Evacuation Operation -** The State of Florida has recently published a series of one-way evacuation operation plans for major corridors throughout the state. The intention of these plans is to fully maximize the available capacity on a freeway by using all lanes to move evacuees away from danger. The model will emulate one-way operations by simultaneously increasing the capacity of links headed away from the threatened area and eliminating the capacity of links headed toward the threatened area. The capacity of links headed away from the threatened area will increase by 66 percent, which is consistent with capacity increases used by Florida's Turnpike Enterprise. Past experience of reverse lane operations have shown that capacities do not double, as is commonly assumed, but increase by a lower percentage of about two thirds.

F. Prototype Model Development

CDM Smith developed the prototype model to test the modeling methodology used to calculate evacuation clearance times. The prototype model demonstrated the viability of the methodology developed for this study. This included the use of dynamic traffic assignment, background traffic curves, regional sub-area trip balancing, the use of survey rates, the use of 100% participation rates, response curves, and county-by-county phasing of evacuations.

The prototype model served as the backbone for all regional evacuation models that have been developed for this study. The models implemented for each RPC use a structure similar to the prototype with identical methodology.

The SRESP evacuation model relies upon data that covers the entire State of Florida as well as areas covering the States of Georgia, Alabama, Mississippi, South Carolina, North Carolina, and Tennessee. While the primary focus of the model is with evacuation behavior within Florida, areas outside of the state had to be considered in order to allow a more precise routing of evacuation traffic. This allows the model to measure the flow of traffic across the state line if needed.

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CHAPTER III
REGIONAL MODEL IMPLEMENTATION

The evacuation transportation model discussed in Chapter II includes several components that are completed using a statewide dataset (determine number of evacuation trips, split trips into destination purposes, and distribute trips throughout state) and several components that can only be completed at the regional level (factor trip tables into time segment matrices, adjust background traffic, and load trips onto the highway network) due to computer run time limitations with the model software. Thus, for the regional level steps, each RPC throughout the State needed to decide on a regional model network to complete the analysis in their region. For the Withlacoochee Region, the regional model network includes the five counties within the RPC plus fifteen other counties surrounding the region, as illustrated in **Figure III-1**.

This chapter discusses the input data used in evaluating evacuation transportation conditions for the Withlacoochee Region. It is important to note that the input data discussed in this chapter is included only for the counties within the Withlacoochee RPC, as these are the counties that the Withlacoochee RPC has direct responsibility for the data. Data for the adjacent counties included in the Withlacoochee Regional model were provided by the corresponding RPC in which the counties belong. The model data for these counties is discussed in the corresponding Volume 4 report for those respective RPCs.

A. Regional Model Network

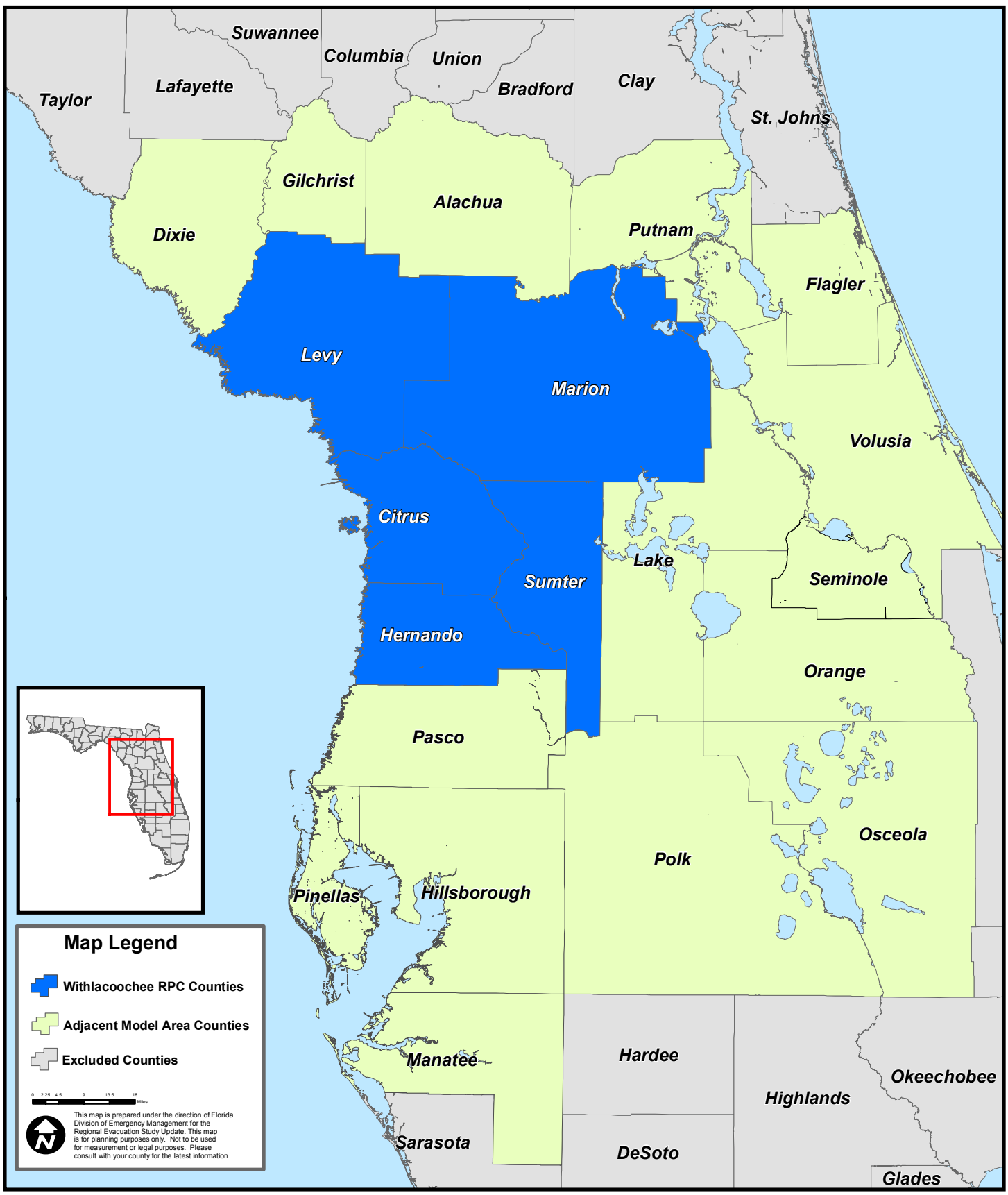
The road network is a key component of the evacuation model. The roadway variables in the network include area type, functional class, number of through lanes, capacity, speed, and several others. The regional model network consists of the RPC designated evacuation routes as well as a supporting roadway network that facilitates movement of evacuation traffic. The 2005 Florida Department of Transportation (FDOT) Statewide Model Network was used as a basis for developing the regional model network, while the evacuation routes were obtained from the Withlacoochee RPC. The RPC relied on the emergency managers of its constituent counties to provide it with information on which roads were to be included as evacuation routes. The resulting model network was updated to 2010 conditions and is referred to as the base model network. **Figure III-2** identifies the model network and evacuation routes for the WRPC. County level details of the regional model network are provided in the Volume 5 report. The regional model network for the Withlacoochee region includes key roadways within the five county region, including I-75, Florida's Turnpike, Suncoast Parkway, US 19, US 98, US 27, US 301, US 19, US 41, SR 24, SR 40, SR 44, and SR 50.

B. Regional Zone System

The regional zone system is based on Traffic Evacuation Zones (TEZ) and contains the regional demographic information, which includes housing and population data that is essential to modeling evacuation traffic, as discussed in Chapter II. The regional demographic characteristics identify where the individuals in the region reside, as well as where the vulnerable populations are located. The TEZs are aggregations of the smaller small area data geographies provided by the RPC. Each traffic evacuation zone has a unique identification

Figure III-1

Withlacoochee Regional Model Area

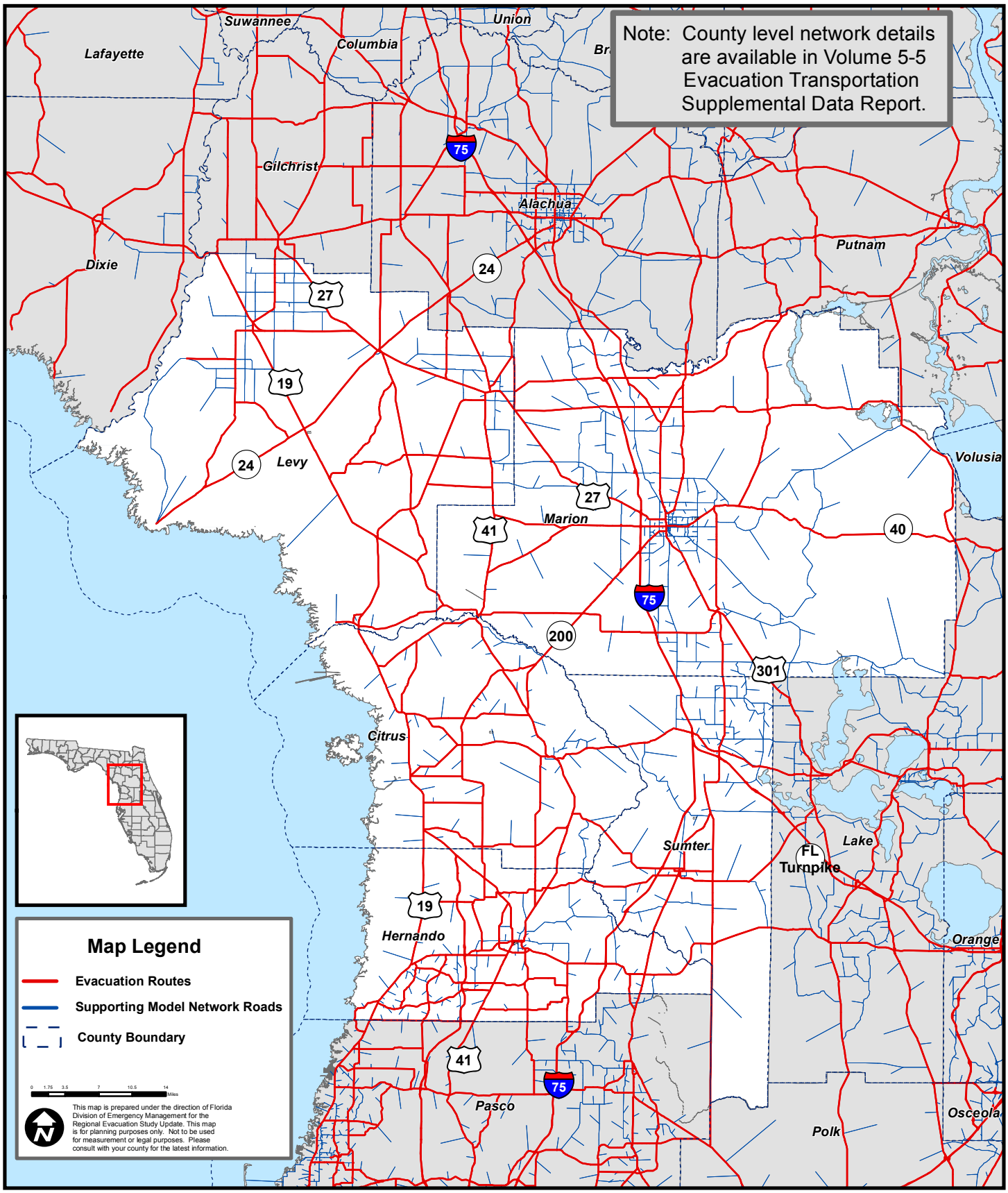


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure III-2

Withlacoochee Regional Model Network



Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: June, 2015

number that is used by the model to connect evacuation trip generation to the evacuation highway network. There is a buffer in zone numbering between counties to allow for future growth in each county.

The final TEZ system for the State of Florida has 17,328 zones. Of the total number of zones in Florida, 363 of the zones are located within the five county Withlacoochee region, as illustrated in Figure III-3. In the Withlacoochee region, Marion County has the largest number of TEZs with 151, and Hernando follows with 71 TEZs. Sumter County has 60 TEZs, while Citrus and Levy Counties have the lowest number of TEZs within the RPC with 55 and 26 zones, respectively. The larger number of TEZs generally reflect counties with denser urban structure and higher population densities.

C. Regional Demographic Characteristics

As discussed in Chapter II, the evacuation model uses the demographic information as input for generating a set of evacuation trips. The demographic data were developed for the following years: 2010, 2015, and 2020.

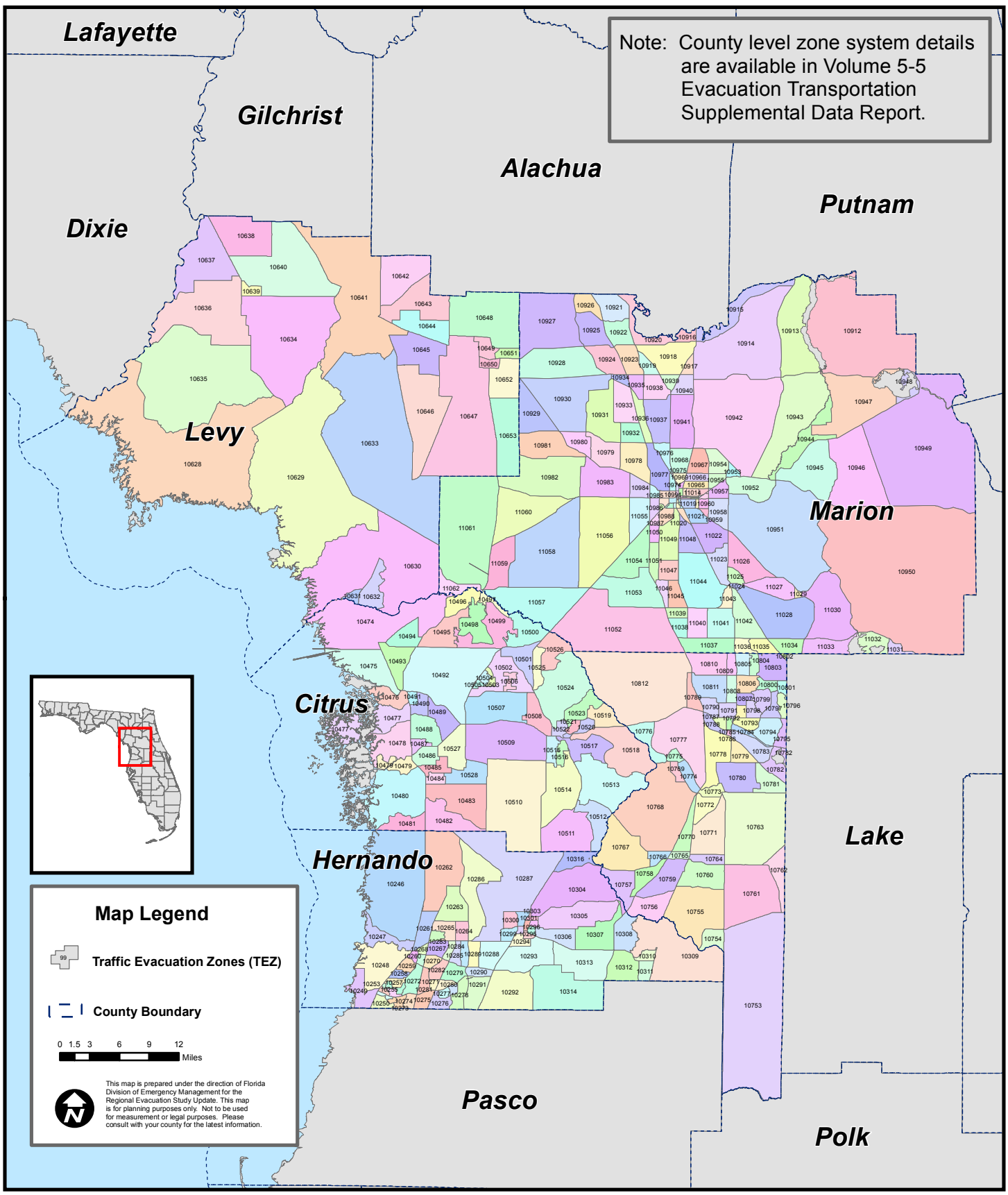
A snapshot of the key demographic data for each county in the Withlacoochee RPC for 2010, 2015 and 2020 is summarized in **Table III-1**. The tables list the number of occupied dwelling units for site built homes, the permanent population in site-built homes, as well as the number of occupied dwelling units for mobile homes and the permanent population in mobile homes. The mobile home category includes RVs and boats and the permanent population in those housing options. The demographic characteristics summary also includes hotels and motels because a number of these units are in vulnerable areas and the proportion of seasonal units and 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. Detailed demographic data for each individual TEZ within the region is included in Volume 5.

Marion County has the largest population in the region during all three time periods. The county is expected to reach approximately 400,000 people by 2020. Hernando County has the second largest population in the region is forecasted to have almost 200,000 people by 2020. Citrus is projected to have the third largest population in the region, exceeding 150,000 by 2020. Sumter County falls just below Citrus at almost 120,000. Of all the counties, Levy County has the smallest population for all three time periods and may reach more than 43,000 people by 2020.

Marion County has the highest number of mobile homes followed by Citrus and Hernando. Levy County has the smallest number of mobile homes in the Withlacoochee region, but these homes, in fact, make up 46% of the total homes in the county.

Figure III-3

Withlacoochee Regional Model Transportation Evacuation Zone (TEZ) System



Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Table III-1 - Withlacoochee Demographic Characteristic Summary

County	Characteristic	Year		
		2010	2015	2020
Citrus	Occupied site-built homes	48,570	50,073	53,715
	Population in site-built homes	104,237	107,457	115,243
	Occupied mobile homes	14,734	15,186	16,296
	Population in mobile homes	34,748	35,824	38,474
	Hotel/motel units	2,155	2,185	2,218
Hernando	Occupied site-built homes	59,704	63,012	69,461
	Population in site-built homes	145,546	153,599	169,294
	Occupied mobile homes	12,041	12,707	14,006
	Population in mobile homes	25,404	26,822	29,591
	Hotel/motel units	3,090	3,102	3,116
Levy	Occupied site-built homes	8,823	9,020	9,595
	Population in site-built homes	21,053	21,520	22,890
	Occupied mobile homes	7,581	7,753	8,243
	Population in mobile homes	19,113	19,547	20,786
	Hotel/motel units	944	950	957
Marion	Occupied site-built homes	108,660	114,869	126,249
	Population in site-built homes	256,001	270,594	297,420
	Occupied mobile homes	29,066	30,730	33,769
	Population in mobile homes	67,058	70,901	77,919
	Hotel/motel units	12,327	12,627	12,936
Sumter	Occupied site-built homes	34,402	40,875	48,748
	Population in site-built homes	70,026	83,212	99,236
	Occupied mobile homes	6,959	8,271	9,867
	Population in mobile homes	14,442	17,160	20,475
	Hotel/motel units	1,748	1,784	1,819

Source: Withlacoochee Regional Planning Council

D. Planned Roadway Improvements

To correspond to the three different sets of demographic data, three model networks were ultimately developed. The base 2010 network, discussed in section A, and two future year networks to correspond to the 2015 demographic data and the 2020 demographic data. The 2010 base model network was updated to reflect roadway capacity improvement projects completed between 2010 and 2015 to create the 2015 network. The 2015 network was then updated to reflect any planned roadway capacity improvement projects expected to be implemented between 2016 and 2020 to create the 2020 network.

The planned roadway improvements that were added to the network generally include only capacity improvement projects such as additional through lanes. **Table III-2** identifies capacity improvement projects completed between 2010 and 2015 that were included in the 2015 network. Likewise, **Table III-3** identifies capacity improvement projects planned for implementation between 2016 and 2020. The tables identify each roadway that will be improved as well as the extent of the improvement. For example, by the end of 2015 in Citrus County, CR 486 from SR 44 to Ottawa Ave will be widened to 4 lanes.

It is important to note that Table III-2 and III-3 are not intended to be all inclusive of every transportation improvement project completed within the region. The tables only identify key capacity improvement projects that impact the evacuation model network and are anticipated to have an impact on evacuation clearance times.

Table III-2 Withlacoochee Region Roadway Improvements, 2015

County	Roadway	From	To	Number of Lanes
Citrus	CR 486	SR 44	Ottawa Ave	4
	US 19 (SR 55)	W Cornflower Dr	W Foss Grove Path	6
Hernando	SR 50 (Cortez Blvd)	US 19 (SR 55)	W of Mariner Blvd	6
	I-75 (SR 93)	N of SR 50	Hernando/Sumter County Lines	6
	I-75 (SR 93)	S of US 98/SR 50/Cortez	N of US 98/SR 50/Cortez	6
	I-75 (SR 93)	Pasco/Hernando County Lines	S of US 98/SR 50/Cortez	6
	SR 50 (Cortez Blvd)	W of Mariner Blvd	SR 589 (Suncoast Pwy)	6
Marion	SW 42nd St	Overpass from SR 200	SW 27th Ave	2
	SR 40	CR 328	SW 80th Ave	4
	SR 35 (Baseline Rd)	S CR 464 (Maricamp Rd)	SR 40	4
	SR 500 (US 27)	N of CR 464B	N of CR 225A	4
Sumter	SR 35 (US 301)	N of CR 466A	CR 214	4
	CR 468	CR 466A	CR 466	4
	Turnpike at CR 468			N/A
	I-75/Turnpike Interchange (SR 44)			8
	I-75 (SR 93)	N of SR 50	Hernando/Sumter County Lines	6

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Withlacoochee Regional Planning Council
Note: Projects included in this table are roadway improvement projects completed between 2010 and 2015 on roadways that are included in the regional transportation model network. Only projects which added roadway capacity, such as additional through lanes, were included. The list is not intended to be all inclusive of every transportation improvement project completed within the region. A list of historical projects completed during the last five years was included in this report because the base regional network developed for the study, along with the base demographic data, is for the year 2010.

Table III-3 Withlacoochee Planned Roadway Improvements, 2020

County	Roadway	From	To	Number of Lanes
Citrus	US 19 (SR 55)	W Green Acres St	W Jump Ct	6
	US 19 (SR 55)	W Jump Ct	W Fort Island Trl	6
Hernando	Suncoast Pkwy	US 98	Hernando/Citrus County Lines	4
	SR 50	Lockhart Rd	E of Remington Rd	6
Sumter	I-75	CR 470	SR 91 (Turnpike)	6
	I-75	Hernando County Line	CR 470	6

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Withlacoochee Regional Planning Council
Note: Projects included in this table are roadway improvement projects planned for completion between 2016 and 2020 on roadways that are included in the regional transportation model network. Only projects which are planned to add roadway capacity, such as additional through lanes, were included. The list is not intended to be all inclusive of every transportation improvement project planned for completion within the region.

E. Behavioral Assumptions

The behavioral assumptions provide important information on the way people respond to an evacuation order and are an important input to the SRESP transportation evacuation model. For the Withlacoochee Region, three counties have evacuation zones corresponding to five categories of storm surge. Evacuation rates for site-built homes and mobile/manufactured homes are provided by county and summarized in **Figure III-4** through **Figure III-9**. Other rates, such as out of county trip rates, vehicle use rates, public shelter use rates, friend/relative refuge use rates, hotel/motel refuge use rates, and other refuge use rates, are detailed by county, storm threat, and evacuation zone in Volume 5-5.

A review of the evacuation rates for the Withlacoochee region illustrates that evacuation participation rates increase as the evacuation level increases, and participation rates for persons living in mobile/manufactured homes are generally higher than for persons living in site-built homes. It should be noted that a certain percentage of the population evacuates, even when they are not living in an area that is ordered to evacuate. These people are commonly referred to as shadow evacuees. Shadow evacuation rates are also included in Figure III-4 through Figure III-9.

For example, if an evacuation order was issued for Citrus County for persons living in evacuation zone A, the county could expect a 60 percent participation rate from persons living in site-built homes in evacuation zone A (Figure III-4) and a 70 percent participation rate from persons living in mobile/manufactured homes in evacuation zone A (Figure III-5). In addition, Citrus County can expect shadow evacuations to occur for persons living in site-built homes at a rate of 30 percent from evacuation zone B, 15 percent from evacuation zone C, 10 percent from evacuation zone D, and 10 percent from evacuation zone E (Figure III-4). Likewise, for persons living in mobile/manufactured homes, Citrus County can expect shadow evacuations to occur at a rate of 65 percent from evacuation zones B and C, and 50 percent each from evacuation zones D and E (Figure III-5).

Figure III-4 Evacuation Participation Rates: Citrus County - Site-Built Homes

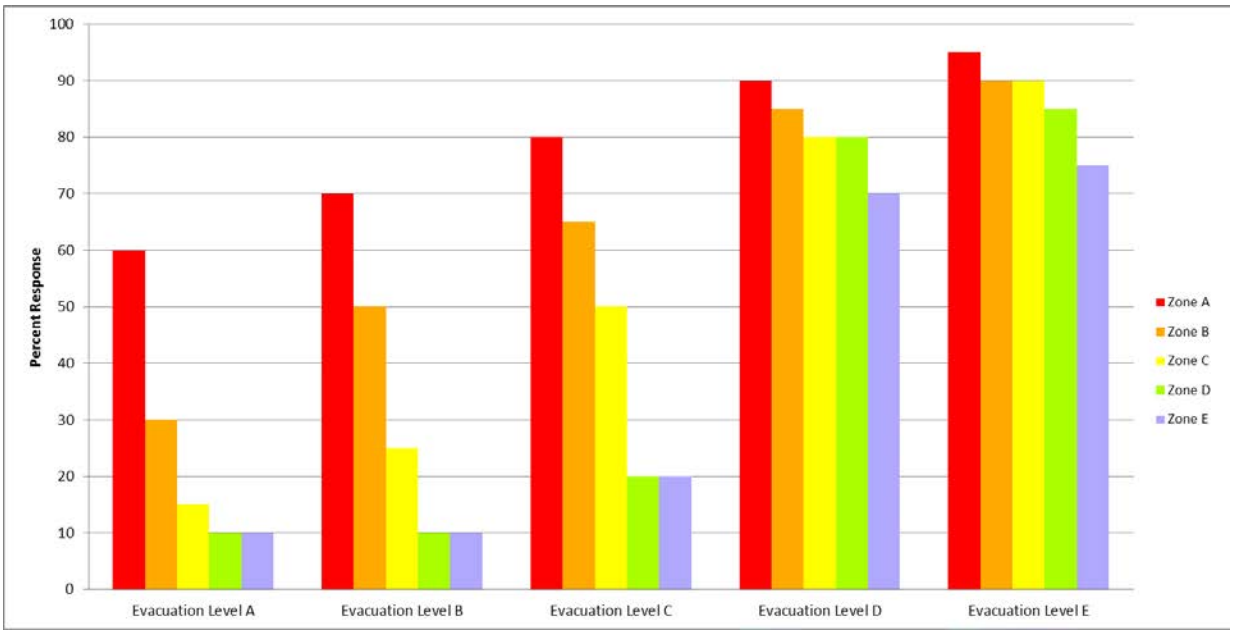


Figure III-5 Evacuation Participation Rates: Citrus County - Mobile Homes

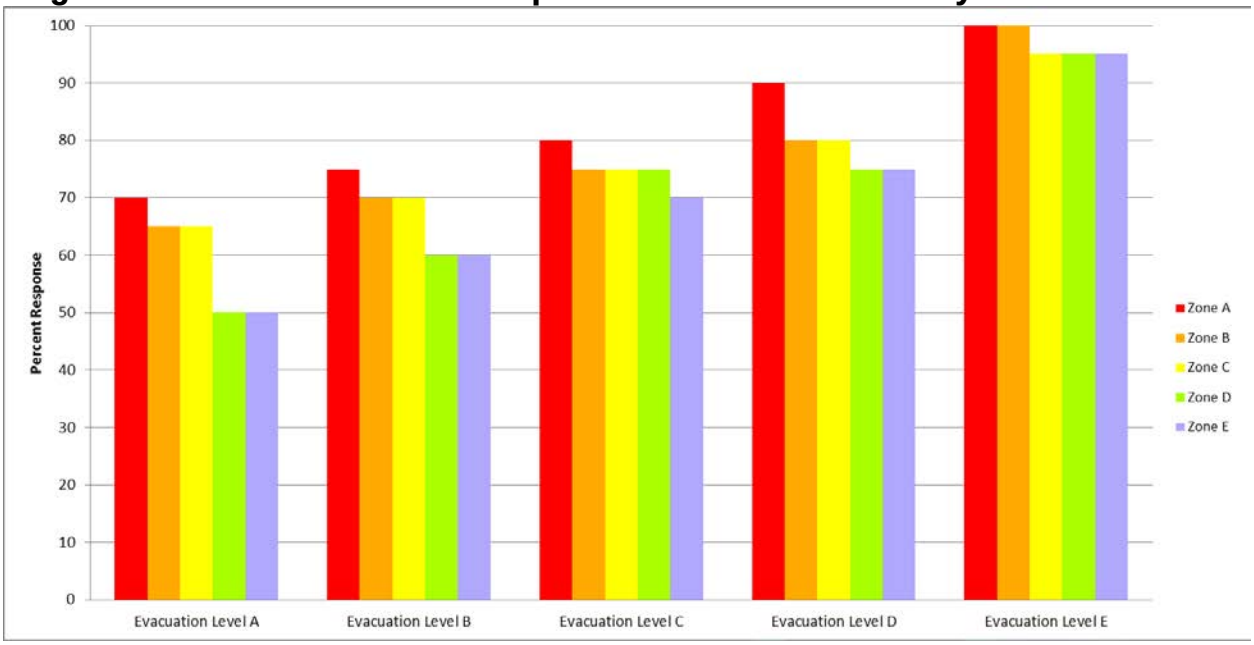


Figure III-6 Evacuation Participation Rates: Hernando County - Site Built Homes

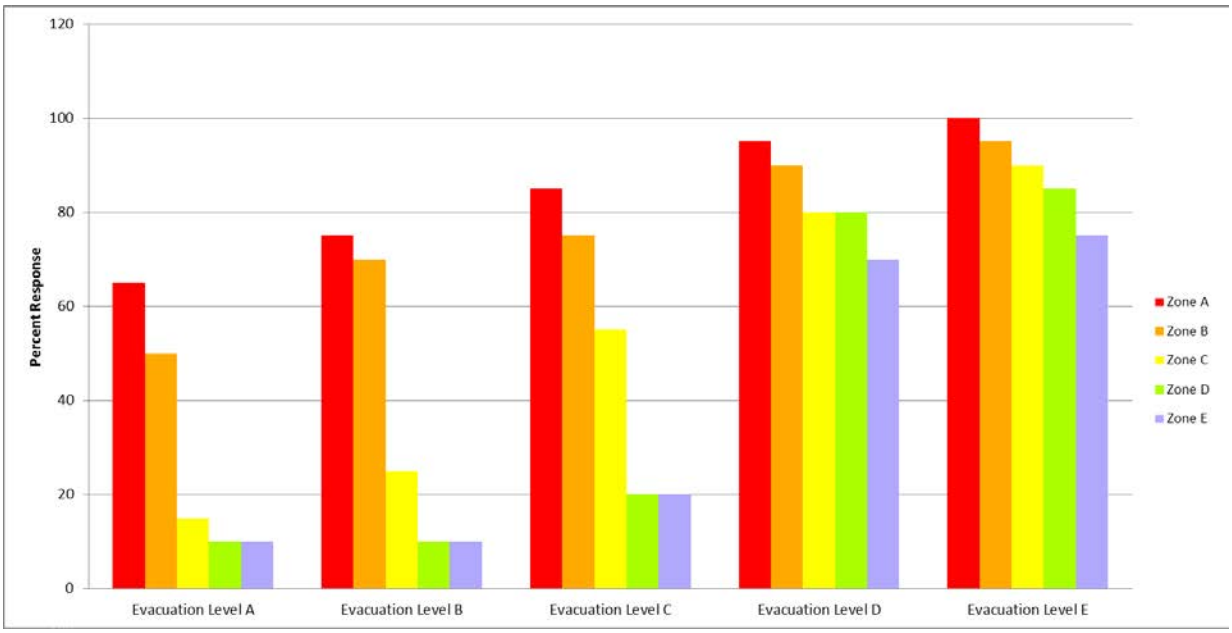


Figure III-7 Evacuation Participation Rates: Hernando County - Mobile Homes

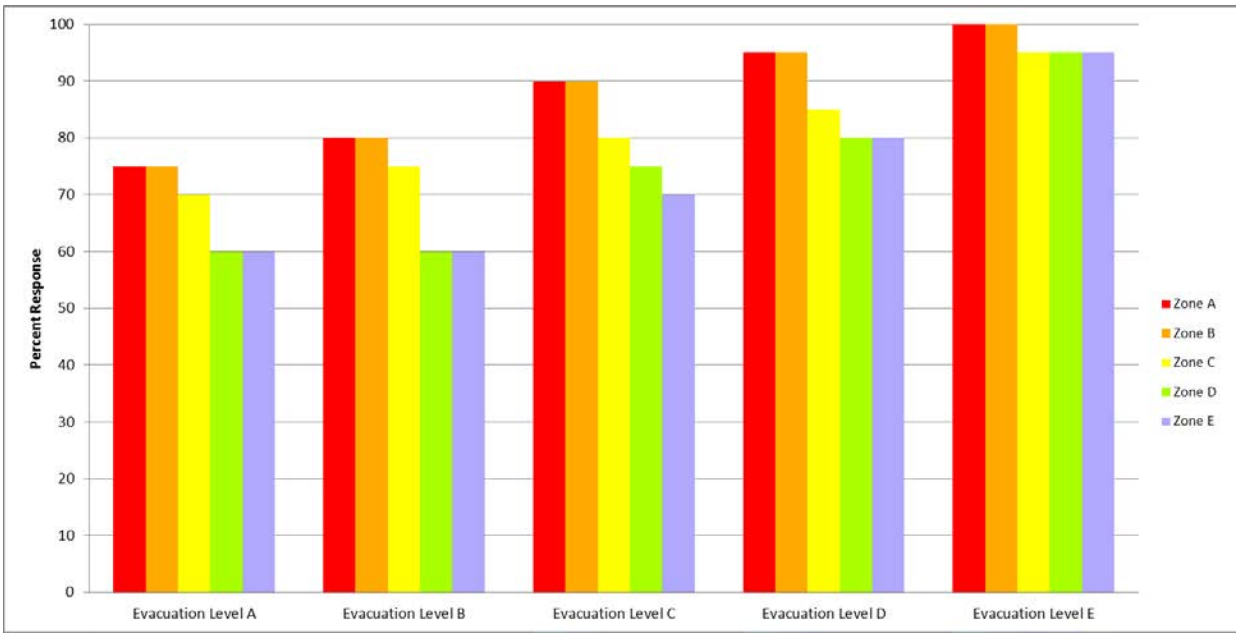


Figure III-8 Evacuation Participation Rates: Levy County - Site Built Homes

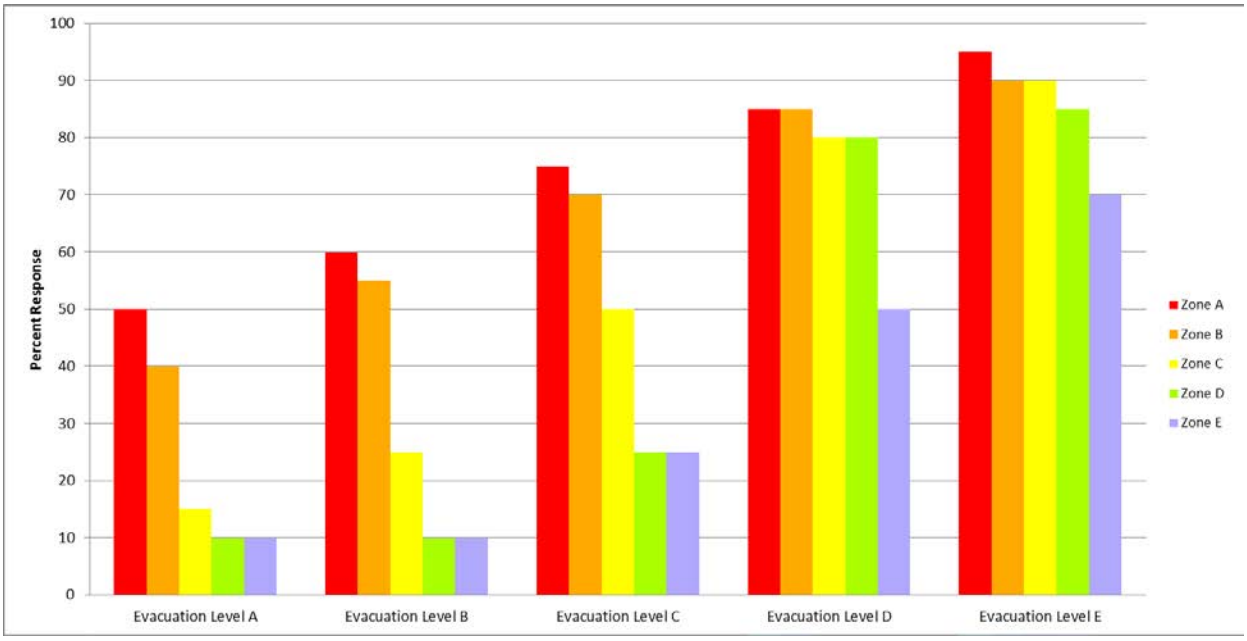
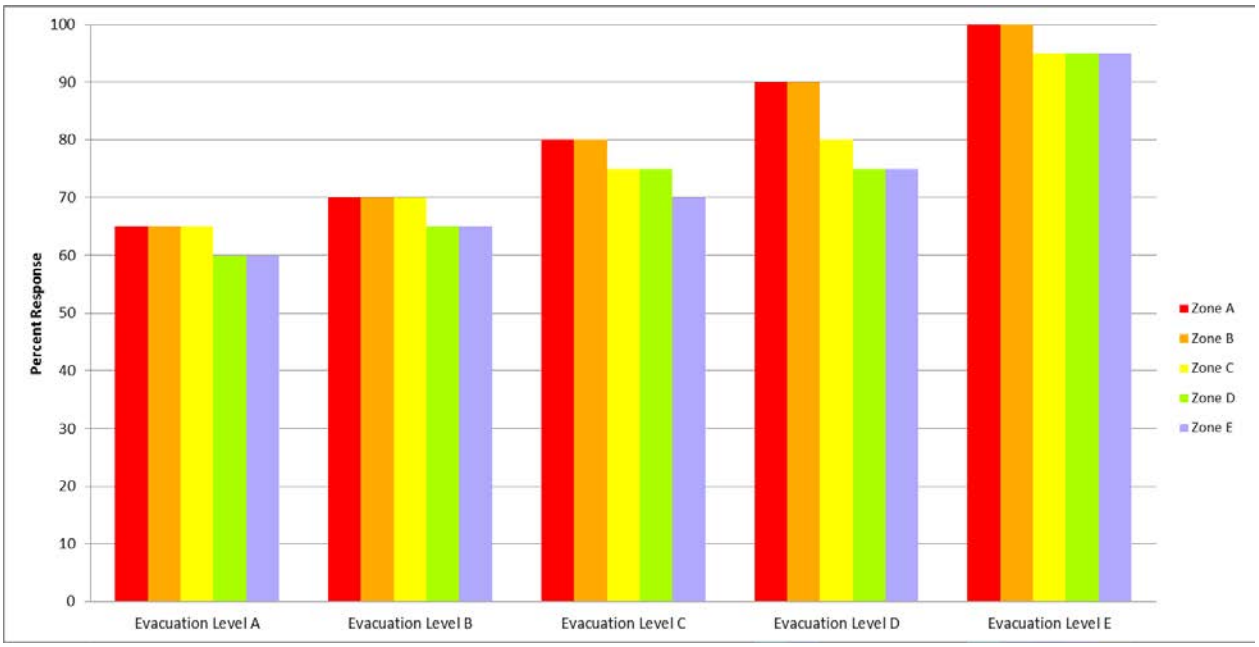


Figure III-9 Evacuation Participation Rates: Levy County - Mobile Homes



F. Shelters

In order for the transportation model to accurately assign public shelter trips to the correct location, a complete list of available public shelters needs to be available. The Withlacoochee RPC compiled the list of available public shelters using information provided by the local county emergency managers. The shelters were categorized as either primary or other, with primary indicating that the shelter is compliant with American Red Cross standards for a shelter and other indicating all other shelters.

In the five county region there are a total of 124 shelters, including 27 in Citrus County, 41 in Marion County, 20 in Hernando County, 22 in Sumter County, and 14 in Levy County. All together, the 124 shelters located within the five county region can host over 29,000 persons during an evacuation event. Detailed lists of the available public shelters by county are included in Volume 5-5.

G. Evacuation Zones

The final input variable that is needed to complete the transportation evacuation model is the delineation of evacuation zones for all coastal counties. Local county emergency managers have the responsibility of identifying and defining evacuation zones for their county. Citrus, Hernando, and Levy Counties within the Withlacoochee region had established their evacuation zones based on the results of the new data and information collected as part of the SRESP in 2010. Evacuation zones for the Withlacoochee Region are illustrated in **Figure III-10**. County level evacuation zones are included in Volume 5-5.

H. TIME User Interface

CDM Smith Associates developed the Transportation Interface for Modeling Evacuations (TIME) to make it easier for RPC staff and transportation planners to use the model and implement the evacuation methodology. The TIME interface is based on an ArcGIS platform and is essentially a condensed transportation model, which provides a user friendly means of modifying input variables that would change the clearance times for various evacuation scenarios.

The evacuation model variables include a set of distinguishing characteristics that could apply to evacuation scenarios as selection criteria. These following variables may be selected using the TIME interface and allow the user to retrieve the best results from various evacuation alternatives:

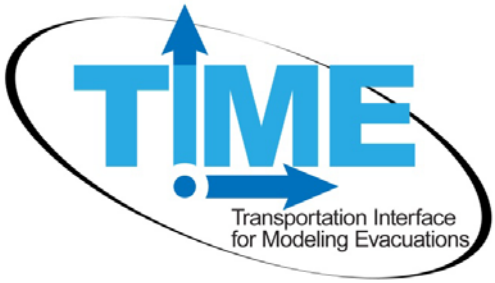
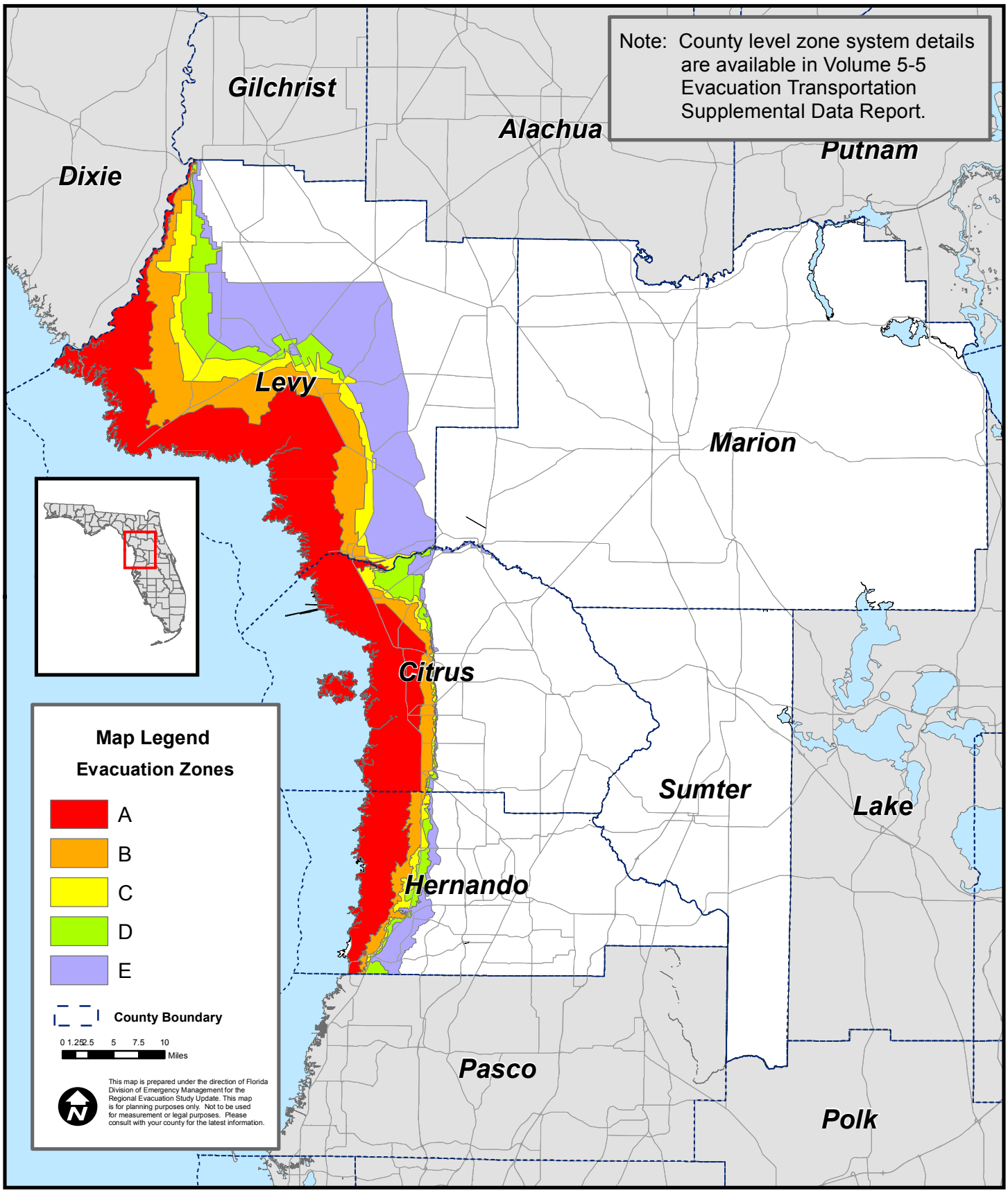


Figure III-10

Withlacoochee Regional Model Transportation Evacuation Zone System



Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: June, 2015

- **Analysis time period -** The first input variable is the evacuation analysis time period. The time period selections include 2010, 2015 and 2020. The time period determines which set of demographic data and which version of the model network will be used.

- **Highway network -** Once the time period is selected, the user must pick either the default highway network or a modified network. The default includes the network corresponding to the selected time period and also incorporates planned highway improvement projects from the Florida Department of Transportation Work Program. In the case that there are any new projects or changes need to be taken into account, the modified network would be chosen. These changes could include possible road or bridge closures because of storm conditions or any managed traffic diversions or traffic control measures.

- **Behavioral response -** The next variable is behavioral response, which is a set of "planning assumptions" that describe the way people respond to an order to evacuate and are an important input to the SRESP Evacuation Model. A user may choose 100% or the survey response. The 100% response indicates that 100% of people in evacuation zones will evacuate, while the survey response uses the percentage of people from the behavioral planning assumptions corresponding to the evacuation level for each county.

- **One-way evacuation operations -** Another variable for consideration is whether to allow one-way evacuation operations or not. One-way evacuation operations allow the user to take into account the FDOT one-way evacuation operations plans for major facilities, including I-75 northbound from Tampa.

- **University population -** The model permits the user to incorporate the population in university housing since this data is not included in the regular population numbers. The default assumption is that the region's universities are at the maximum housing capacity housing during the Fall/Spring semester. The other options available are the summer university population, which is generally much less than the fall or spring, and an option for no school in session.

- **Tourist occupancy rates -** The RPC has the option to choose the default rates or to modify those rates based on any special circumstance they may have for tourist rates since there are different tourist seasons, sectors and special events. If modified rates are desired, then the user may select no tourist occupancy or modify the rates on a county by county basis.

- **Shelters -** When choosing which shelters are open to the public during an evacuation event, the user may select either primary shelters or other shelters, both primary and other shelters, and/or modified. In many situations, the shelters category may need to be modified because of availability or capacity changes.

- **Counties evacuating -** The evacuating counties are the counties within the geographic extent of Withlacoochee's model network and include both coastal and inland counties. The coastal counties include Dixie, Levy, Citrus, Hernando, Pasco, Pinellas, Hillsborough, Manatee, Flagler, and Volusia Counties. The inland counties are Marion, Sumter, Gilchrist, Alachua, Putnam, Lake, Seminole, Orange, Osceola, and Polk

Counties. The user has the opportunity to pick which of the counties in the network actually evacuate.

- **Evacuation level -** Once the evacuating counties are chosen, the evacuation level is designated. The evacuation levels range from A to E and represent the evacuation zones that are ordered to evacuate. The user may also select "none", which assumes that no evacuations are made within the selected county; only regular background traffic will occur.

- **Response curve hours –** The user must define which evacuation response curve will be applied to each evacuating county in the area. The evacuation response curves show the proportion of evacuation by increment of time for evacuation orders that were issued. There are six different curves to from which to choose: a 6-hour curve, 9-hour curve, 12-hour curve, 18-hour curve, 24-hour curve, and a 36-hour curve. The faster curves represent more urgent circumstances and slower curves represent less urgent circumstances.

- **Evacuation Phasing –** The phase selection indicates when an evacuation would begin in a given county. There are ten different options beginning in hour 1 and extending to hour 27. After hour 3, the other phasing options follow in 3 hour increments.

CHAPTER IV
TRANSPORTATION ANALYSIS

The transportation analysis brings together key factors such as evacuation level, transportation network, shelters, and evacuation population, and explicitly links people's behavioral responses to the regional evacuation infrastructure. The results of this analysis help to formulate effective and responsive evacuation policy options. Two distinct sets of analyses were conducted using the SRESP evacuation transportation model, including one set of analysis for growth management purposes and one set of analysis for emergency management purposes. The results of this analysis are discussed in this chapter.

A. Vulnerable Population

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 vulnerable population for the Withlacoochee Region for 2015 is identified in **Table IV-1**, summarized by evacuation zone and split between site-built homes and mobile/manufactured homes. Vulnerable population for 2020 is summarized in **Table IV-2**.

The vulnerable population in the Withlacoochee Region includes only Citrus, Hernando, and Levy Counties, as these are the only coastal counties in the region. The vulnerable population varies by evacuation zone. Citrus County, for example, has ALMOST 19,000 vulnerable residents in evacuation zone A and only slightly more than 2,000 vulnerable residents in evacuation zone C in 2015. In Citrus and Hernando Counties, the vulnerable population living in site-built homes far exceeds the vulnerable population living in mobile/manufactured homes. However, in Levy County, the vulnerable population in site-built homes is about the same as the vulnerable population in mobile/manufactured homes.

In addition, based again on the demographic data, behavioral assumptions, and evacuation zones, the planned destinations of vulnerable population in each county could be determined by evacuation level. Destinations include friends and family, hotel/motel, public shelter, and other locations. Vulnerable population destinations for the Withlacoochee Region are identified in **Table IV-3** for 2015 and in **Table IV-4** for 2020.

In all cases in the Withlacoochee Region, the vulnerable population is far more likely to stay with friends and family during an evacuation. This is followed by hotel/motel and other locations. In all cases, public shelter destinations are identified as the least likely destination of the vulnerable population during an evacuation event.

The vulnerable shadow population is provided in **Table IV-5** for both 2015 and 2020. The vulnerable shadow population was determined using the behavioral assumptions for evacuating shadow population and is based on evacuation level (storm category), not evacuation zone. Vulnerable shadow population for the five county region ranges from 247,000 to 332,000 persons for 2015, depending upon the evacuation level.

Table IV-1 – Vulnerable Population in the Withlacoochee Region for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Citrus County					
Site-built Homes	13,058	7,446	1,309	4,131	2,234
Mobile/Manuf. Homes	5,726	4,815	959	1,139	916
TOTAL	18,784	12,261	2,268	5,271	3,149
Hernando County					
Site-built Homes	4,235	1,836	3,097	8,001	32,410
Mobile/Manuf. Homes	511	136	316	1,224	1,906
TOTAL	4,746	1,972	3,413	9,225	34,315
Levy County					
Site-built Homes	1,493	1,111	446	320	1,398
Mobile/Manuf. Homes	1,031	1,047	701	382	1,616
TOTAL	2,523	2,158	1,147	702	3,014

Note: Vulnerable population determined using SRESP behavioral 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.

Table IV-2 – Vulnerable Population in the Withlacoochee Region for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Citrus County					
Site-built Homes	14,009	7,987	1,403	4,429	2,393
Mobile/Manuf. Homes	6,141	5,168	1,030	1,226	986
TOTAL	20,150	13,155	2,433	5,655	3,379
Hernando County					
Site-built Homes	4,668	2,024	3,415	8,819	35,721
Mobile/Manuf. Homes	563	149	347	1,349	2,103
TOTAL	5,231	2,174	3,761	10,168	37,824
Levy County					
Site-built Homes	1,589	1,181	475	341	1,488
Mobile/Manuf. Homes	1,095	1,113	745	405	1,717
TOTAL	2,684	2,294	1,219	746	3,205

Note: Vulnerable population determined using SRESP behavioral 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.

Table IV-3 – Vulnerable Population by Destination for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Citrus County					
To Friends and Family	11,923	7,729	1,426	3,369	2,001
To Hotel/ Motel	2,531	1,598	292	791	472
To Public Shelter	1,226	854	201	387	224
To Other Destination	3,104	2,080	349	724	451
Hernando County					
To Friends and Family	3,085	1,282	2,218	5,996	22,305
To Hotel/ Motel	712	296	512	1,384	5,147
To Public Shelter	288	112	279	762	2,783
To Other Destination	661	282	403	1,082	4,080
Levy County					
To Friends and Family	1,336	1,134	596	367	1,577
To Hotel/ Motel	430	376	207	124	533
To Public Shelter	178	160	150	89	382
To Other Destination	579	487	194	121	522

Note: Vulnerable population destinations determined using SRESP behavioral 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.

Table IV-4 – Vulnerable Population by Destination for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Citrus County					
To Friends and Family	12,790	8,292	1,530	3,614	2,147
To Hotel/ Motel	2,715	1,715	313	848	507
To Public Shelter	1,315	916	215	416	241
To Other Destination	3,330	2,232	374	777	484
Hernando County					
To Friends and Family	3,400	1,413	2,445	6,609	24,586
To Hotel/ Motel	785	326	564	1,525	5,674
To Public Shelter	318	124	308	840	3,068
To Other Destination	728	311	444	1,193	4,497
Levy County					
To Friends and Family	1,422	1,206	633	390	1,677
To Hotel/ Motel	457	400	220	132	567
To Public Shelter	189	170	159	95	406
To Other Destination	616	518	207	129	555

Note: Vulnerable population destinations determined using SRESP behavioral 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.

Table IV-5 – Vulnerable Shadow Evacuation Population

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2015					
Citrus County	42,489	35,806	39,118	46,416	51,889
Hernando County	42,346	41,868	50,012	73,954	60,351
Levy County	21,218	19,891	20,174	21,741	21,976
Marion County	111,434	124,958	138,482	152,006	152,006
Sumter County	29,617	33,772	37,927	42,081	46,236
2020					
Citrus County	45,569	38,383	41,935	49,751	55,616
Hernando County	46,709	46,164	55,148	81,537	66,495
Levy County	22,522	21,103	21,406	23,072	23,320
Marion County	122,448	137,312	152,176	167,040	167,040
Sumter County	35,328	40,282	45,235	50,189	55,143

Note: Vulnerable shadow population determined using SRESP behavioral data and county provided evacuation zones.

B. Clearance Time Definitions

The determination of clearance time is one of the most important outcomes from the evacuation transportation analysis. Calculated clearance times are used by county emergency managers as one input to determine when to recommend an evacuation order. This calculation can include the population-at-risk, shadow evacuees, as well as evacuees from other counties anticipated to pass through the county. Clearance time is developed to include the time required for evacuees to secure their homes and prepare to leave, the time spent by all vehicles traveling along the evacuation route network, and the additional time spent on the road caused by traffic and road congestion. Clearance time does not relate to the time any one vehicle spends traveling along the evacuation route network, nor does it guarantee vehicles will safely reach their destination once outside the County. The Glossary of the SRESP contains the agreed upon language of the four clearance times that are calculated as part of the evacuation transportation analysis. Below provides a simplified explanation of these clearance times:

- **Clearance Time to Shelter** - The time necessary for all in-County trips to have reached their destination within the County. This does not mean all traffic movement in the County has ended; rather it means that everyone going to a point of safety AND that point is in the County, has reached their shelter. While this is primarily a growth management number, it gives emergency managers information about how long it will take for shelters to fill-up once an evacuation order is given. Key points to remember for clearance time to shelter include:
  - o All in-county trips reach their destination within the county; and,
  - o This definition does not include any out of county trips.

- **In-County Clearance Time** - The time necessary for all in-County trips to have reached their destination AND all out of county trips have left the Evacuation Zone AND traffic originating from outside the County that passes through the Evacuation Zone has also cleared the Zone. This does not mean all traffic movement in the County has ended; rather it means that everyone going to a point of safety AND that point is in the County, has reached their shelter AND the Evacuation Zone is clear. This gives you vital planning information regarding how long it will take to clear the most vulnerable zones once an evacuation order is given. Key points to remember for in-county clearance time include:
  - o All in-county trips reach their destination within the county;
  - o All out of county trips exit the evacuation zone, but may still be located in the county; and,
  - o This definition does not include out-of-county pass-through trips from adjacent counties, unless they evacuate through an evacuation zone.

- **Out of County Clearance Time** - The time necessary for all in-County trips to have reached their destination AND all out of county trips have left the County AND traffic originating from outside the County that pass through the County has also cleared the County. This does not mean all traffic movement in the County has ended; rather it means that everyone going to a point of safety has reached their shelter or left the County. Key points to remember for out of county clearance time include:
  - o The roadway network within the county is clear;
  - o All out of county trips exit the county, including out of county pass-through trips from adjacent counties; and,

- All in-county trips reach their destination.

- **Regional Clearance Time** - The time that is the highest time for any County Clearance time in the designated region. Calculated from last vehicle assigned an external destination exits the region. Key points to remember for regional clearance time include:
  - The roadway network within the RPC is clear;
  - All out of county trips exit the RPC, including out of county pass-through trips from adjacent counties;
  - All in-county trips reach their destination; and,
  - Regional clearance time is equal to the largest out of county clearance time for a given scenario for any of the counties within the RPC, since the out of county clearance time includes out of county pass through trips from adjacent counties.

C. Evacuation Model Scenarios

There are literally thousands of possible combinations of variables that can be applied using the evacuation transportation model, which will result in thousands of possible outcomes. For the purposes of this analysis, two distinct sets of analyses were conducted using the SRESP evacuation transportation model, including one set of analysis for growth management purposes and one set of analysis for emergency management purposes. The two sets of analysis include the following:

- **Base Scenarios** – The base scenarios were developed to estimate a series of worst case scenarios and are identical for all eleven RPCs across the State. These scenarios assume 100 percent of the vulnerable population evacuates and includes impacts from counties outside of the RPC area. These scenarios are generally designed for growth management purposes, in order to ensure that all residents that choose to evacuate during an event are able to do so; and,

- **Operational Scenarios** – The operational scenarios were developed by the RPCs in coordination with local county emergency managers and are designed to provide important information to emergency management personnel to plan for different storm events. These scenarios are different from region to region and vary for each evacuation level.

Because of the numerous possible combinations of variables that can be applied in the model, the evacuation transportation model is available for use through the Withlacoochee RPC to continue testing combinations of options and provide additional information to emergency managers.

D. Base Scenarios

A total of ten base scenarios were developed through discussions with the SRESP Statewide Work Group and are identical for all eleven RPCs. The SRESP requires a consistent set of base scenarios that will be used by all regions across the State to provide a consistent background between regions. The base scenarios also allow the results to be used consistently from region to region for other purposes, such as growth management. The ten base scenarios were developed to include the following assumptions:

- **Analysis Time Period** – Five scenarios for the 2015 time period and five scenarios for the 2020 time period. The five scenarios for each time period include one for each of the five evacuation levels, A, B, C, D, and E;

- **Highway Network** – The five 2015 scenarios use the 2015 network and the five 2020 scenarios use the 2020 network, which includes planned roadway capacity improvement projects expected to be implemented by 2020;

- **One-Way Evacuation Operations** – The base scenarios do not include implementation of any one-way evacuation operations;

- **University Population** – The base scenarios use the fall/spring semester data to estimate evacuation trips by the student population. This data was provided by each RPC as part of the demographic small area data;

- **Tourist Occupancy Rates** – The base scenarios use the default hotel/motel occupancy rates to estimate tourist evacuation trips. This data was provided by each RPC as part of the demographic small area data;

- **Shelters** – The base scenarios assume all designated primary shelters within each county in the model network are open. The base scenarios do not include shelters that are designated as other shelters, only primary shelters;

- **Response Curve** – The 12-hour response curve is used for all ten base scenarios;

- **Evacuation Phasing** - All counties that are evacuating begin at same time, within 1 hour of the evacuation order being given;

- **Behavioral Response** - For all five evacuation levels (A, B, C, D, or E) in both the 2015 and 2020 time periods, the behavioral response for the base scenarios includes the following:
  - 100% response in evacuation zones for both mobile homes and site built homes for the counties in the RPC, plus one coastal county on either side of the region (includes Citrus, Levy, Hernando, Pasco, and Dixie Counties);
  - 100% response for mobile homes in inland areas for the counties in the RPC, plus one coastal county on either side of the region (includes Citrus, Levy, Hernando, Marion, Sumter, Pasco, and Dixie Counties);
  - Planning Assumption response (shadow evacuation) for site built homes in inland areas for the counties in the RPC plus one coastal county on either side of the region (includes Citrus, Levy, Hernando, Marion, Sumter, Pasco, and Dixie Counties); and,
  - For the remaining counties in the Withlacoochee model network, no evacuations are assumed, including shadow evacuations.

The ten base scenarios are summarized in **Table IV-6**.

Table IV-6 – Base Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C 2015	Scenario 4 Level D 2015	Scenario 5 Level E 2015
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco
	Scenario 6 Level A 2020	**Scenario 7 Level B 2020**	**Scenario 8 Level C 2020**	**Scenario 9 Level D 2020**	**Scenario 10 Level E 2020**
Demographic Data	2020	2020	2020	2020	2020
Highway Network	2020	2020	2020	2020	2020
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco

E. Base Scenario Results

Each of the ten base scenarios were modeled for the Withlacoochee Region using the regional evacuation model. Results were derived from the model to summarize the evacuating population, evacuating vehicles, clearance times, and critical congested roadways. Each of these results are discussed in the following sections.

Evacuating Population

It is important to determine the evacuating population for each of the base scenarios in order to understand the magnitude of the evacuation effort, including estimated population that is evacuating and the county level shelter demand. Evacuating population for the base scenarios is summarized by county for 2015 in **Table IV-7** and for 2020 in **Table IV-8**.

Within the five county region, total evacuating population ranges from more than 273,000 persons for a base scenario level A evacuation to more than 437,000 persons for a base scenario level E evacuation in 2015. By 2020, this range increases within the five counties to nearly 301,000 persons for a base scenario level A evacuation and almost 482,000 persons for a base scenario level E evacuation.

Evacuating Vehicles

From a transportation standpoint, the number of evacuating vehicles is more important than the evacuating population. Evacuating vehicles for the base scenarios is summarized by county for 2015 in **Table IV-9** and for 2020 in **Table IV-10**.

The total number of evacuating vehicles within the five county region for the base scenarios also varies by evacuation level. A total of more than 155,000 vehicles evacuate from the five county RPC for a base scenario level A evacuation in 2015, and this number increases to more than 244,000 evacuating vehicles from the five county region for a base scenario level E evacuation in 2015. By 2015, the number of evacuating vehicles is expected to increase to more than 170,000 vehicles for a base scenario level A evacuation and almost 269,000 evacuating vehicles for a base scenario level E evacuation.

Shelter Demand

Shelter demand is another critical piece of the evacuating population, and shelter demand estimates by county are summarized for each of the base scenarios in **Table IV-11**. Shelter demand is the population in each county who will seek public shelter during their evacuation, either at an in-county shelter or an out of county shelter.

Public shelter demand in the five county region ranges from more than 33,000 persons for the base scenario level A evacuation in 2015 to more than 58,000 persons for the base scenario level E evacuation. By 2020, the public shelter demand is expected to increase to more than 37,000 persons for the level A evacuation and more than 64,000 persons for the level E evacuation.

Table IV-7 – Evacuating Population by Base Scenario for 2015

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Citrus					
Site-built Homes	24,050	29,390	34,970	47,317	55,915
Mobile/Manuf. Homes	35,819	35,819	35,819	35,819	35,819
Tourists	1,404	1,642	1,642	1,864	1,888
TOTAL	61,273	66,851	72,431	85,000	93,622
Hernando					
Site-built Homes	20,032	21,256	32,812	65,810	85,919
Mobile/Manuf. Homes	26,862	26,862	26,862	26,862	26,862
Tourists	198	468	468	637	1,240
TOTAL	47,092	48,586	60,142	93,309	114,021
Levy					
Site-built Homes	3,853	4,565	5,995	8,259	11,470
Mobile/Manuf. Homes	19,542	19,542	19,542	19,542	19,542
Tourists	346	465	465	469	507
TOTAL	23,741	24,572	26,002	28,270	31,519
Marion					
Site-built Homes	40,571	54,095	67,619	81,143	81,143
Mobile/Manuf. Homes	70,863	70,863	70,863	70,863	70,863
Tourists	0	0	0	0	0
TOTAL	111,434	124,958	138,482	152,006	152,006
Sumter					
Site-built Homes	12,464	16,619	20,774	24,928	29,083
Mobile/Manuf. Homes	17,153	17,153	17,153	17,153	17,153
Tourists	0	0	0	0	0
TOTAL	29,617	33,772	37,927	42,081	46,236

Table IV-8 – Evacuating Population by Base Scenario for 2020

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Citrus					
Site-built Homes	25,795	31,526	37,511	50,753	59,973
Mobile/Manuf. Homes	38,482	38,482	38,482	38,482	38,482
Tourists	1,442	1,680	1,680	1,909	1,933
TOTAL	65,719	71,688	77,673	91,144	100,388
Hernando					
Site-built Homes	22,113	23,471	36,216	72,605	94,779
Mobile/Manuf. Homes	29,629	29,629	29,629	29,629	29,629
Tourists	198	468	468	637	1,245
TOTAL	51,940	53,568	66,313	102,871	125,653
Levy					
Site-built Homes	4,100	4,857	6,379	8,787	12,202
Mobile/Manuf. Homes	20,751	20,751	20,751	20,751	20,751
Tourists	355	474	474	478	516
TOTAL	25,206	26,082	27,604	30,016	33,469
Marion					
Site-built Homes	44,592	59,456	74,320	89,184	89,184
Mobile/Manuf. Homes	77,856	77,856	77,856	77,856	77,856
Tourists	0	0	0	0	0
TOTAL	122,448	137,312	152,176	167,040	167,040
Sumter					
Site-built Homes	14,861	19,815	24,768	29,722	34,676
Mobile/Manuf. Homes	20,467	20,467	20,467	20,467	20,467
Tourists	0	0	0	0	0
TOTAL	35,328	40,282	45,235	50,189	55,143

Table IV-9 – Evacuating Vehicles by Base Scenario for 2015

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Citrus					
Site-built Homes	14,457	17,705	20,906	27,933	32,791
Mobile/Manuf. Homes	21,603	21,603	21,603	21,603	21,603
Tourists	638	746	746	847	858
TOTAL	36,698	40,054	43,255	50,383	55,252
Hernando					
Site-built Homes	11,095	11,864	18,220	36,041	46,615
Mobile/Manuf. Homes	15,742	15,742	15,742	15,742	15,742
Tourists	90	213	213	290	564
TOTAL	26,927	27,819	34,175	52,073	62,921
Levy					
Site-built Homes	2,174	2,604	3,396	4,581	6,290
Mobile/Manuf. Homes	10,617	10,617	10,617	10,617	10,617
Tourists	157	211	211	213	230
TOTAL	12,948	13,432	14,224	15,411	17,137
Marion					
Site-built Homes	21,195	28,260	35,325	42,390	42,390
Mobile/Manuf. Homes	40,014	40,014	40,014	40,014	40,014
Tourists	0	0	0	0	0
TOTAL	61,209	68,274	75,339	82,404	82,404
Sumter					
Site-built Homes	6,887	9,183	11,479	13,775	16,071
Mobile/Manuf. Homes	10,463	10,463	10,463	10,463	10,463
Tourists	0	0	0	0	0
TOTAL	17,350	19,646	21,942	24,238	26,534

Table IV-10 – Evacuating Vehicles by Base Scenario for 2020

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Citrus					
Site-built Homes	15,510	18,995	22,429	29,968	35,178
Mobile/Manuf. Homes	23,193	23,193	23,193	23,193	23,193
Tourists	655	763	763	868	878
TOTAL	39,358	42,951	46,385	54,029	59,249
Hernando					
Site-built Homes	12,248	13,100	20,110	39,761	51,416
Mobile/Manuf. Homes	17,347	17,347	17,347	17,347	17,347
Tourists	90	213	213	290	566
TOTAL	29,685	30,660	37,670	57,398	69,329
Levy					
Site-built Homes	2,314	2,774	3,616	4,876	6,693
Mobile/Manuf. Homes	11,272	11,272	11,272	11,272	11,272
Tourists	162	216	216	217	235
TOTAL	13,748	14,262	15,104	16,365	18,200
Marion					
Site-built Homes	23,291	31,054	38,818	46,581	46,581
Mobile/Manuf. Homes	43,946	43,946	43,946	43,946	43,946
Tourists	0	0	0	0	0
TOTAL	67,237	75,000	82,764	90,527	90,527
Sumter					
Site-built Homes	8,214	10,951	13,689	16,427	19,165
Mobile/Manuf. Homes	12,484	12,484	12,484	12,484	12,484
Tourists	0	0	0	0	0
TOTAL	20,698	23,435	26,173	28,911	31,649

Table IV-11 – Shelter Demand by Base Scenario

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2015					
Citrus	4,891	5,208	7,219	12,062	13,374
Hernando	5,842	5,937	6,976	9,820	11,609
Levy	3,232	3,278	3,465	3,765	4,203
Marion	13,283	15,244	17,205	19,166	19,166
Sumter	6,420	7,269	8,118	8,969	9,818
2020					
Citrus	5,247	5,583	7,744	12,941	14,347
Hernando	6,442	6,543	7,689	10,824	12,793
Levy	3,430	3,482	3,680	3,998	4,464
Marion	14,593	16,746	18,901	21,057	21,057
Sumter	7,657	8,671	9,685	10,697	11,711

Note: Shelter demand is the population in each county who will seek public shelter during their evacuation, either at an in-county shelter or an out of county shelter.

Congested Roadways

Another important component of the transportation analysis is the identification of critical roadway segments for evacuation traffic. This analysis includes a review of vehicle flows during the evacuation period, along with excessive vehicle queues. A summary of the total number of evacuating vehicles for each of the base scenarios is presented in **Table IV-12**. It is important to note that the total number of evacuating vehicles in the table below includes vehicles evacuating from the two coastal counties on either side of the RPC, in addition to the five counties within the RPC, for a total of seven evacuating counties.

Table IV-12 – Total Evacuating Vehicles for Base Scenarios

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
2015	252,865	285,614	345,744	398,307	432,293
2020	273,519	308,593	374,304	431,918	470,058

The identification of critical roadways in the evacuation network is also important to assist emergency managers with identifying roadways that have the greatest impact on clearance times. Critical roadways were identified by reviewing roadways in the model network that have the highest vehicle queues for extended periods of time during an evacuation. Due to the nature of a major evacuation in general, nearly all roadway facilities will have extended vehicle queues at some point during the evacuation process. The point of this analysis is to identify those roadway facilities that have vehicle queues for the longest time periods during each of the evacuation scenarios. Critical roadway segments for the Withlacoochee Region are identified in **Figures IV-1** through **IV-10** for each of the base scenarios for 2015 and 2020.

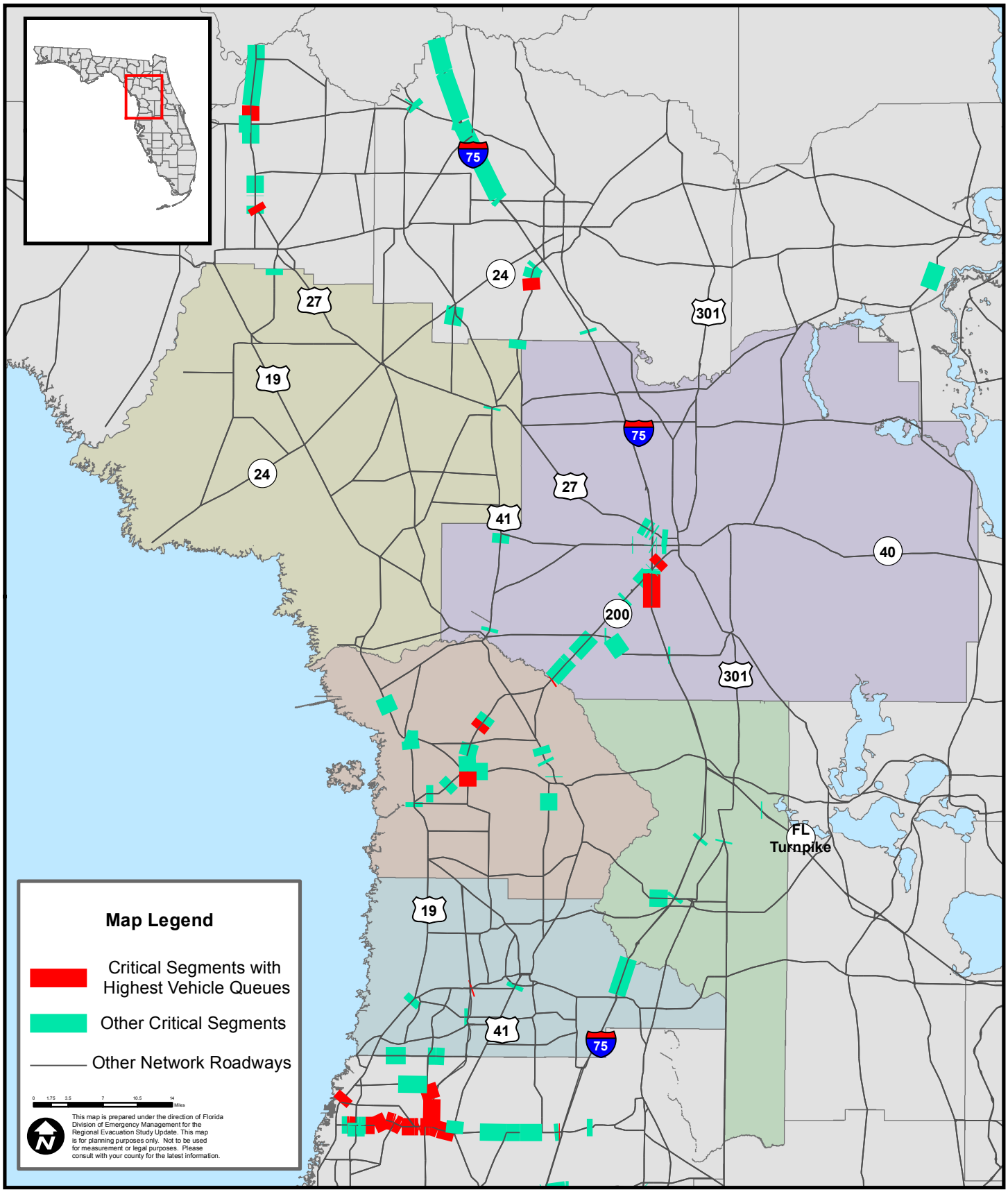
Through a review of the critical roadway segment figures, it is clear that I-75, US 19, US 301, and portions of SR 200 and US 41 are critical facilities for all evacuation scenarios. During the level A evacuation scenarios, the roadway segments with the highest vehicle queues are primarily concentrated along the major Interstate and State Highway system. In contrast, for the level E evacuation scenarios, the roadway segments with the highest vehicle queues include other roadways within the region.

In addition to the identification of critical roadway segments, the total number of evacuating vehicles entering and exiting each county by evacuation scenario was also determined. Evacuating vehicles exiting each county by major evacuation route are identified in **Table IV-13** for 2015 and **Table IV-14** for 2020. In addition, evacuating vehicles entering each county by major evacuation route are identified in **Table IV-15** for 2015 and **Table IV-16** for 2020. Detailed volume figures for all evacuation routes in the Withlacoochee Region for each base scenario are included in Volume 5-5.

The number of vehicles entering and exiting each county during an evacuation varies widely depending upon the scenario, roadway, and county. As expected, major interstates and state highways generally carry larger volumes of evacuating traffic. The vehicle flows into and out of each county also generally follow the same pattern as the critical segment figures, as locations with higher queues and congestion generally have higher traffic volumes.

Figure IV-1

Critical Roadway Segments with Excessive Vehicle Queues for 2015 Base Scenario Evacuation Level A

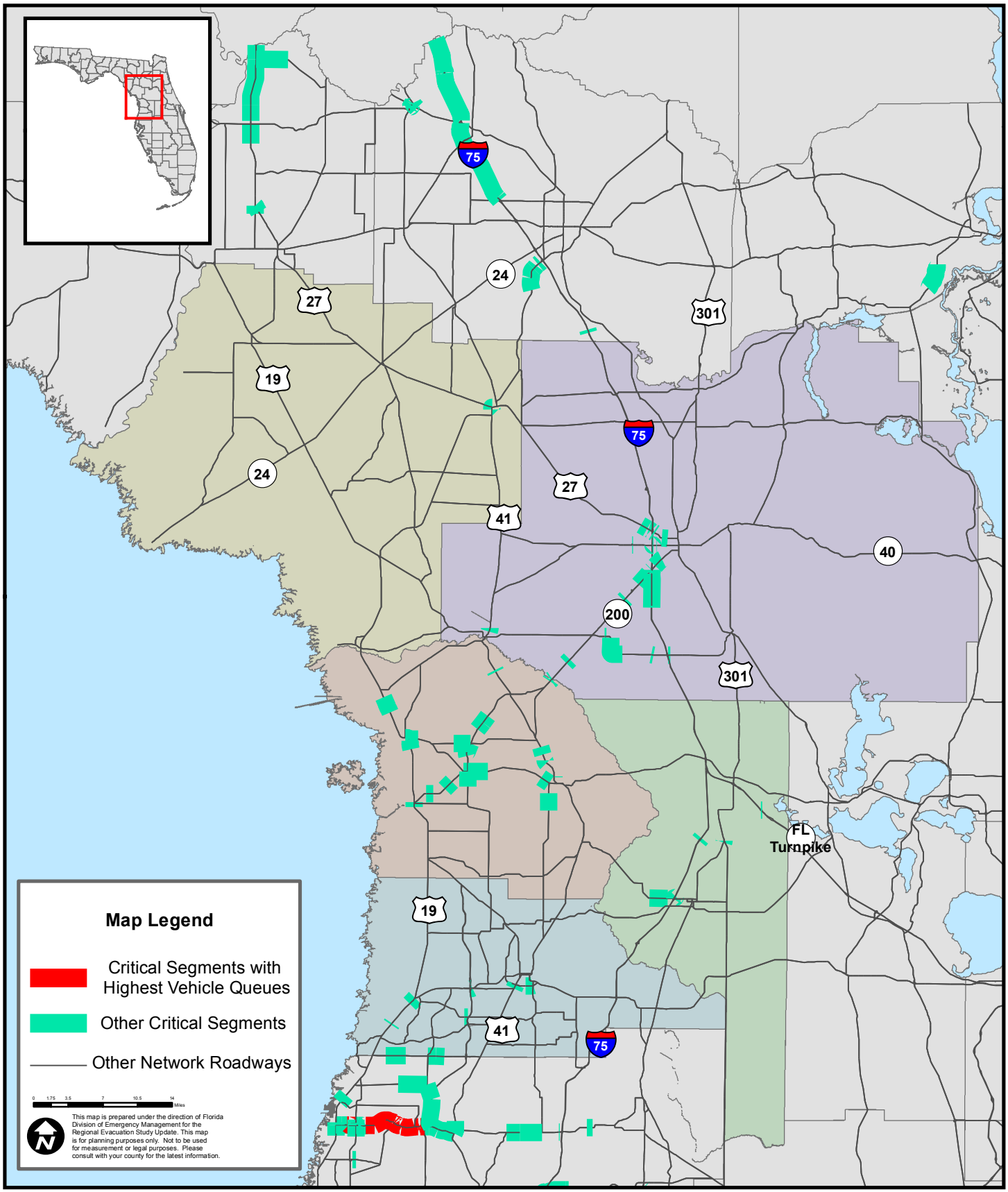


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-2

Critical Roadway Segments with Excessive Vehicle Queues for 2015 Base Scenario Evacuation Level B

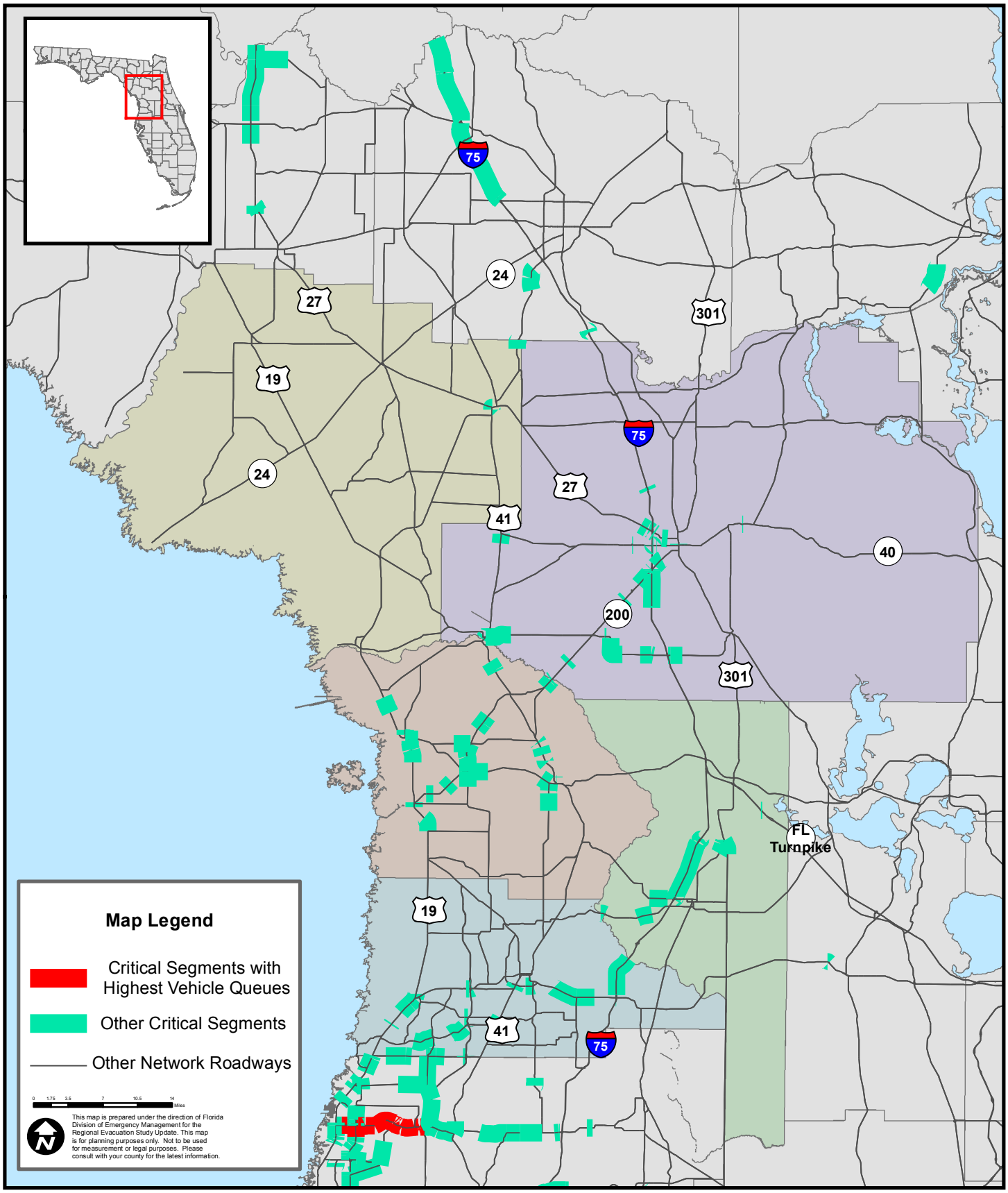


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-3

Critical Roadway Segments with Excessive Vehicle Queues for 2015 Base Scenario Evacuation Level C

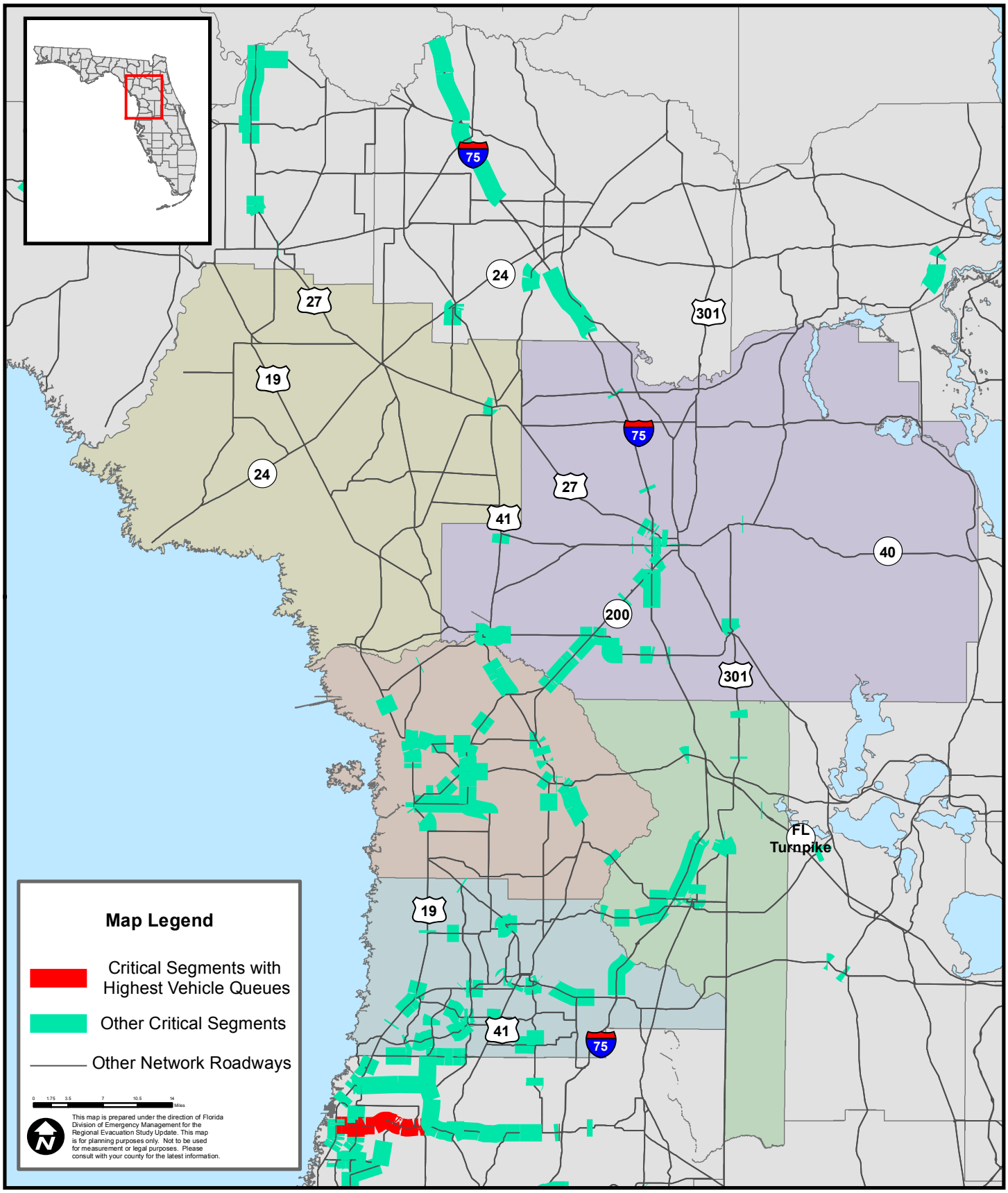


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-4

Critical Roadway Segments with Excessive Vehicle Queues for 2015 Base Scenario Evacuation Level D

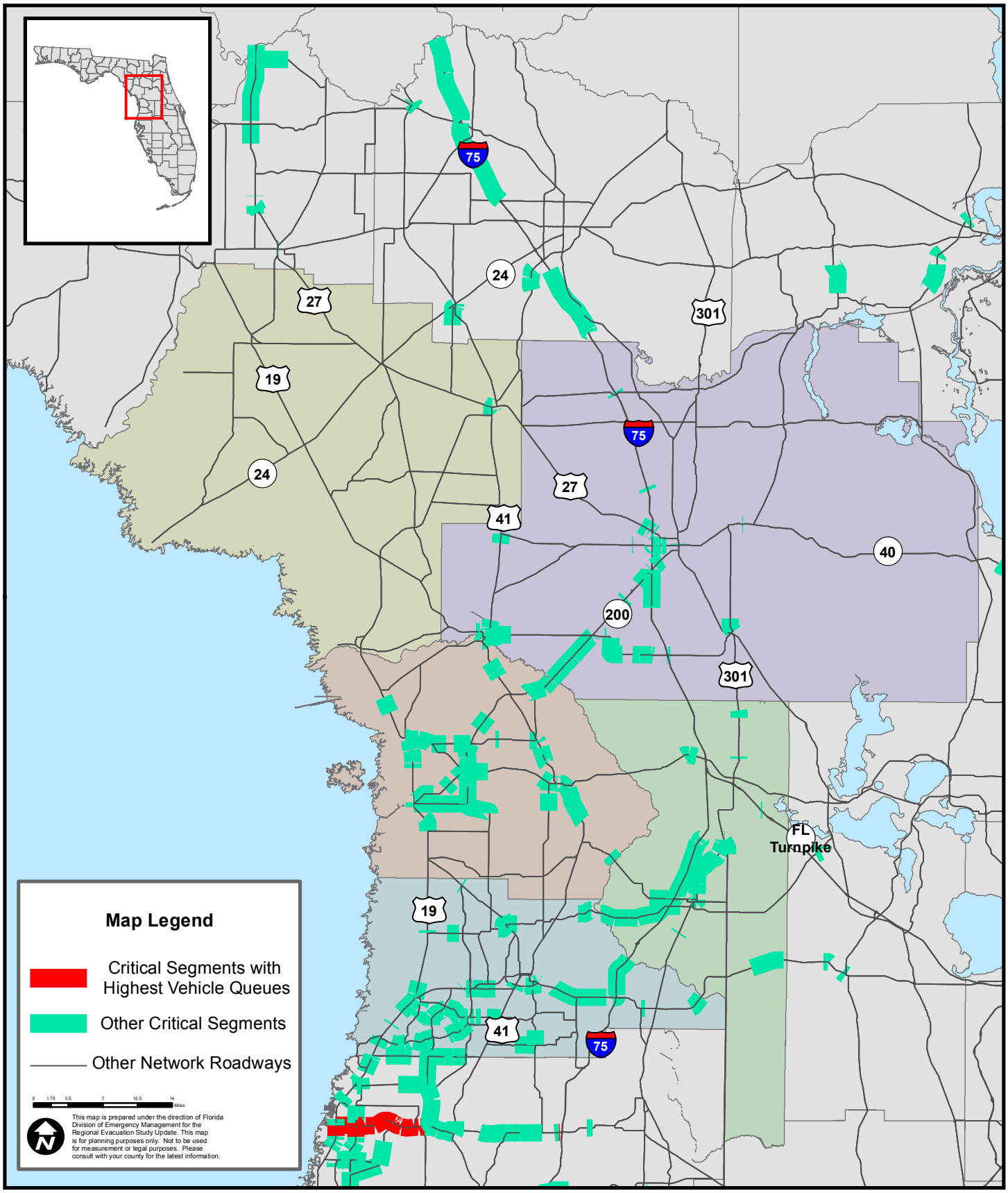


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-5

Critical Roadway Segments with Excessive Vehicle Queues for 2015 Base Scenario Evacuation Level E

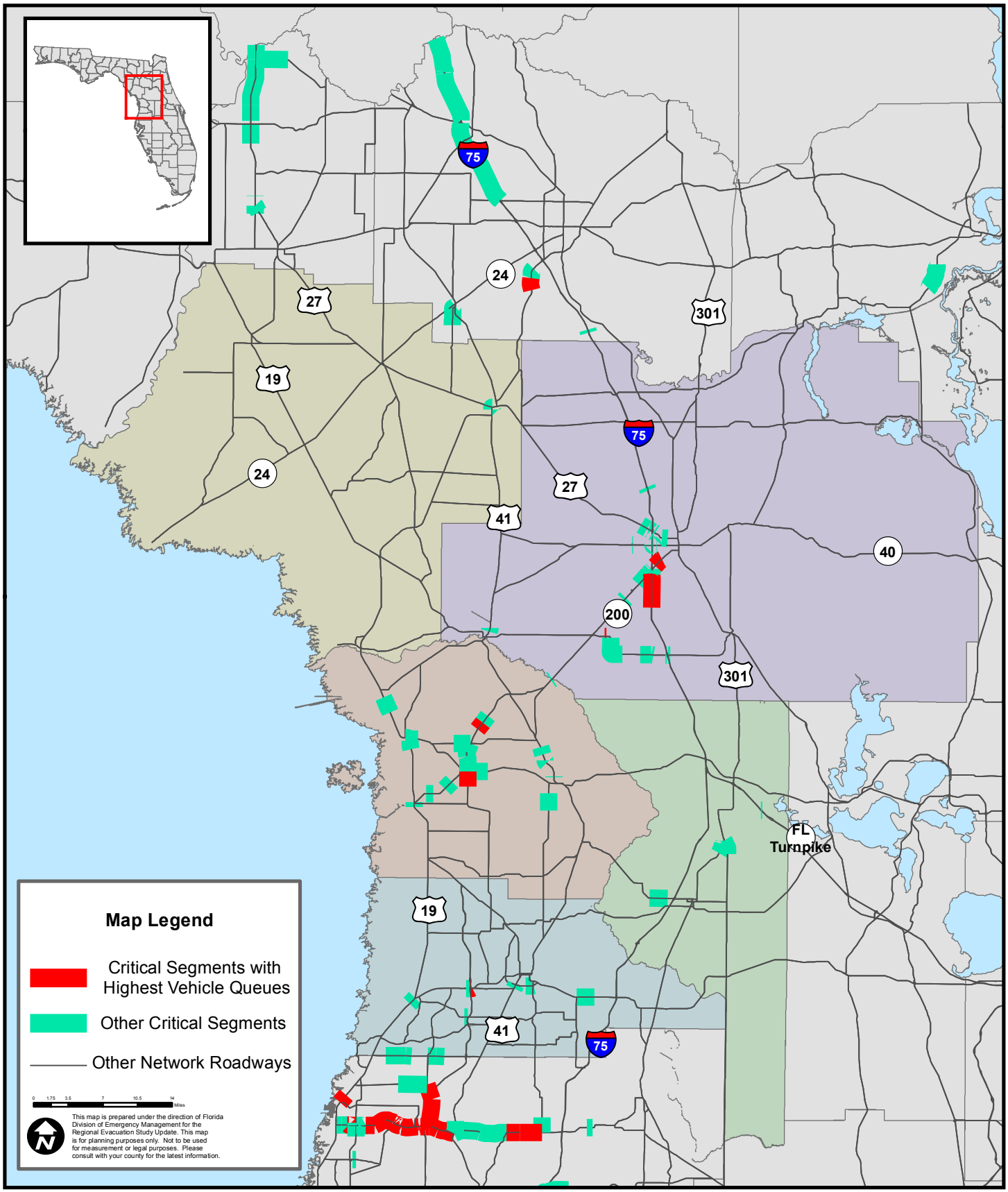


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-6

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Base Scenario Evacuation Level A

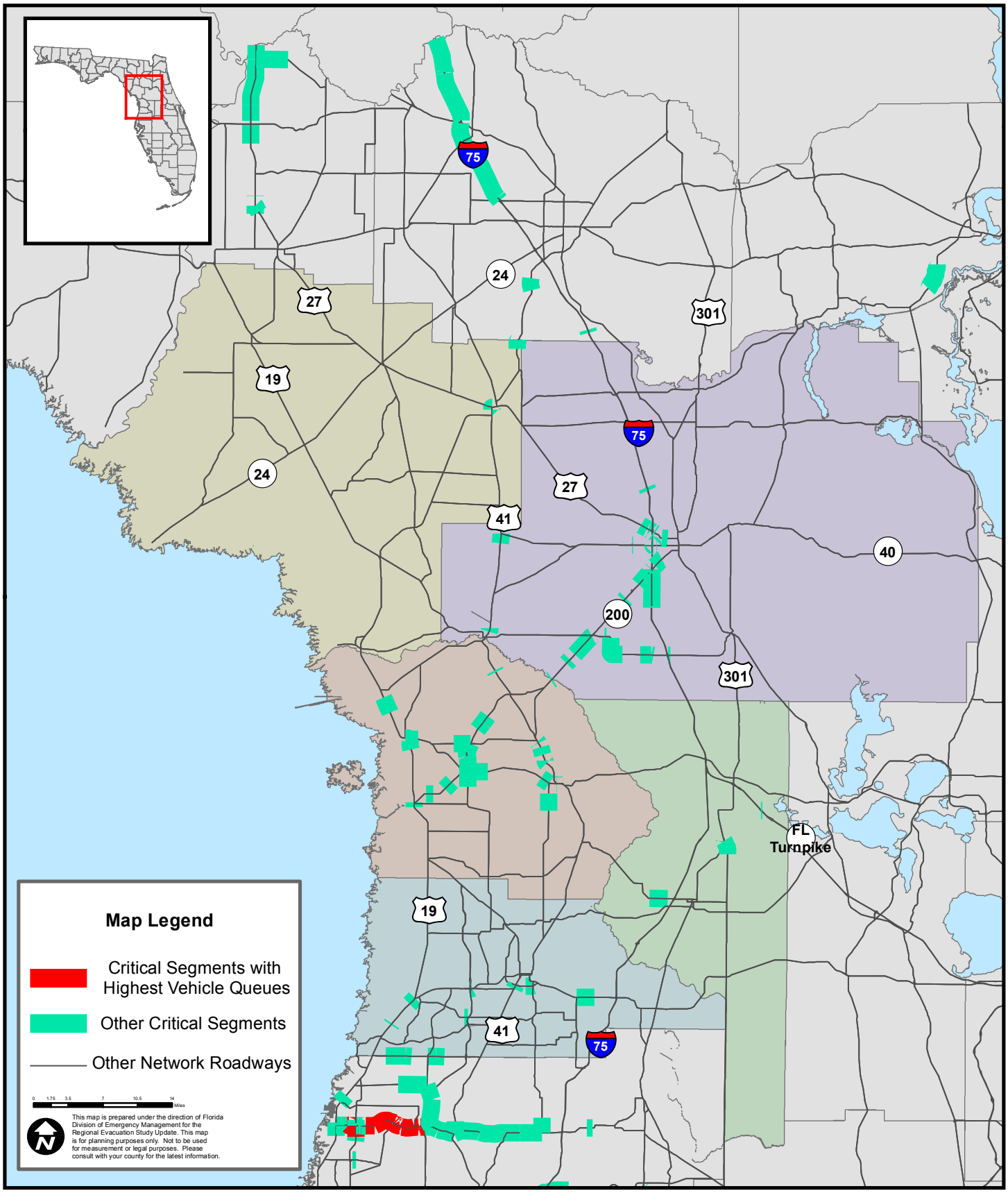


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-7

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Base Scenario Evacuation Level B

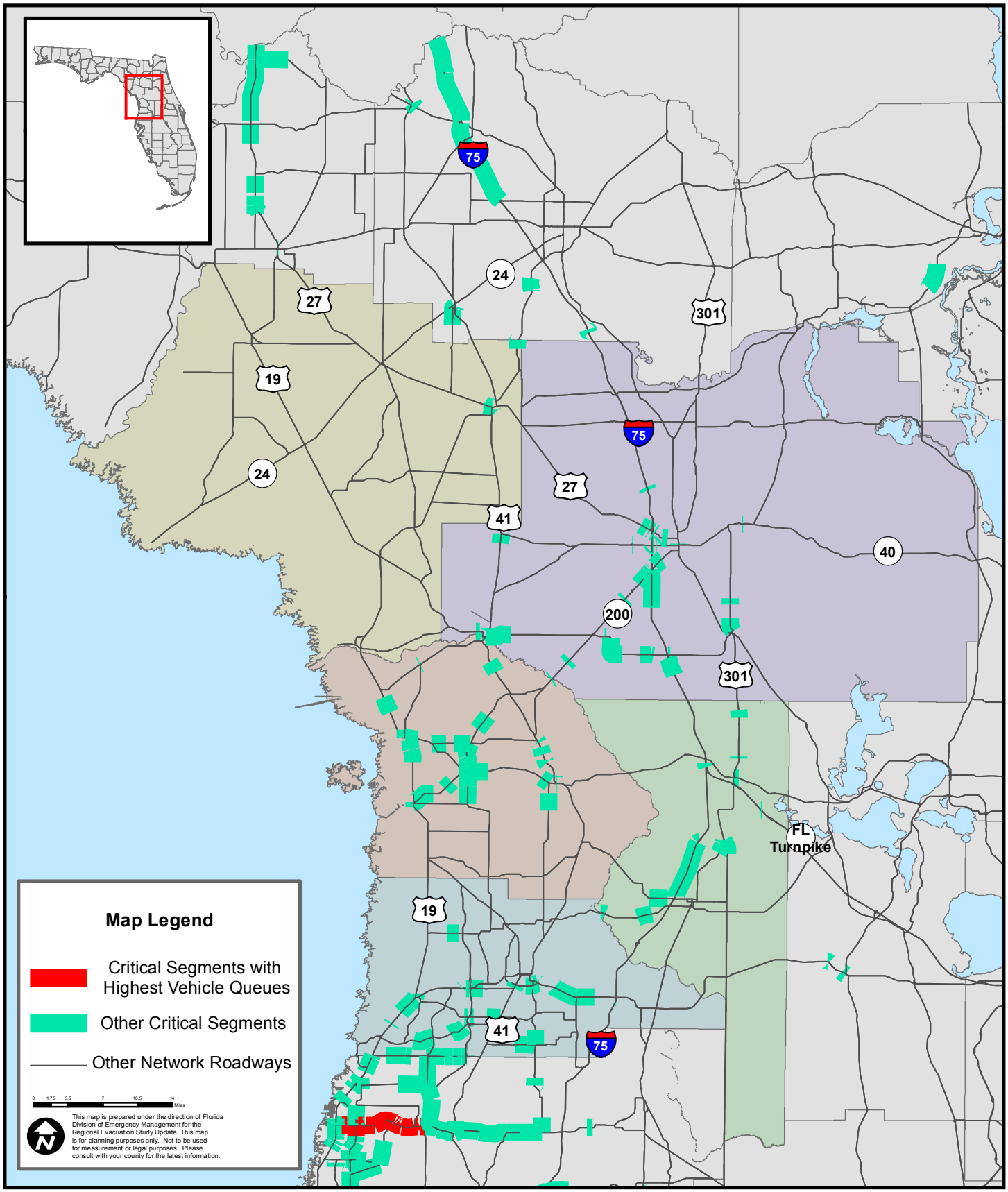


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-8

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Base Scenario Evacuation Level C

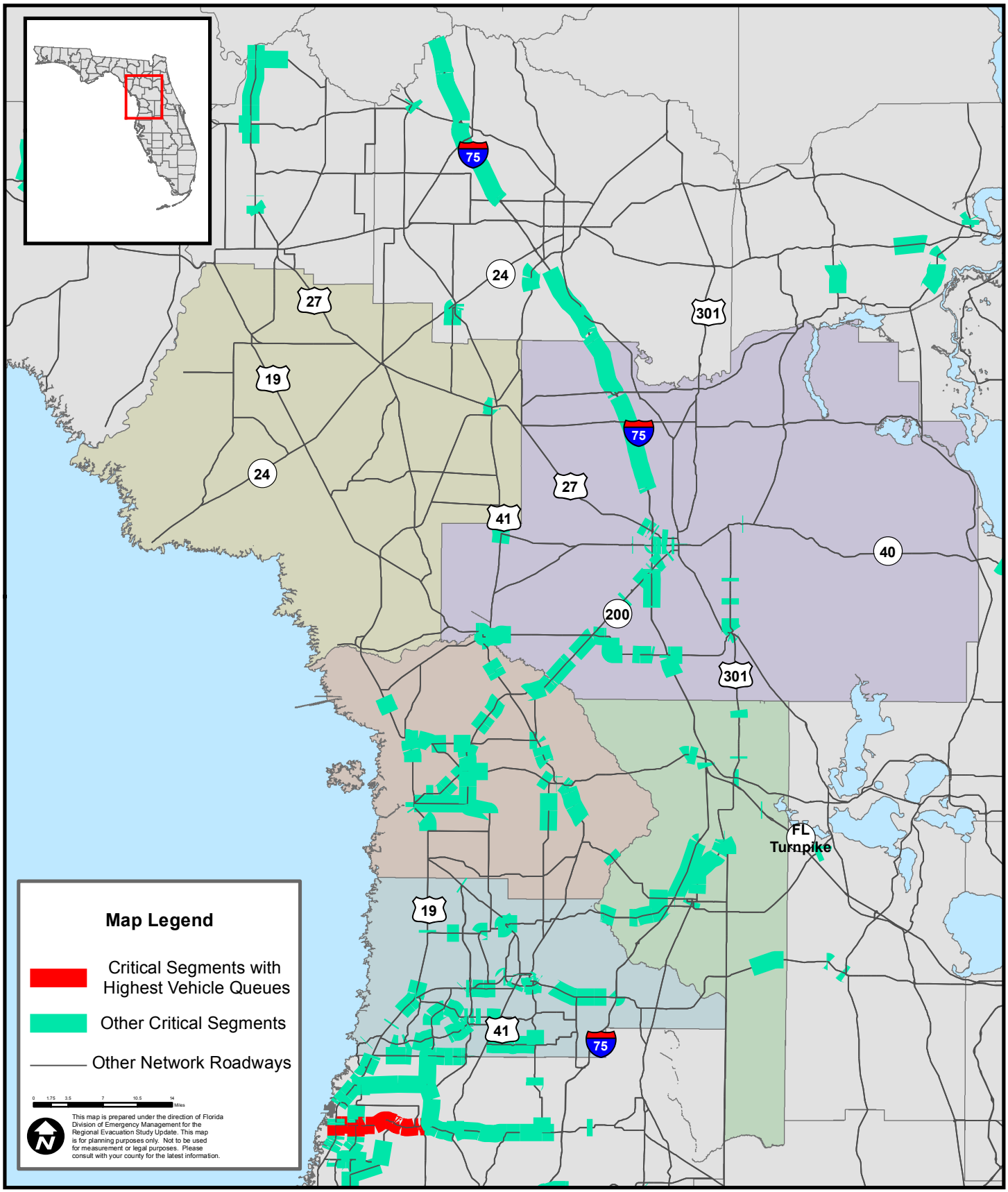


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-9

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Base Scenario Evacuation Level D

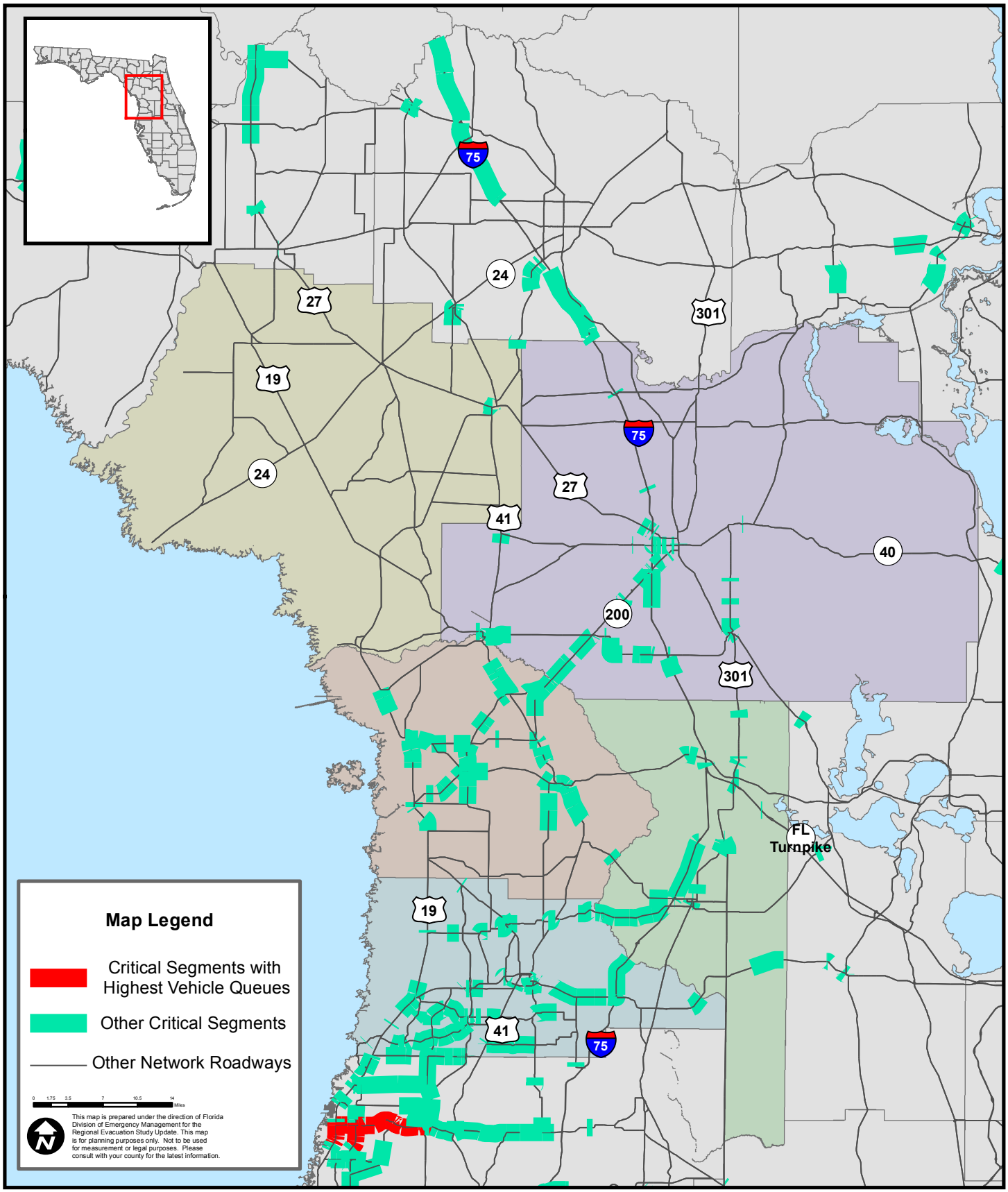


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-10

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Base Scenario Evacuation Level E



Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Table IV-13 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2015 Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Citrus					
SR 44 Eastbound	2300	2700	4600	8100	10000
US 19 Northbound	11100	11300	11700	15400	17200
US 19 Southbound	100	100	100	100	200
US 41 Northbound	5600	7100	9700	12300	12800
US 41 Southbound	100	100	100	200	300
Hernando					
I-75 Northbound	17300	20500	27500	30000	33700
I-75 Southbound	2900	3400	4100	5300	6000
SR 589 Southbound	1700	1900	2500	4200	5500
US 19 Northbound	10200	10500	12200	15100	15800
US 19 Southbound	100	100	100	200	300
US 301 Northbound	300	300	700	1100	2000
US 301 Southbound	0	0	100	100	100
US 41 Northbound	100	200	1200	2500	3000
US 41 Southbound	1100	1400	2300	3100	3000
Marion					
I-75 Northbound	29900	32000	38300	41300	43800
I-75 Southbound	5900	6800	7800	10100	11200
SR 19 Northbound	1400	2000	2700	3600	3600
SR 19 Southbound	100	100	200	200	200
SR 40 Eastbound	1000	1100	1500	2300	2400
US 27 Northbound	100	200	300	500	700
US 27 Southbound	100	100	100	200	200
US 301 Northbound	600	1100	2100	3600	4800
US 301 Southbound	1800	2100	2300	2900	3100
US 41 Northbound	4400	5100	6400	7200	7100
US 41 Southbound	300	300	300	400	500
US 441 Northbound	400	1700	900	1700	2800
Sumter					
FL Turnpike Southbound	6000	6900	8200	11100	12400
I-75 Northbound	17000	20100	24300	27000	29200
I-75 Southbound	3500	4100	4900	6100	6800
SR 44 Eastbound	200	300	500	700	1000
SR 471 Southbound	500	700	900	1100	1300
US 27 Northbound	0	200	600	1100	1300
US 27 Southbound	200	300	400	500	500
US 301 Northbound	2300	3100	4800	6400	8600
US 301 Southbound	0	0	100	0	0
Levy					
US 19 Northbound	4200	5600	7500	10100	12000
US 19 Southbound	600	600	700	800	900
US 41 Northbound	900	1100	1200	1800	2100
US 41 Southbound	200	200	200	200	300

Table IV-14 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2020 Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Citrus					
SR 44 Eastbound	2500	3000	4700	8600	10400
US 19 Northbound	11600	11800	12200	17200	17800
US 19 Southbound	100	100	100	200	100
US 41 Northbound	6000	7500	10100	12300	12900
US 41 Southbound	100	100	100	200	300
Hernando					
I-75 Northbound	18700	22100	30600	34100	40700
I-75 Southbound	3400	4000	4800	6200	6800
SR 589 Southbound	1800	2200	2900	5400	6500
US 19 Northbound	10300	10900	12100	15600	15800
US 19 Southbound	100	100	100	300	300
US 301 Northbound	100	100	400	500	700
US 301 Southbound	100	100	100	100	100
US 41 Northbound	100	200	1000	2400	2900
US 41 Southbound	1200	1600	3100	3100	3100
Marion					
I-75 Northbound	32300	36100	40800	47900	46300
I-75 Southbound	6700	7600	8900	11500	12500
SR 19 Northbound	1900	2300	3200	3700	4500
SR 19 Southbound	200	100	200	300	300
SR 40 Eastbound	1100	1400	1800	2400	2700
US 27 Northbound	200	200	300	500	700
US 27 Southbound	100	100	100	200	200
US 301 Northbound	900	1400	2800	4200	6200
US 301 Southbound	2100	2400	2700	3300	3500
US 41 Northbound	4700	5300	6700	7100	7100
US 41 Southbound	300	300	400	500	500
US 441 Northbound	100	600	1400	1600	2900
Sumter					
FL Turnpike Southbound	6900	7900	9600	13000	14400
I-75 Northbound	18400	20300	26800	27400	31300
I-75 Southbound	4000	4700	5600	7000	7700
SR 44 Eastbound	300	400	500	1200	1600
SR 471 Southbound	700	800	1000	1300	1400
US 27 Northbound	200	400	1000	1500	1800
US 27 Southbound	300	300	400	500	800
US 301 Northbound	3100	4000	6000	8000	9600
US 301 Southbound	100	100	0	100	100
Levy					
US 19 Northbound	5100	6200	7900	12100	13100
US 19 Southbound	600	700	700	800	1000
US 41 Northbound	1000	1000	1300	1700	1800
US 41 Southbound	200	200	200	200	200

Table IV-15 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2015 Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Citrus					
US 19 Southbound	600	600	700	800	900
US 19 Northbound	10200	10500	12200	15100	15800
US 41 Southbound	300	300	300	400	500
US 41 Northbound	100	200	1200	2500	3000
Hernando					
US 19 Southbound	100	100	100	100	200
SR 589 Northbound	100	300	700	700	800
US 41 Northbound	100	100	200	200	200
US 41 Southbound	100	100	100	200	300
I-75 Northbound	9300	10700	15800	17200	20300
I-75 Southbound	3500	4100	4900	6100	6800
US 301 Southbound	0	0	100	0	0
US 19 Northbound	11600	15600	21500	24500	25300
US 301 Northbound	500	500	1000	1000	1500
Marion					
US 41 Northbound	5600	7100	9700	12300	12800
US 41 Southbound	200	200	200	200	300
I-75 Northbound	17000	20100	24300	27000	29200
US 301 Northbound	2300	3100	4800	6400	8600
US 27 Northbound	0	200	600	1100	1300
Sumter					
I-75 Northbound	17300	20500	27500	30000	33700
SR 44 Eastbound	2300	2700	4600	8100	10000
US 301 Northbound	300	300	700	1100	2000
I-75 Southbound	5900	6800	7800	10100	11200
US 301 Southbound	1800	2100	2300	2900	3100
Levy					
US 19 Northbound	11100	11300	11700	15400	17200
US 41 Northbound	4400	5100	6400	7200	7100
US 27 Northbound	100	200	300	500	700

Table IV-16 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2020 Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Citrus					
US 19 Southbound	600	700	700	800	1000
US 19 Northbound	10300	10900	12100	15600	15800
US 41 Southbound	300	300	400	500	500
US 41 Northbound	100	200	1000	2400	2900
Hernando					
US 19 Southbound	100	100	100	200	100
SR 589 Northbound	200	200	500	700	700
US 41 Northbound	100	100	200	200	200
US 41 Southbound	100	100	100	200	300
I-75 Northbound	9600	11200	17600	19500	24400
I-75 Southbound	4000	4700	5600	7000	7700
US 301 Southbound	100	100	0	100	100
US 19 Northbound	12100	16100	23300	24900	23900
US 301 Northbound	300	300	800	800	1300
Marion					
US 41 Northbound	6000	7500	10100	12300	12900
US 41 Southbound	200	200	200	200	200
I-75 Northbound	18400	20300	26800	27400	31300
US 301 Northbound	3100	4000	6000	8000	9600
US 27 Northbound	200	400	1000	1500	1800
Sumter					
I-75 Northbound	18700	22100	30600	34100	40700
SR 44 Eastbound	2500	3000	4700	8600	10400
US 301 Northbound	100	100	400	500	700
I-75 Southbound	6700	7600	8900	11500	12500
US 301 Southbound	2100	2400	2700	3300	3500
Levy					
US 19 Northbound	11600	11800	12200	17200	17800
US 41 Northbound	4700	5300	6700	7100	7100
US 27 Northbound	200	200	300	500	700

Clearance Times

Calculated clearance times are used by county emergency managers as one input to determine when to recommend an evacuation order. Clearance times for each of the base scenarios are summarized in **Table IV-17** and **IV-18**, as well as **Figures IV-11, IV-12,** and **IV-13**. Clearance time includes several components, including the mobilization time for the evacuating population to prepare for an evacuation (pack supplies and personal belongs, load their vehicle, etc.), the actual time spent traveling on the roadway network, and the delay time caused by traffic congestion.

In-county clearance times for the base scenarios range from 12.5 hours in Hernando County for evacuation level A to 30 hours in Citrus County for evacuation level E in 2015. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 12.5 hours for evacuation level A in Sumter and Hernando Counties to 16.5 hours for evacuation level E in Citrus and Sumter Counties in 2015.

In 2020, in-county clearance times for the base scenarios remain consistent, between 12.5 hours for the evacuation level A in Hernando County and 29.5 hours in Levy County for evacuation level E. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 12.5 hours in Hernando and Sumter Counties for evacuation level A, to 16.5 hours in Citrus and Sumter Counties for evacuation level E in 2020.

Out of county clearance times for the 2015 base scenarios range from 15 hours in Levy County for the base evacuation level A scenario to 36 hours in Marion County for the evacuation level E scenario. Out of county clearance times for the 2020 base scenarios range from 15 hours in Levy County for the base evacuation level A scenario to 39 hours in Marion County for the evacuation level E scenario.

Regional clearance time for the five county WRPC region ranges from 22 hours to 36 hours in 2015. This time increases to between 23 and 39 hours in 2020.

Table IV-17 – 2015 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
Citrus County	13.0	13.0	14.0	15.0	16.5
Hernando County	12.5	13.0	13.0	13.0	14.0
Levy County	13.0	13.0	13.0	13.0	13.0
Marion County	13.0	13.0	13.0	13.0	13.5
Sumter County	12.5	12.5	12.5	15.0	16.5
In-County Clearance Time					
Citrus County	14.0	17.0	23.0	28.0	30.0
Hernando County	12.5	16.0	22.5	23.5	25.5
Levy County	14.0	17.0	23.5	24.5	27.0
Marion County	13.5	13.5	13.5	13.5	26.0
Sumter County	13.0	13.0	13.0	15.5	17.0
Out of County Clearance Time					
Citrus County	21.0	24.0	31.5	33.0	35.0
Hernando County	15.0	17.5	24.0	25.0	27.0
Levy County	22.0	26.0	32.5	34.0	36.0
Marion County	21.5	25.0	32.0	33.5	35.5
Sumter County	17.5	23.5	31.5	33.0	34.5
Regional Clearance Time					
Withlacoochee	22.0	26.0	32.5	34.0	36.0

Table IV-18 – 2020 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
Citrus County	13.0	13.0	13.5	16.0	16.5
Hernando County	12.5	13.0	13.0	13.5	14.5
Levy County	13.0	13.0	13.0	13.0	13.0
Marion County	13.0	13.0	13.5	13.5	13.5
Sumter County	12.5	12.5	12.5	14.5	16.5
In-County Clearance Time					
Citrus County	14.0	17.5	23.0	25.0	29.0
Hernando County	12.5	17.0	22.5	24.5	28.0
Levy County	14.0	17.5	23.0	25.0	29.5
Marion County	13.5	13.5	14.0	14.0	29.0
Sumter County	13.0	13.0	13.0	15.0	17.0
Out of County Clearance Time					
Citrus County	21.5	22.0	31.0	33.0	38.0
Hernando County	22.0	25.0	31.5	34.0	38.0
Levy County	15.0	18.5	24.0	26.0	29.5
Marion County	23.0	26.0	32.5	35.0	39.0
Sumter County	22.5	25.5	32.0	34.5	38.5
Regional Clearance Time					
Withlacoochee	23.0	26.0	32.5	35.0	39.0

Figure IV-11 - Clearance Time to Shelter
Base Scenarios

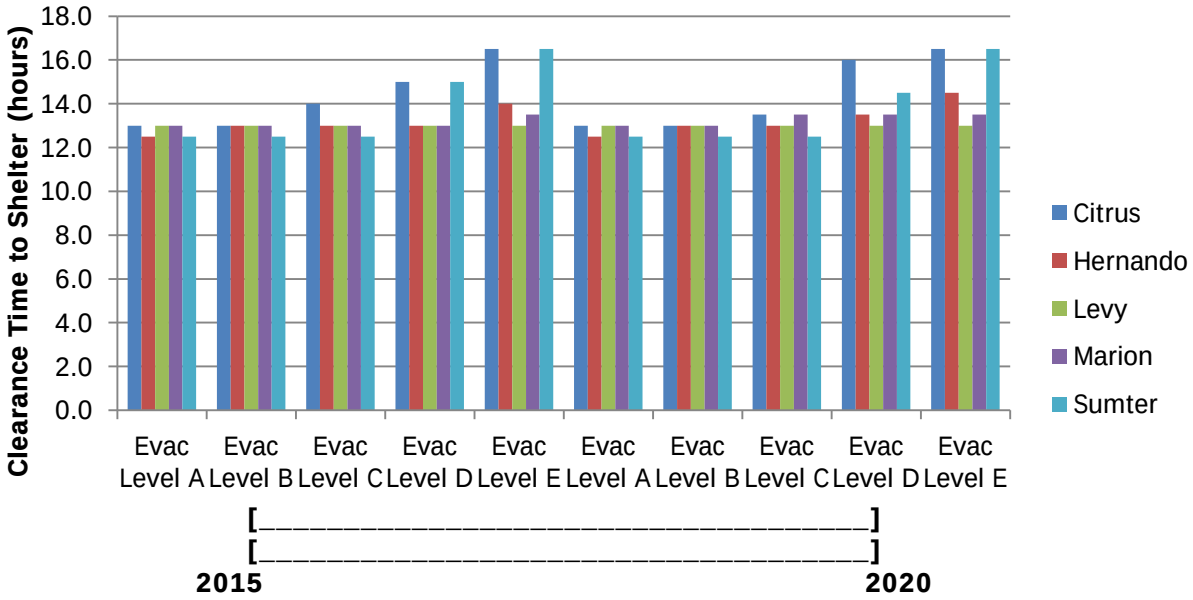


Figure IV-12 - In-County Clearance Times
Base Scenarios

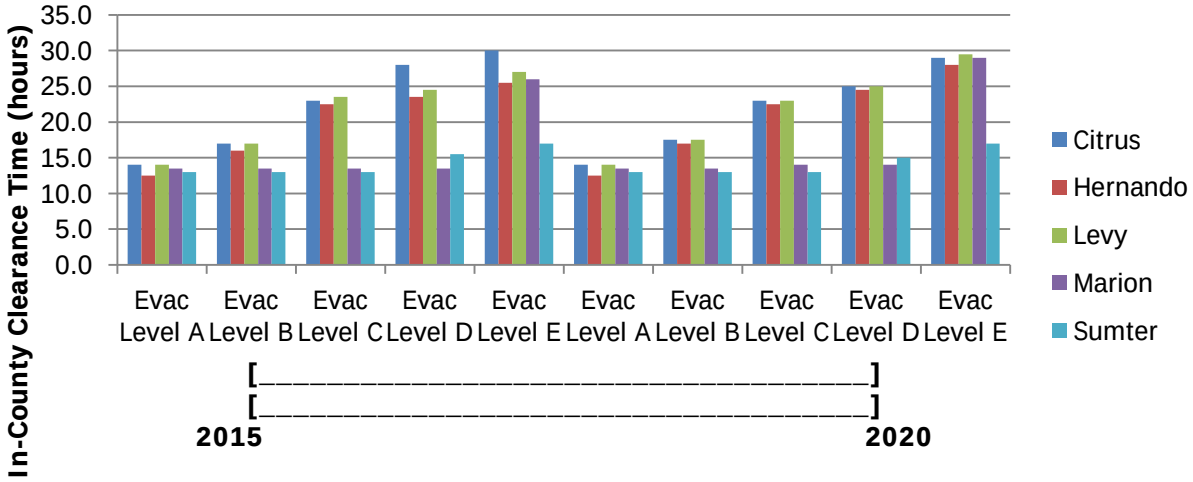
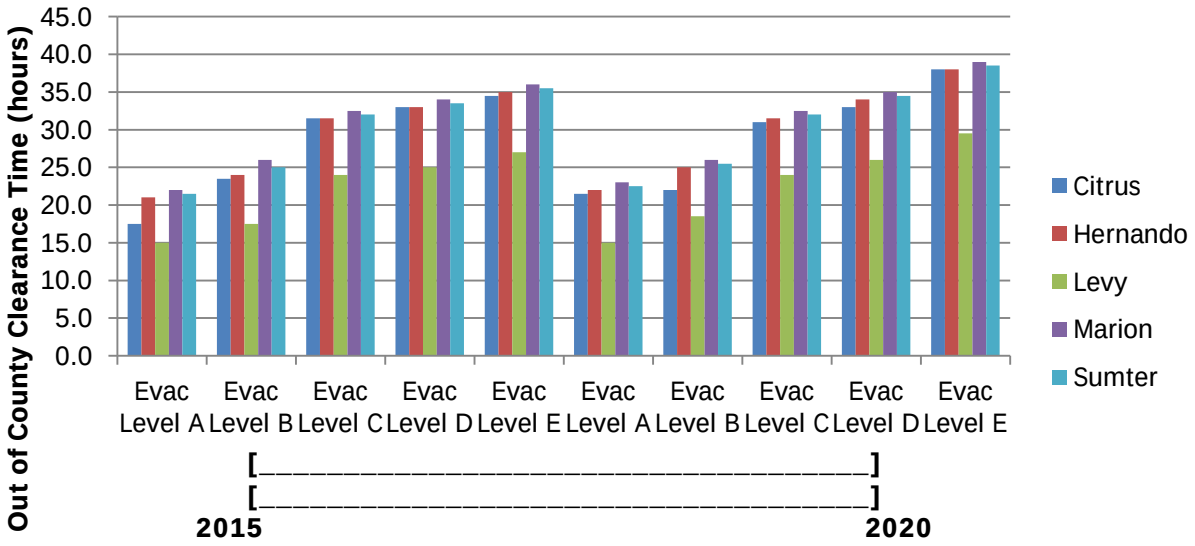


Figure IV-13 - Out of County Clearance Times Base Scenarios



F. Operational Scenarios

The transportation analysis also included ten region wide operational scenarios selected by the county emergency managers and RPC staff for the Withlacoochee Region. While the base scenarios required that the basic assumptions were consistent between scenarios except for the year and the evacuation level, this is not the case for the operational scenarios. The only requirement for each region is that two operational scenarios are developed for each evacuation level (two for Level A, two for Level B, etc.). Otherwise, the assumptions and characteristics between the ten operational scenarios can be different for each scenario.

The ten operational scenarios selected for analysis in the Withlacoochee Region are illustrated in **Table IV-19**. All ten operational scenarios used the default tourist and university population rates, along with the planning assumption behavioral response rates. The Withlacoochee region's largest issues in terms of evacuation response typically come from major evacuations in Tampa. All operational scenarios did not use phased evacuations, but did include a mixture of fast and slow response conditions. In addition, primary shelters were open in all scenarios, with other shelters also open as part of the level C, D, and E scenarios. The ten operational scenarios were developed to estimate response and evacuation conditions for a variety of Gulf of Mexico storms and include the following:

- 2015 Level A - Mild Gulf parallel path storm event
- 2015 Level B – Moderate Gulf Tampa Bay impact event
- 2015 Level C – Moderate Gulf Withlacoochee impact event
- 2015 Level D – Severe Gulf parallel path storm event
- 2015 Level E – Severe Withlacoochee direct hit event with quick response required
- 2020 Level A – Mild Gulf Withlacoochee impact event
- 2020 Level B – Mild Gulf Parallel path store event
- 2020 Level C – Moderate Gulf parallel path storm event
- 2020 Level D – Severe Gulf Tampa Bay impact event
- 2020 Level E – Severe Tampa Bay and Withlacoochee event with slow response

Table IV-19 – Operational Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C 2015	Scenario 4 Level D 2015	Scenario 5 Level E 2015
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	None	None	None
University Population	Default	Default	Default	Default	Default
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	9-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Hillsborough Pasco Pinellas Levy Hernando Citrus Dixie Taylor Gilchrist Lafayette Madison Jefferson	Wakulla Leon Jefferson Taylor Dixie Madison Lafayette (A) Gilchrist (A) Hamilton (A) Suwannee (A)	Duval St. Johns Flagler Volusia Nassau Clay (B) Putnam (B) Baker (A) Union (A) Bradford (A) Alachua (A) Columbia (A)	Hillsborough Pasco Pinellas Hernando (C) Citrus (C) Sumter (B) Polk (B) Marion (B) Levy (B) Dixie (A) Taylor (A) Gilchrist (A) Lafayette (A) Alachua (A) Suwannee (A) Hamilton (A) Columbia (A)	Dixie Taylor Levy Citrus Jefferson (C) Wakulla (C) Hernando (D) Pasco (C) Pinellas (B) Hillsborough (B) Sumter (B) Marion (C) Alachua (C) Gilchrist (C) Lafayette (D) Madison (A) Hamilton (A) Suwannee (A) Columbia (A) Union (A) Leon (B) Bradford (A) Baker (A)

Table IV-19 – Operational Scenarios

	Scenario 6 Level A 2020	Scenario 7 Level B 2020	Scenario 8 Level C 2020	Scenario 9 Level D 2020	Scenario 10 Level E 2020
Demographic Data	2020	2020	2020	2020	2020
Highway Network	2020	2020	2020	2020	2020
One-Way Operations	None	None	None	None	None
University Population	Default	Default	Default	Default	Default
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	18-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Duval St. Johns Flagler Volusia Nassau Clay Putnam Baker Union Bradford Alachua	Hillsborough Pasco Pinellas Hernando (A) Citrus (A) Levy (A) Dixie (A) Taylor (A)	Wakulla Leon Jefferson Taylor Dixie Madison Lafayette (B) Gilchrist (B) Hamilton (B) Suwannee (B) Levy (A)	Duval St. Johns Flagler Volusia Nassau Clay (C) Putnam (C) Baker (B) Union (B) Bradford (B) Alachua (B) Columbia (A) Hamilton (A) Suwannee (A) Gilchrist (A) Dixie (A) Lafayette (A) Taylor (A) Madison (A)	Dixie Taylor Levy Citrus Jefferson (C) Wakulla (C) Hernando (D) Pasco (C) Pinellas (B) Hillsborough (B) Sumter (B) Marion (C) Alachua (C) Gilchrist (C) Lafayette (D) Madison (A) Hamilton (A) Suwannee (A) Columbia (A) Union (A) Leon (B) Bradford (A) Baker (A)

G. Operational Scenario Results

Each of the ten operational scenarios were modeled for the Withlacoochee Region using the regional evacuation model. Results were derived from the model to summarize the evacuating population, evacuating vehicles, clearance times, and critical congested roadways. The results are discussed in the following sections.

Evacuating Population

Similar to the base scenarios, the evacuating population was estimated for the five county region. Evacuating population for the operational scenarios is summarized by county for 2015 in **Table IV-20** and for 2020 in **Table IV-21**.

Within the five county region, total evacuating population ranges from about 188,000 persons for the operational scenario level A evacuation to more than 411,000 persons for the operational scenario level E evacuation in 2015. By 2020, this range increases within the five counties to more than 207,000 persons for the operational scenario level A evacuation and more than 452,000 persons for the operational scenario level E evacuation.

Evacuating Vehicles

From a transportation standpoint, the number of evacuating vehicles is more important than the evacuating population. Evacuating vehicles for the operational scenarios are summarized by county for 2015 in **Table IV-22** and for 2020 in **Table IV-23**.

The total number of evacuating vehicles within the five county region for the operational scenarios also varies by evacuation level. A total of more than 105,000 vehicles evacuate from the five county RPC for the operational scenario level A evacuation in 2015, and this number increases to slightly more than 229,000 evacuating vehicles from the five county region for the operational scenario level E evacuation in 2015. By 2020, the number of evacuating vehicles is expected to increase to over 116,000 vehicles for the operational scenario level A evacuation and nearly 253,000 evacuating vehicles for the operational scenario level E evacuation.

Shelter Demand

Shelter demand estimates by county are summarized for each of the operational scenarios in **Table IV-24**. Shelter demand is the population in each county who will seek public shelter during their evacuation, either at an in-county shelter or an out of county shelter.

Public shelter demand in the five county region ranges from nearly 24,000 persons for the operational scenario level A evacuation in 2015 to more than 55,000 persons for the operational scenario level E evacuation. By 2020, the public shelter demand is expected to increase to nearly 27,000 persons for the level A evacuation and more than 61,000 persons for the level E evacuation.

Table IV-20 – Evacuating Population by Operational Scenario for 2015

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Citrus					
Site-built Homes	18,826	21,751	29,100	43,808	53,208
Mobile/Manuf. Homes	19,918	22,926	25,990	29,124	33,440
Tourists	1,404	1,642	1,642	1,864	1,888
TOTAL	40,148	46,319	56,732	74,796	88,536
Hernando					
Site-built Homes	18,554	19,652	30,329	63,195	76,217
Mobile/Manuf. Homes	13,969	15,156	17,887	23,879	25,551
Tourists	198	468	468	637	1,240
TOTAL	32,721	35,276	48,684	87,711	103,008
Levy					
Site-built Homes	3,106	3,467	5,064	7,715	10,772
Mobile/Manuf. Homes	11,864	12,841	13,941	15,003	17,931
Tourists	346	465	465	469	507
TOTAL	15,316	16,773	19,470	23,187	29,210
Marion					
Site-built Homes	40,571	54,095	67,619	81,143	81,143
Mobile/Manuf. Homes	35,431	42,518	49,604	56,690	63,776
Tourists	0	0	0	0	0
TOTAL	76,002	96,613	117,223	137,833	144,919
Sumter					
Site-built Homes	12,464	16,619	20,774	24,928	29,083
Mobile/Manuf. Homes	11,149	12,864	13,722	15,437	16,295
Tourists	0	0	0	0	0
TOTAL	23,613	29,483	34,496	40,365	45,378

Table IV-21 – Evacuating Population by Operational Scenario for 2020

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Citrus					
Site-built Homes	20,193	23,331	31,213	46,988	57,071
Mobile/Manuf. Homes	21,400	24,631	27,923	31,290	35,927
Tourists	1,442	1,680	1,680	1,909	1,933
TOTAL	43,035	49,642	60,816	80,187	94,931
Hernando					
Site-built Homes	20,477	21,693	33,470	69,718	84,077
Mobile/Manuf. Homes	15,408	16,716	19,729	26,339	28,183
Tourists	198	468	468	637	1,245
TOTAL	36,083	38,877	53,667	96,694	113,505
Levy					
Site-built Homes	3,304	3,688	5,388	8,207	11,459
Mobile/Manuf. Homes	12,599	13,636	14,804	15,932	19,040
Tourists	355	474	474	478	516
TOTAL	16,258	17,798	20,666	24,617	31,015
Marion					
Site-built Homes	44,592	59,456	74,320	89,184	89,184
Mobile/Manuf. Homes	38,928	46,713	54,499	62,284	70,070
Tourists	0	0	0	0	0
TOTAL	83,520	106,169	128,819	151,468	159,254
Sumter					
Site-built Homes	14,861	19,815	24,768	29,722	34,676
Mobile/Manuf. Homes	13,304	15,350	16,374	18,420	19,444
Tourists	0	0	0	0	0
TOTAL	28,165	35,165	41,142	48,142	54,120

Table IV-22 – Evacuating Vehicles by Operational Scenario for 2015

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Citrus					
Site-built Homes	11,196	12,997	17,290	25,803	31,158
Mobile/Manuf. Homes	12,020	13,834	15,678	17,581	20,168
Tourists	638	746	746	847	858
TOTAL	23,854	27,577	33,714	44,231	52,184
Hernando					
Site-built Homes	10,160	10,852	16,650	34,461	41,296
Mobile/Manuf. Homes	8,257	8,952	10,548	14,002	14,985
Tourists	90	213	213	290	564
TOTAL	18,507	20,017	27,411	48,753	56,845
Levy					
Site-built Homes	1,724	1,943	2,828	4,258	5,881
Mobile/Manuf. Homes	6,446	6,976	7,576	8,151	9,746
Tourists	157	211	211	213	230
TOTAL	8,327	9,130	10,615	12,622	15,857
Marion					
Site-built Homes	21,195	28,260	35,325	42,390	42,390
Mobile/Manuf. Homes	20,007	24,008	28,009	32,011	36,012
Tourists	0	0	0	0	0
TOTAL	41,202	52,268	63,334	74,401	78,402
Sumter					
Site-built Homes	6,887	9,183	11,479	13,775	16,071
Mobile/Manuf. Homes	6,801	7,847	8,371	9,417	9,940
Tourists	0	0	0	0	0
TOTAL	13,688	17,030	19,850	23,192	26,011

Table IV-23 – Evacuating Vehicles by Operational Scenario for 2020

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Citrus					
Site-built Homes	12,011	13,943	18,549	27,683	33,426
Mobile/Manuf. Homes	12,906	14,852	16,833	18,875	21,653
Tourists	655	763	763	868	878
TOTAL	25,572	29,558	36,145	47,426	55,957
Hernando					
Site-built Homes	11,212	11,979	18,373	38,015	45,550
Mobile/Manuf. Homes	9,099	9,865	11,624	15,429	16,513
Tourists	90	213	213	290	566
TOTAL	20,401	22,057	30,210	53,734	62,629
Levy					
Site-built Homes	1,835	2,068	3,010	4,532	6,258
Mobile/Manuf. Homes	6,843	7,407	8,044	8,654	10,347
Tourists	162	216	216	217	235
TOTAL	8,840	9,691	11,270	13,403	16,840
Marion					
Site-built Homes	23,291	31,054	38,818	46,581	46,581
Mobile/Manuf. Homes	21,973	26,368	30,762	35,157	39,551
Tourists	0	0	0	0	0
TOTAL	45,264	57,422	69,580	81,738	86,132
Sumter					
Site-built Homes	8,214	10,951	13,689	16,427	19,165
Mobile/Manuf. Homes	8,114	9,363	9,987	11,235	11,859
Tourists	0	0	0	0	0
TOTAL	16,328	20,314	23,676	27,662	31,024

Table IV-24 – Shelter Demand by Operational Scenario

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2015					
Citrus	3,495	3,876	5,794	10,604	12,684
Hernando	3,756	4,035	5,393	9,154	10,625
Levy	2,070	2,239	2,577	3,053	3,896
Marion	9,583	12,284	14,985	17,686	18,426
Sumter	5,065	6,301	7,345	8,580	9,624
2020					
Citrus	3,748	4,157	6,216	11,378	13,607
Hernando	4,138	4,444	5,946	10,090	11,707
Levy	2,196	2,377	2,736	3,243	4,138
Marion	10,528	13,496	16,463	19,431	20,245
Sumter	6,042	7,517	8,760	10,236	11,479

Note: Shelter demand is the population in each county who will seek public shelter during their evacuation, either at an in-county shelter or an out of county shelter.

Congested Roadways

A summary of the total number of evacuating vehicles for each of the operational scenarios is presented in **Table IV-25**. It is important to note that the total number of evacuating vehicles in the table below includes vehicles evacuating from all of the counties included in the operational scenario, as identified in Table IV-19. The number of counties varies by scenario, with the 2020 Level E scenario including 14 counties stretching from Manatee County to Alachua County.

Table IV-25 – Total Evacuating Vehicles for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
2015	450,852	926,571	841,790	1,088,425	1,110,715
2020	618,679	582,689	901,892	1,456,650	1,450,174

Similar to the base scenarios, critical roadways were identified by reviewing roadways in the model network that have the highest vehicle queues for extended periods of time during an evacuation. Due to the nature of a major evacuation in general, nearly all roadway facilities will have extended vehicle queues at some point during the evacuation process. The point of this analysis is to identify those roadway facilities that have vehicle queues for the longest time periods during each of the evacuation scenarios. Critical roadway segments for the Withlacoochee region are identified in **Figures IV-14** through **IV-23** for each of the operational scenarios for 2015 and 2020.

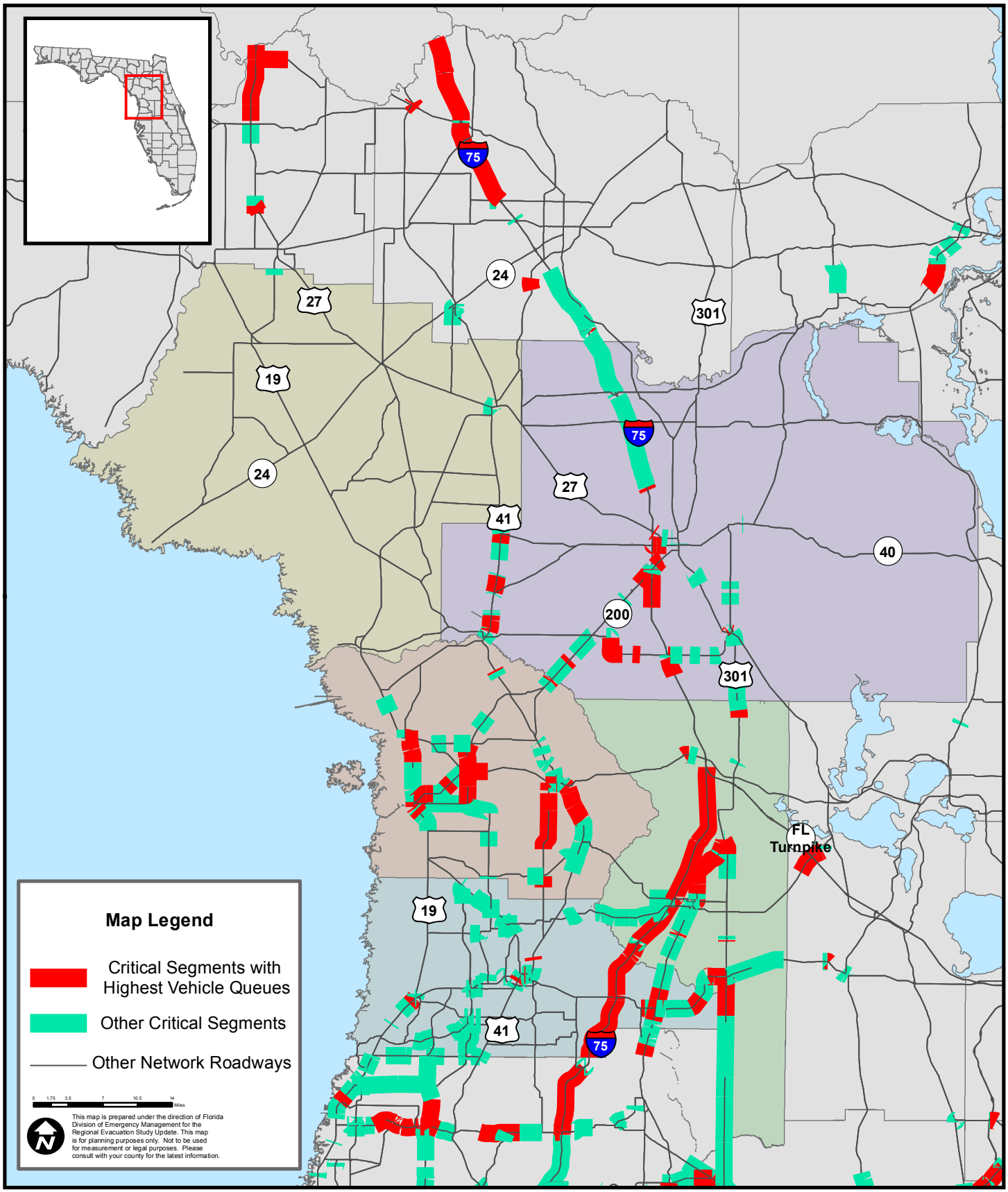
I-75, US 19, US 301, and portions of SR 200 and US 41 are critical facilities for the operational scenarios as well. Critical segments do vary by scenario, however, as the location of the evacuation event determines which portions of the region experience congestion and queuing. For example, for the level E operational scenario for 2015 where the Tampa Bay region is evacuating, I-4 and I-75 experience higher queuing, as well as I-95 in Volusia County.

In addition to the identification of critical roadway segments, the total number of evacuating vehicles entering and exiting each county by evacuation scenario was also determined. Evacuating vehicles exiting each county by major evacuation route are identified in **Table IV-26** for 2015 and **Table IV-27** for 2020. In addition, evacuating vehicles entering each county by major evacuation route are identified in **Table IV-28** for 2015 and **Table IV-29** for 2020. Detailed volume figures for all evacuation routes in the Withlacoochee Region for each operational scenario are included in Volume 5-5.

The number of vehicles entering and exiting each county during an evacuation varies widely depending upon the scenario, roadway, and county. As expected, major interstates and state highways generally carry larger volumes of evacuating traffic. The vehicle flows into and out of each county also generally follow the same pattern as the critical segment figures, as locations with higher queues and congestion generally have higher traffic volumes.

Figure IV-11

Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level A

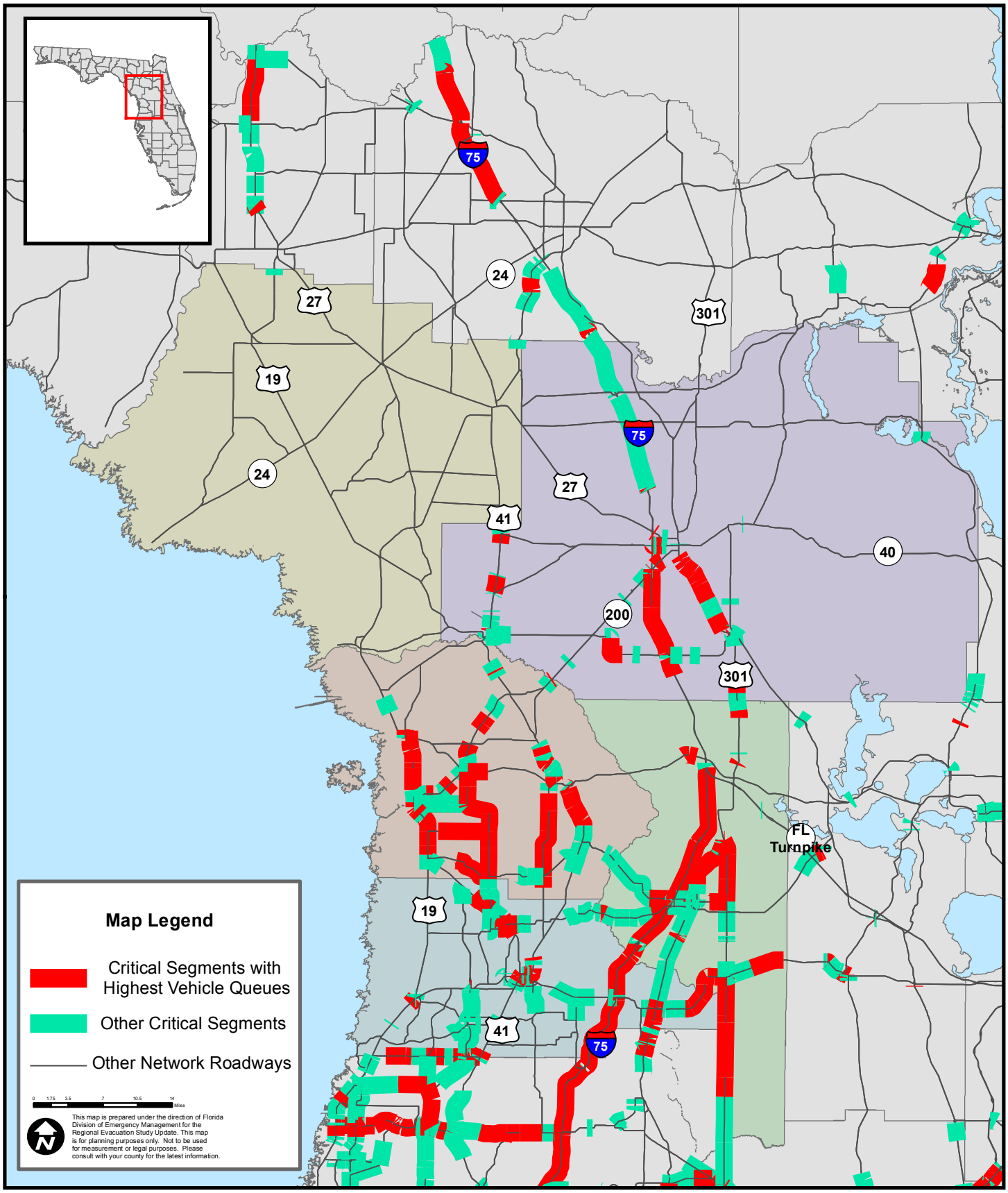


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-12

Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level B

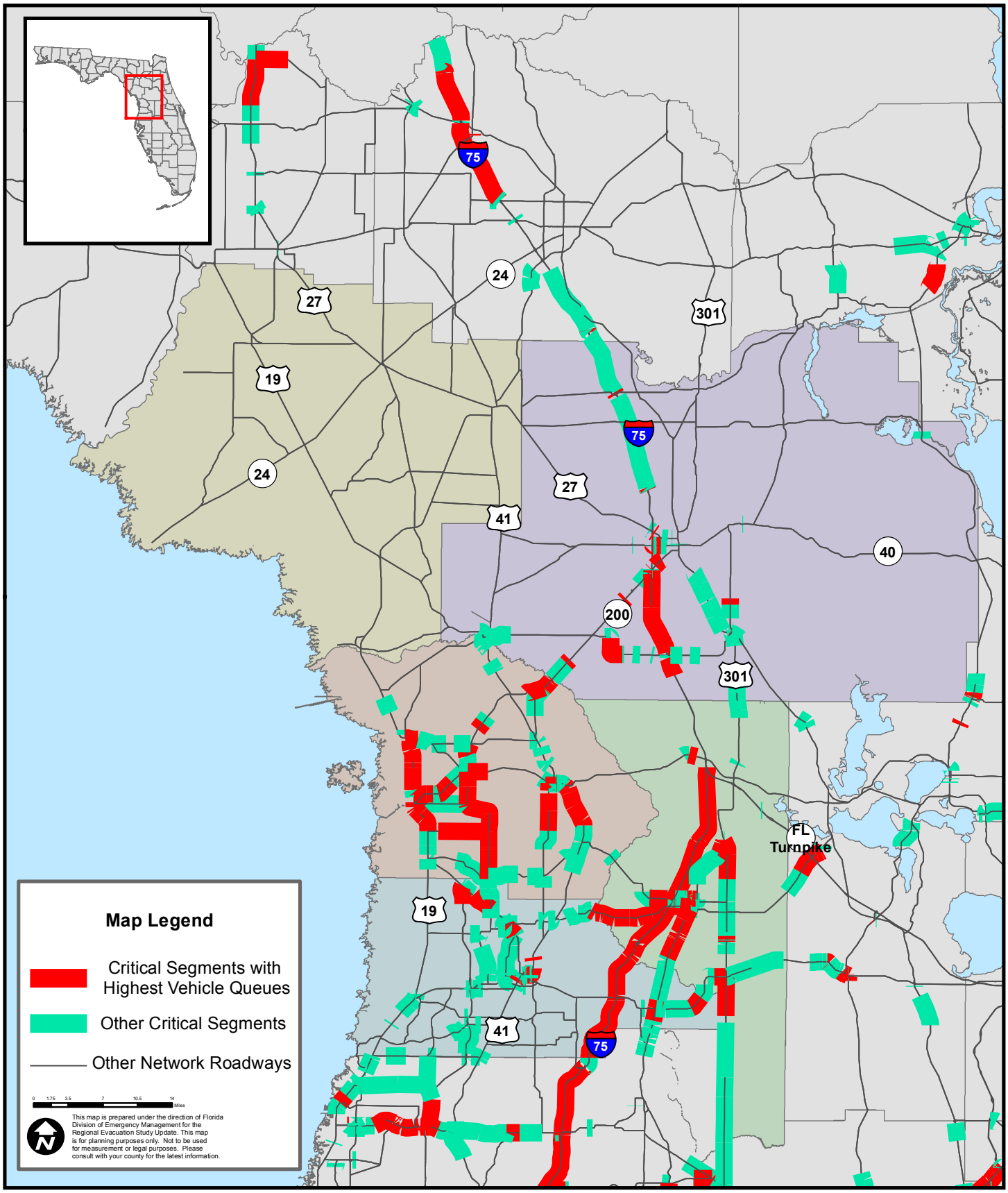


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-13

Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level C

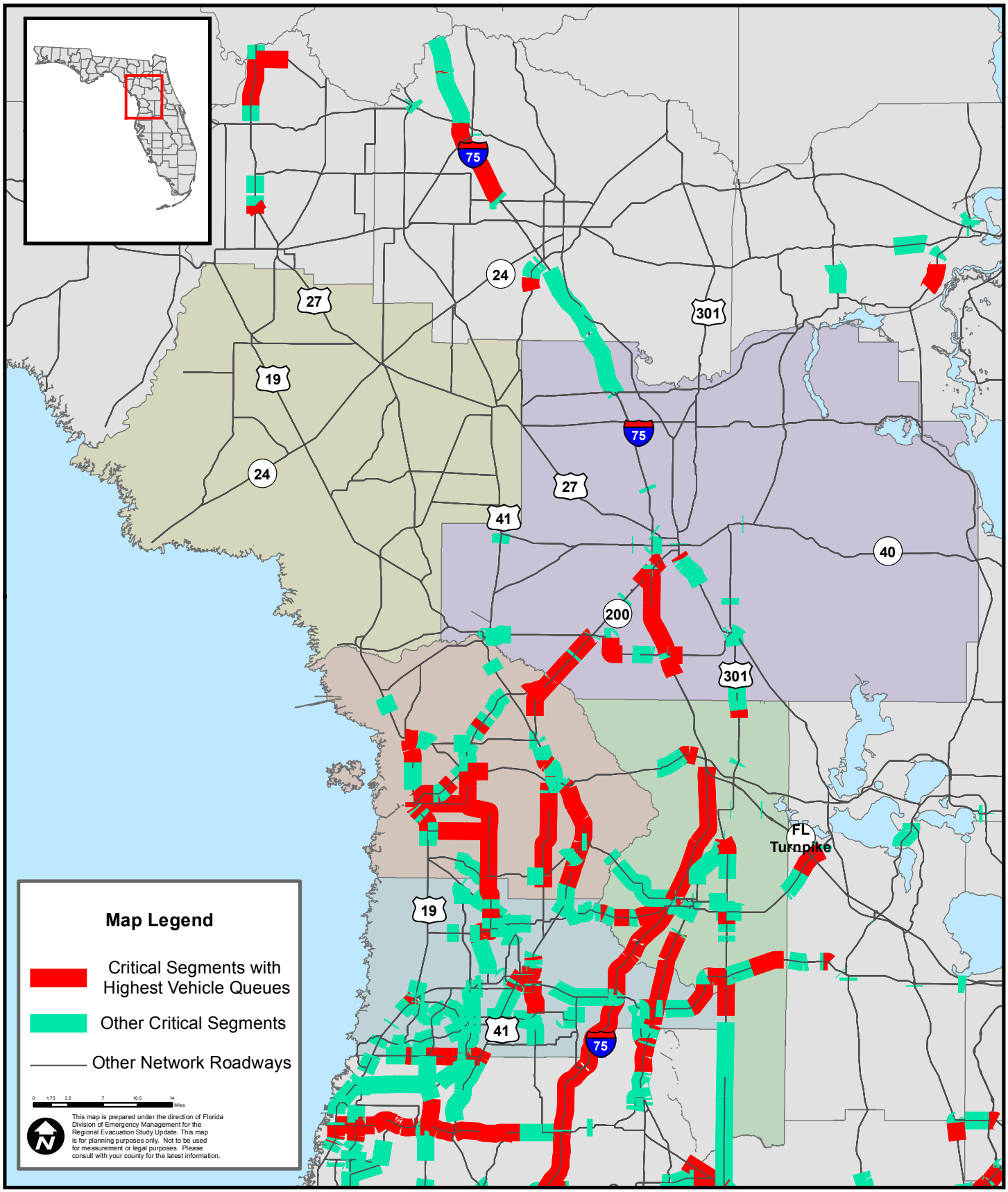


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-14

Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level D

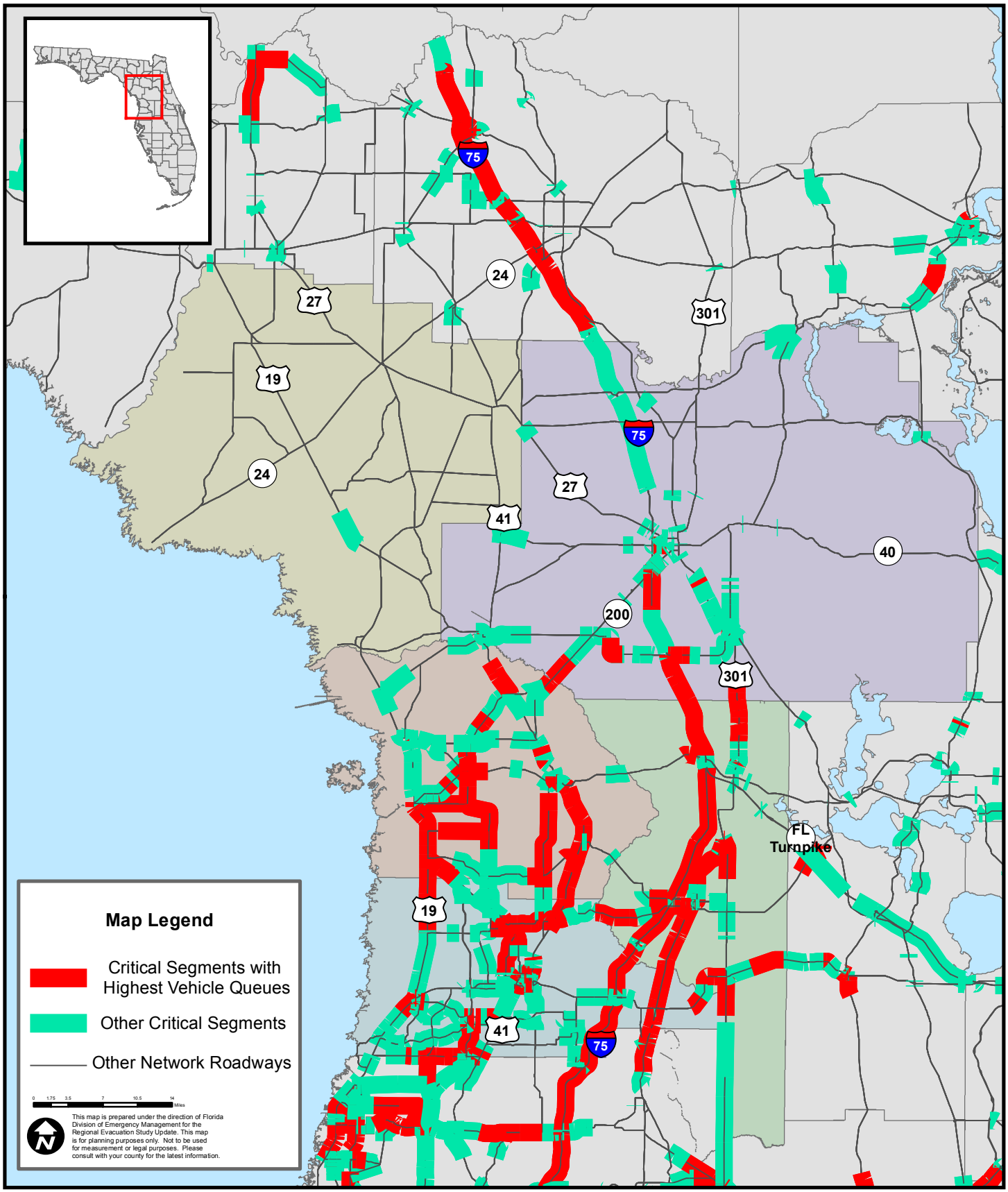


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-15

Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level E

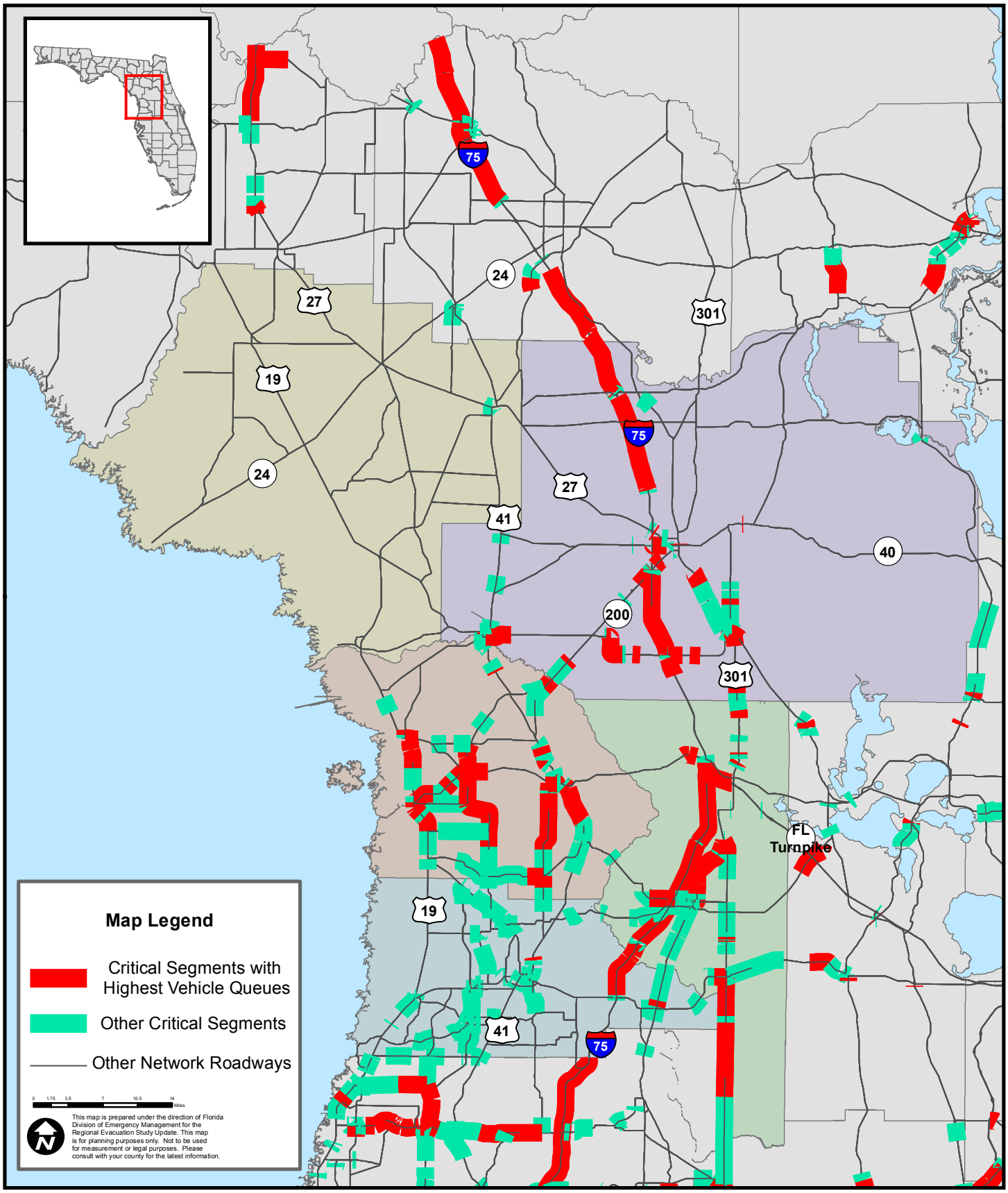


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-16

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level A

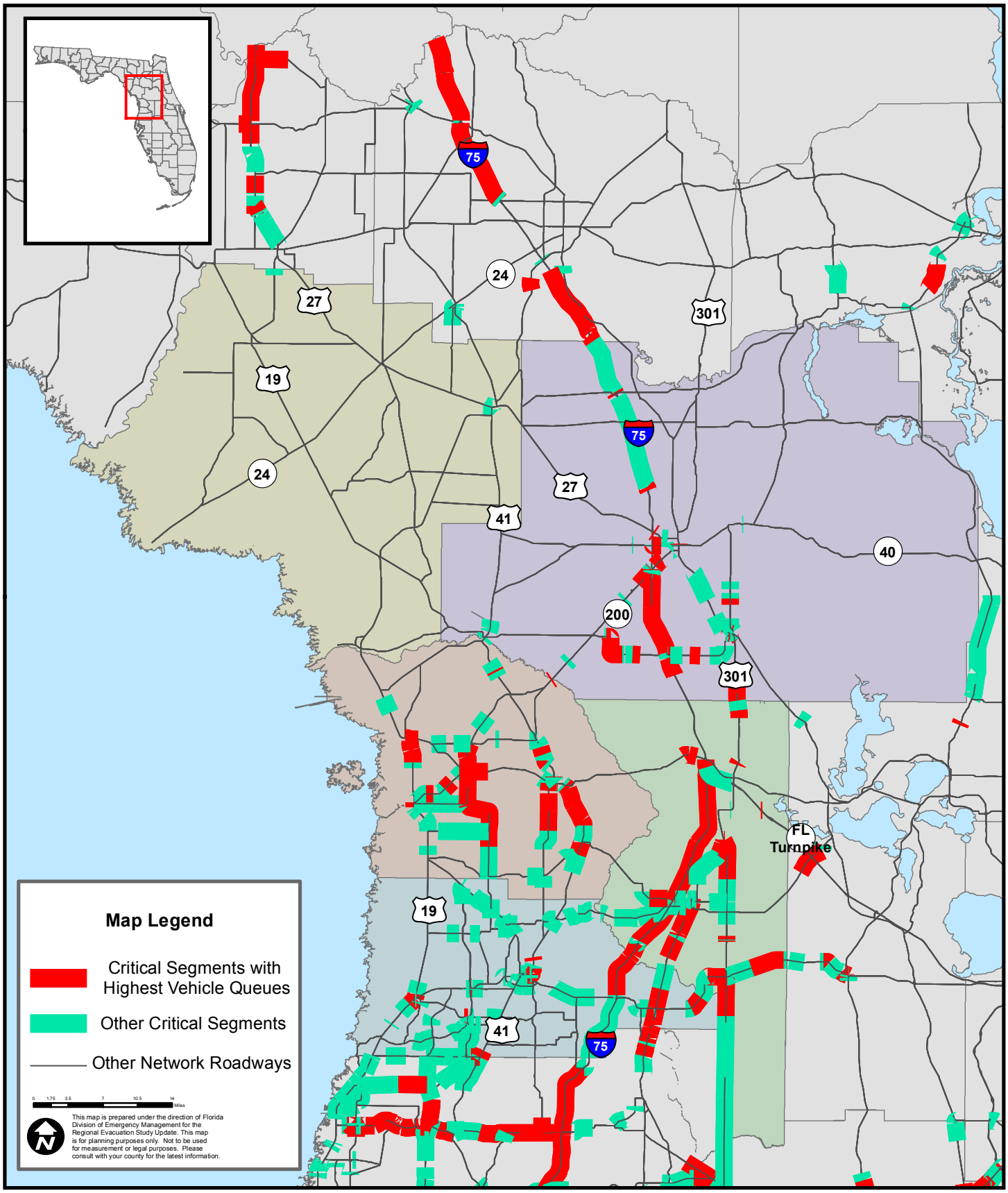


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-17

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level B

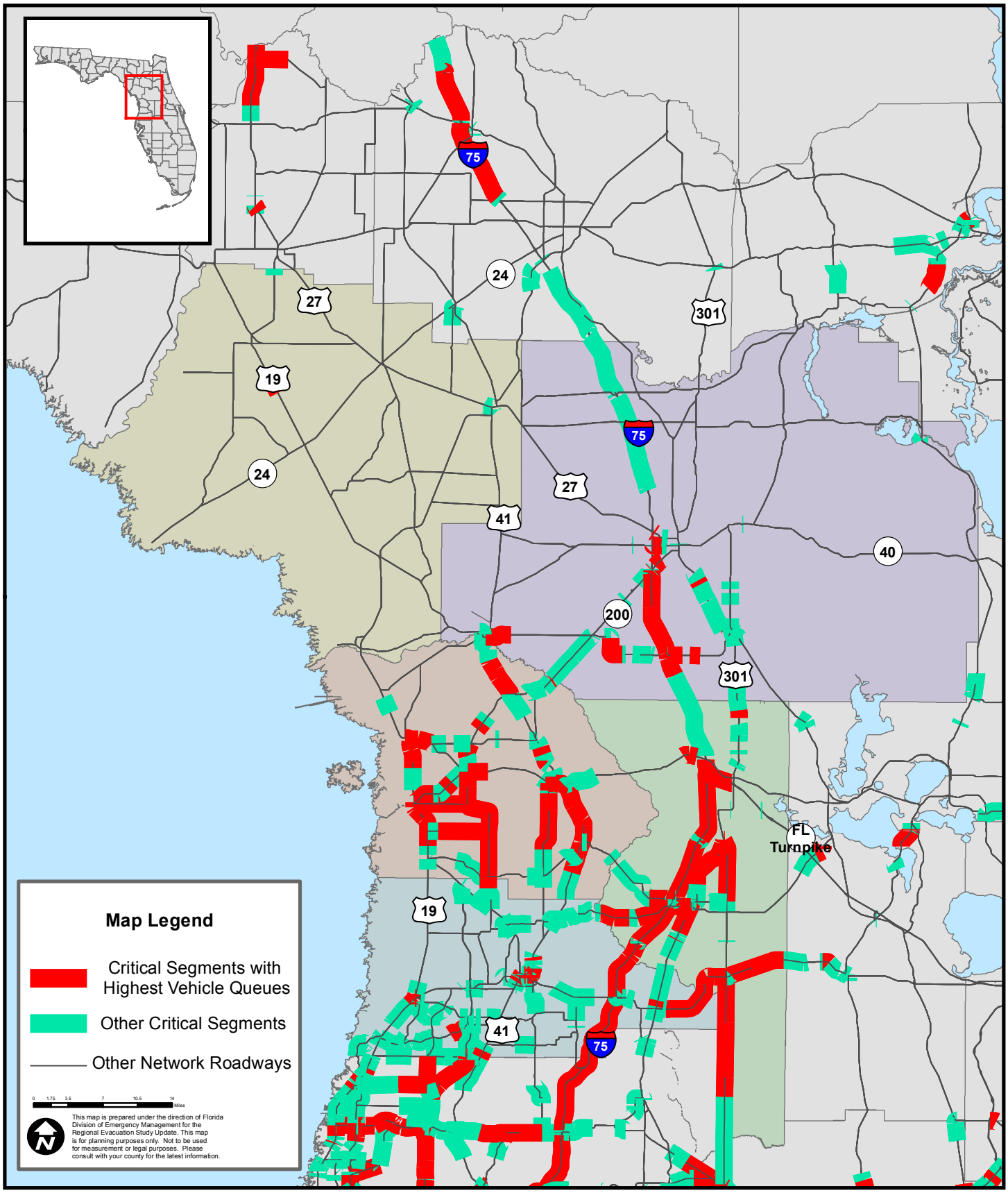


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-18

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level C

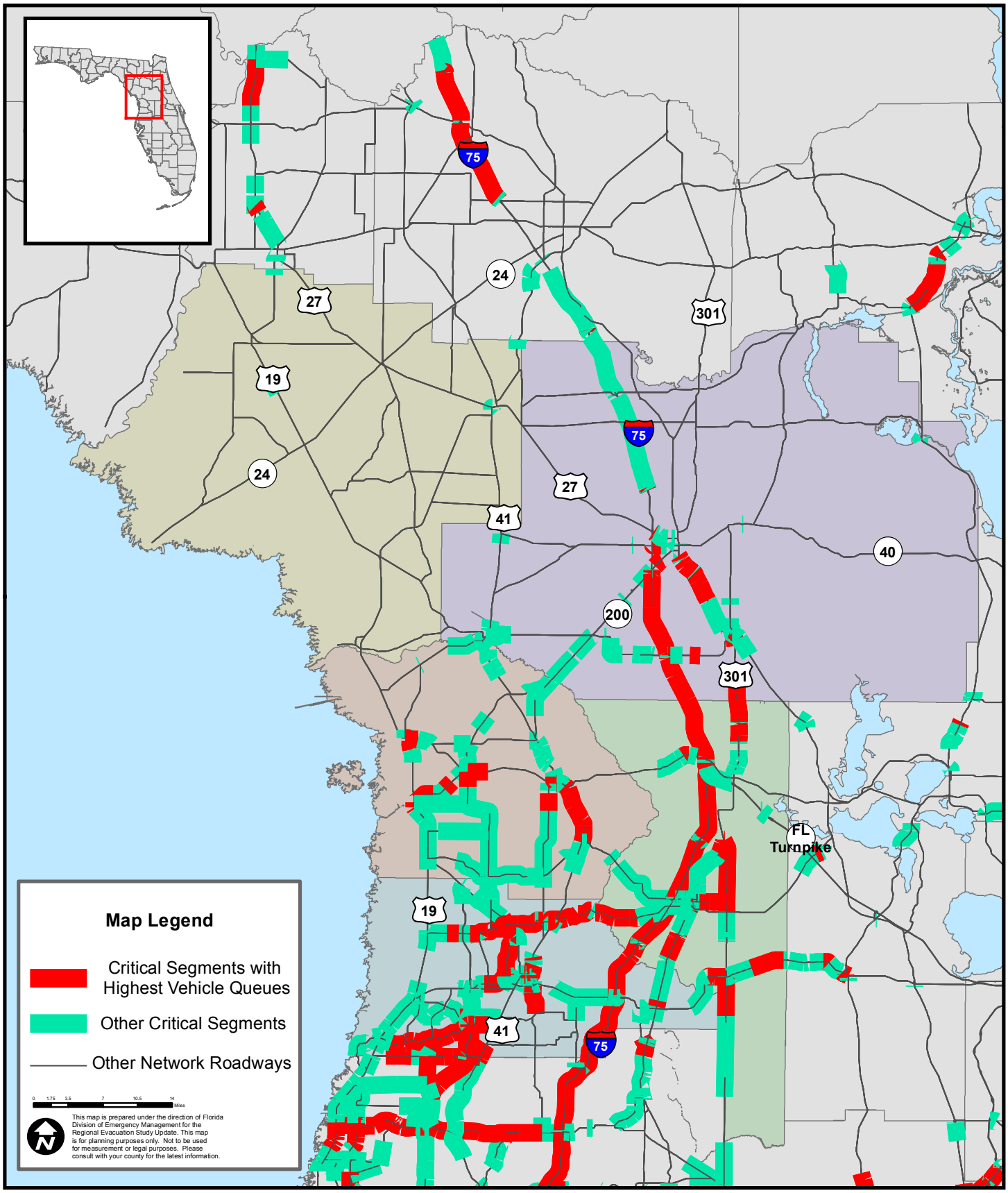


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-19

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level D

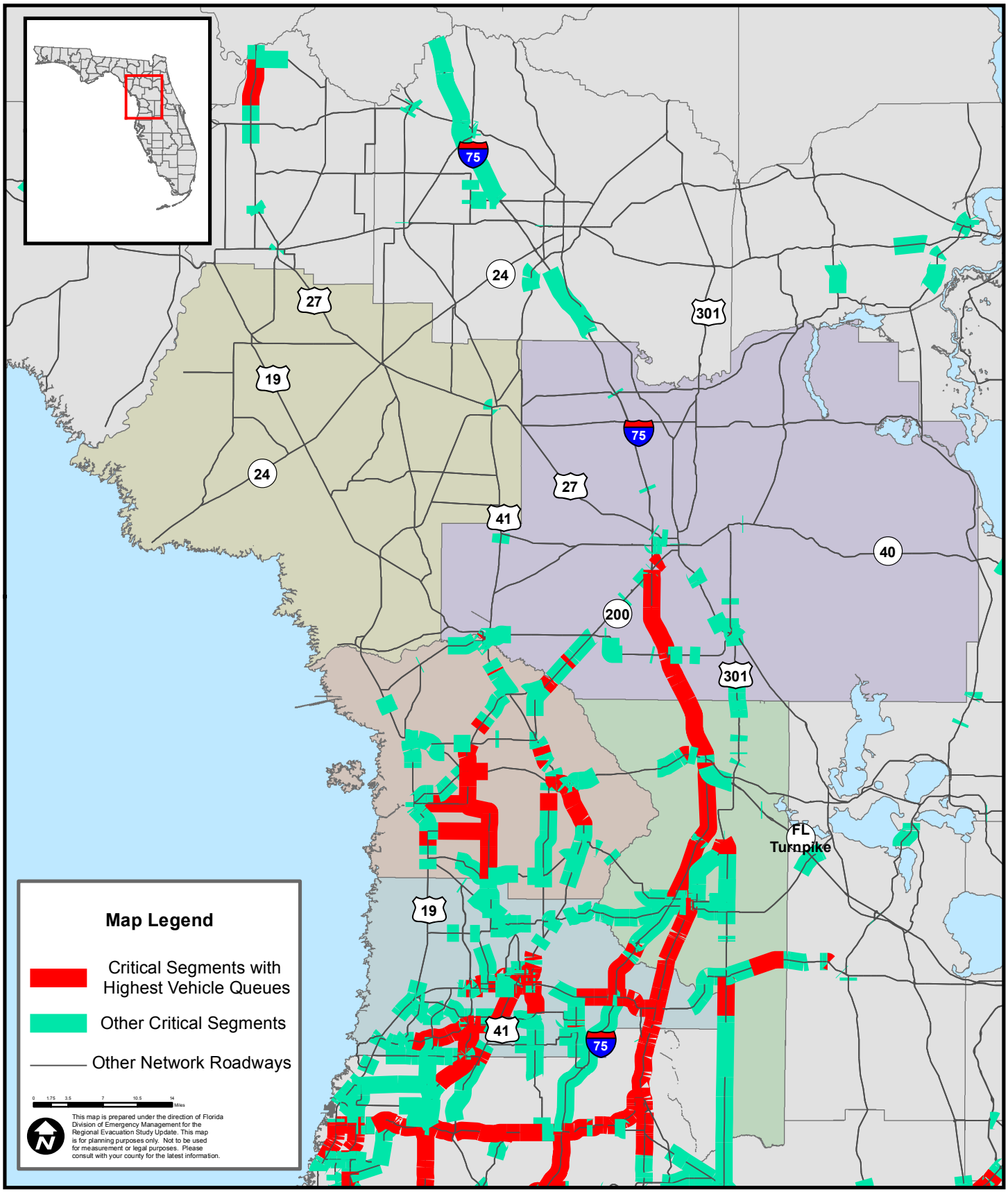


Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Figure IV-20

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level E



Sources: Withlacoochee Regional Planning Council, CDM Smith

Map Printed: May, 2015

Table IV-26 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2015 Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Citrus					
SR 44 Eastbound	4900	8600	5200	15400	13000
US 19 Northbound	10000	17900	18100	25200	25000
US 19 Southbound	0	100	200	100	100
US 41 Northbound	9100	16300	12400	17800	22500
US 41 Southbound	0	0	100	100	200
Hernando					
I-75 Northbound	25700	53100	38500	73600	56500
I-75 Southbound	1200	2500	3000	4100	5500
SR 589 Southbound	700	900	1300	2200	3300
US 19 Northbound	7900	12100	11700	20600	21000
US 19 Southbound	0	0	0	100	200
US 301 Northbound	5700	9000	7100	13900	10500
US 301 Southbound	0	100	100	100	100
US 41 Northbound	3800	6400	7100	12000	17300
US 41 Southbound	500	1200	700	1400	900
Marion					
I-75 Northbound	44600	93100	72800	107000	101400
I-75 Southbound	3200	4400	6200	8200	11200
SR 19 Northbound	3400	5800	6200	8900	13600
SR 19 Southbound	100	100	100	200	200
SR 40 Eastbound	400	500	1000	1800	2300
US 27 Northbound	300	900	2600	2400	3200
US 27 Southbound	0	0	100	100	500
US 301 Northbound	2300	4700	5900	9900	13300
US 301 Southbound	1000	1400	1800	2400	2400
US 41 Northbound	6700	11500	6800	12000	9600
US 41 Southbound	200	300	300	400	400
US 441 Northbound	0	2900	700	2300	2900
Sumter					
FL Turnpike Southbound	3600	4800	6500	9300	11200
I-75 Northbound	30300	60900	48500	70700	67000
I-75 Southbound	1800	3800	4100	4800	6400
SR 44 Eastbound	300	500	500	800	1300
SR 471 Southbound	200	400	600	800	1100
US 27 Northbound	600	5100	2900	2400	5300
US 27 Southbound	200	200	300	300	1000
US 301 Northbound	7800	18700	11400	24300	28600
US 301 Southbound	0	0	0	0	100
Levy					
US 19 Northbound	4700	10400	16900	13600	29100
US 19 Southbound	200	200	400	300	500
US 41 Northbound	3100	1700	1300	2900	4900
US 41 Southbound	100	200	100	200	200

Table IV-27 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2020 Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Citrus					
SR 44 Eastbound	3700	4000	7400	15500	17100
US 19 Northbound	11400	14600	28000	27800	29700
US 19 Southbound	100	100	200	100	100
US 41 Northbound	11400	9200	17200	22900	31700
US 41 Southbound	0	100	100	400	200
Hernando					
I-75 Northbound	33300	37200	54000	106800	108100
I-75 Southbound	1900	2100	3200	4600	6200
SR 589 Southbound	800	1200	2100	2800	3200
US 19 Northbound	7700	9400	15100	18200	26500
US 19 Southbound	0	0	0	100	100
US 301 Northbound	4600	7500	7600	11000	20900
US 301 Southbound	100	100	100	200	200
US 41 Northbound	3400	5600	9800	12600	21000
US 41 Southbound	600	800	1200	1700	1600
Marion					
I-75 Northbound	50400	52100	70500	144300	129600
I-75 Southbound	3500	4900	6600	8600	12800
SR 19 Northbound	5000	5000	6900	17200	14900
SR 19 Southbound	100	100	100	200	200
SR 40 Eastbound	400	700	1000	2000	2600
US 27 Northbound	700	1000	1100	3600	3600
US 27 Southbound	100	100	100	100	200
US 301 Northbound	3200	4900	11400	12400	16600
US 301 Southbound	1200	1600	2100	2800	3200
US 41 Northbound	7400	5900	6100	12900	12900
US 41 Southbound	200	300	300	400	500
US 441 Northbound	2900	900	700	4200	1700
Sumter					
FL Turnpike Southbound	4100	5500	7200	10200	13700
I-75 Northbound	31100	35000	44900	81300	76000
I-75 Southbound	2800	3000	4400	5500	7200
SR 44 Eastbound	400	500	800	1200	1400
SR 471 Southbound	300	400	700	1000	1400
US 27 Northbound	3100	1100	3700	8700	8300
US 27 Southbound	200	300	300	400	600
US 301 Northbound	8100	10100	12200	24400	31500
US 301 Southbound	0	0	100	100	100
Levy					
US 19 Northbound	7300	8300	20900	15000	27100
US 19 Southbound	200	300	300	300	600
US 41 Northbound	1900	1800	1500	1900	6100
US 41 Southbound	100	200	200	200	300

Table IV-28 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2015 Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Citrus					
US 19 Southbound	200	200	400	300	500
US 19 Northbound	7900	12100	11700	20600	21000
US 41 Southbound	200	300	300	400	400
US 41 Northbound	3800	6400	7100	12000	17300
Hernando					
US 19 Southbound	0	100	200	100	100
SR 589 Northbound	12900	30700	23500	26400	26600
US 41 Northbound	700	3200	1100	4500	4600
US 41 Southbound	0	0	100	100	200
I-75 Northbound	24400	48300	36100	58300	46900
I-75 Southbound	1800	3800	4100	4800	6400
US 19 Northbound	11200	23500	15300	31600	29300
US 301 Northbound	4000	7500	6300	9500	9900
Marion					
US 41 Northbound	9100	16300	12400	17800	22500
US 41 Southbound	100	200	100	200	200
I-75 Northbound	30300	60900	48500	70700	67000
US 301 Northbound	7800	18700	11400	24300	28600
US 27 Northbound	600	5100	2900	2400	5300
Sumter					
I-75 Northbound	25700	53100	38500	73600	56500
SR 44 Eastbound	4900	8600	5200	15400	13000
US 301 Northbound	5700	9000	7100	13900	10500
I-75 Southbound	3200	4400	6200	8200	11200
US 301 Southbound	1000	1400	1800	2400	2400
US 27 Southbound	0	0	100	100	500
Levy					
US 19 Northbound	10000	17900	18100	25200	25000
US 41 Northbound	6700	11500	6800	12000	9600
US 27 Northbound	300	900	2600	2400	3200

Table IV-29 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2020 Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Citrus					
US 19 Southbound	200	300	300	300	600
US 19 Northbound	7700	9400	15100	18200	26500
US 41 Southbound	200	300	300	400	500
US 41 Northbound	3400	5600	9800	12600	21000
Hernando					
US 19 Southbound	100	100	200	100	100
SR 589 Northbound	15200	16700	17700	29000	30300
US 41 Northbound	1000	1500	4400	7200	8600
US 41 Southbound	0	100	100	400	200
I-75 Northbound	28800	32000	44800	77800	76700
I-75 Southbound	2800	3000	4400	5500	7200
US 19 Northbound	11300	13900	24600	36900	36500
US 301 Northbound	4300	7600	8200	11600	15500
Marion					
US 41 Northbound	11400	9200	17200	22900	31700
US 41 Southbound	100	200	200	200	300
I-75 Northbound	31100	35000	44900	81300	76000
US 301 Northbound	8100	10100	12200	24400	31500
US 27 Northbound	3100	1100	3700	8700	8300
Sumter					
I-75 Northbound	33300	37200	54000	106800	108100
SR 44 Eastbound	3700	4000	7400	15500	17100
US 301 Northbound	4600	7500	7600	11000	20900
I-75 Southbound	3500	4900	6600	8600	12800
US 301 Southbound	1200	1600	2100	2800	3200
US 27 Southbound	100	100	100	100	200
Levy					
US 19 Northbound	11400	14600	28000	27800	29700
US 41 Northbound	7400	5900	6100	12900	12900
US 27 Northbound	700	1000	1100	3600	3600

Clearance Times

Clearance times for each of the operational scenarios are summarized in **Table IV-30** and **IV-31**, as well as **Figures IV-24, IV-25,** and **IV-26**. Clearance time includes several components, including the mobilization time for the evacuating population to prepare for an evacuation (pack supplies and personal belongs, load their vehicle, etc.), the actual time spent traveling on the roadway network, and the delay time caused by traffic congestion.

In-county clearance times for the 2015 operational scenarios range from 7.5 hours to 33.5 hours depending upon the scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the operational scenarios ranging from 6.5 hours to 26.5 hours depending upon the county and the scenario.

In 2020, in-county clearance times for the operational scenarios vary from 8 hours to 54 hours for the level E evacuation. The 2020 level D and E scenarios include vehicle trips evacuating from Tampa for a large storm event (approximately 1.45 million evacuating vehicles in the model network), which cause a large increase in clearance times. Clearance Time to Shelter shows a similar pattern to the 2015 scenarios, with clearance times for the base scenarios ranging from 6.5 hours to 49.5 hours depending upon the scenario.

Out of county clearance times for the 2015 operational scenarios range from 14.5 hours to 35.5 hours, depending upon the scenario. Out of county clearance times show a similar pattern in 2020 to between 15 and 56 hours depending upon the scenario. Regional clearance time for the five county Withlacoochee region ranges from 18 hours to 39.5 hours in 2015. This time increases to between 19 and 56 hours in 2020.

Table IV-30 – 2015 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Citrus County	10.5	22.5	11.0	22.5	26.5
Hernando County	7.5	15.5	8.0	21.0	26.5
Levy County	6.5	13.0	10.0	13.0	7.0
Marion County	14.0	16.0	15.5	15.5	10.0
Sumter County	14.5	17.5	19.0	19.0	10.0
In-County Clearance Time					
Citrus County	12.5	24.0	18.5	28.5	33.5
Hernando County	7.5	19.0	14.0	26.0	26.5
Levy County	13.0	24.5	19.5	27.5	34.5
Marion County	14.5	16.5	16.0	16.0	33.5
Sumter County	15.0	18.0	19.5	19.5	10.5
Out of County Clearance Time					
Citrus County	14.5	27.0	20.5	32.5	33.5
Hernando County	14.5	27.5	18.5	33.5	27.0
Levy County	16.5	29.5	24.5	36.5	34.5
Marion County	18.0	32.0	25.5	39.5	35.5
Sumter County	15.0	28.0	22.5	34.0	34.5
Regional Clearance Time					
Withlacoochee	18.0	32.0	25.5	39.5	35.5

Table IV-31 – 2020 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Citrus County	13.5	13.5	14.0	21.5	27.5
Hernando County	8.0	9.0	11.5	32.0	49.5
Levy County	6.5	6.5	7.0	13.0	13.0
Marion County	14.5	16.5	16.5	22.0	21.5
Sumter County	12.5	16.5	17.0	28.5	27.0
In-County Clearance Time					
Citrus County	15.0	15.5	25.0	42.0	53.5
Hernando County	8.0	13.0	17.0	32.0	49.5
Levy County	15.5	16.0	27.5	42.5	54.0
Marion County	15.0	17.0	17.0	22.5	53.5
Sumter County	13.0	17.0	17.5	29.0	27.5
Out of County Clearance Time					
Citrus County	17.0	17.0	27.0	43.5	55.0
Hernando County	15.0	17.0	23.5	40.5	53.5
Levy County	18.0	20.0	28.0	44.0	54.5
Marion County	19.0	20.0	28.0	46.5	56.0
Sumter County	15.5	18.0	26.5	44.0	55.0
Regional Clearance Time					
Withlacoochee	19.0	20.0	28.0	46.5	56.0

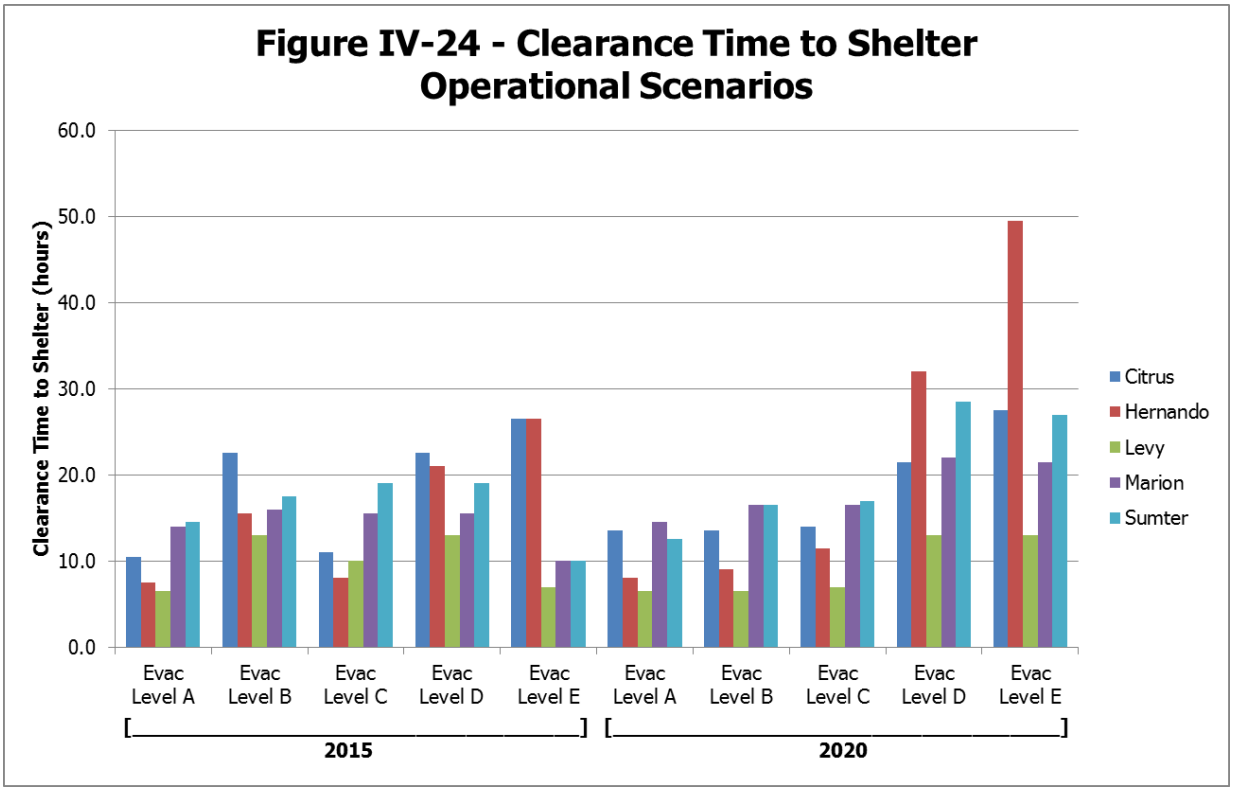


Figure IV-24 - Clearance Time to Shelter
Operational Scenarios
Clearance Time to Shelter (hours)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
2015
2020
Citrus
Hernando
Levy
Marion
Sumter

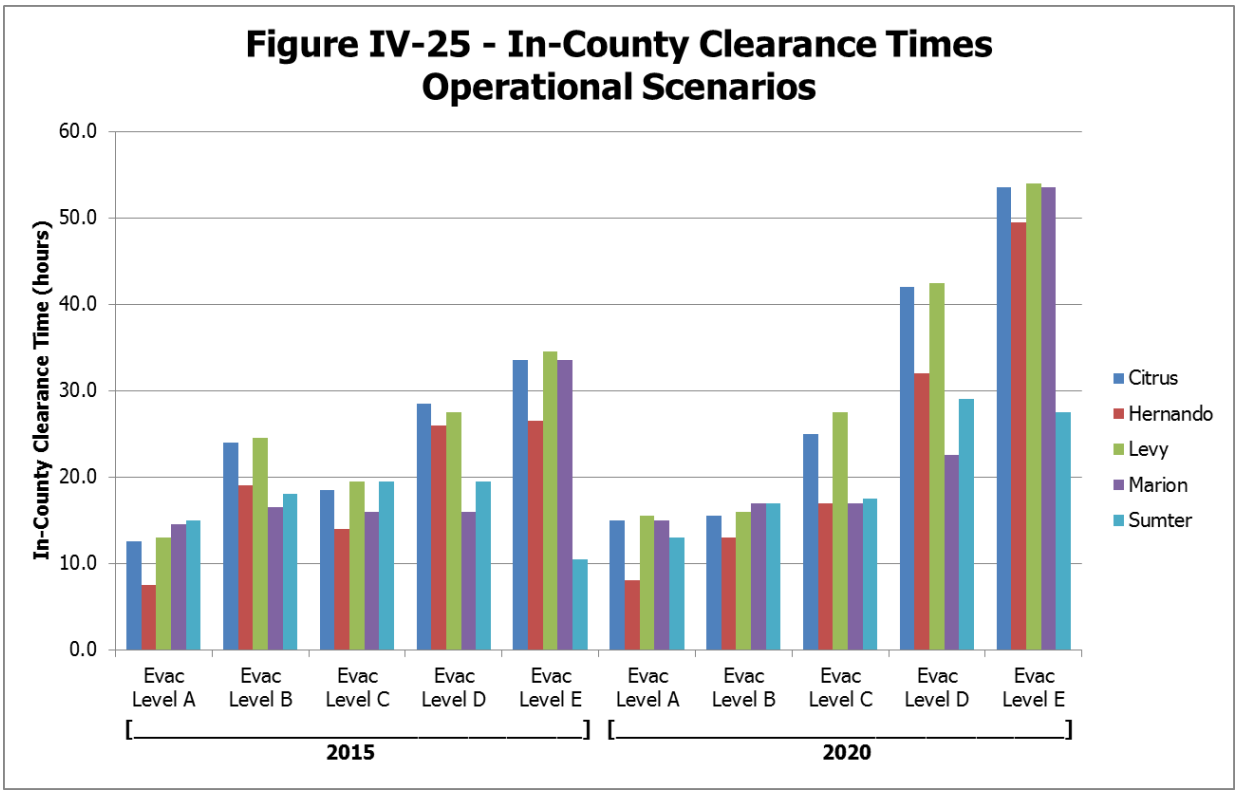


Figure IV-25 - In-County Clearance Times
Operational Scenarios
In-County Clearance Time (hours)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
2015
2020
Citrus
Hernando
Levy
Marion
Sumter

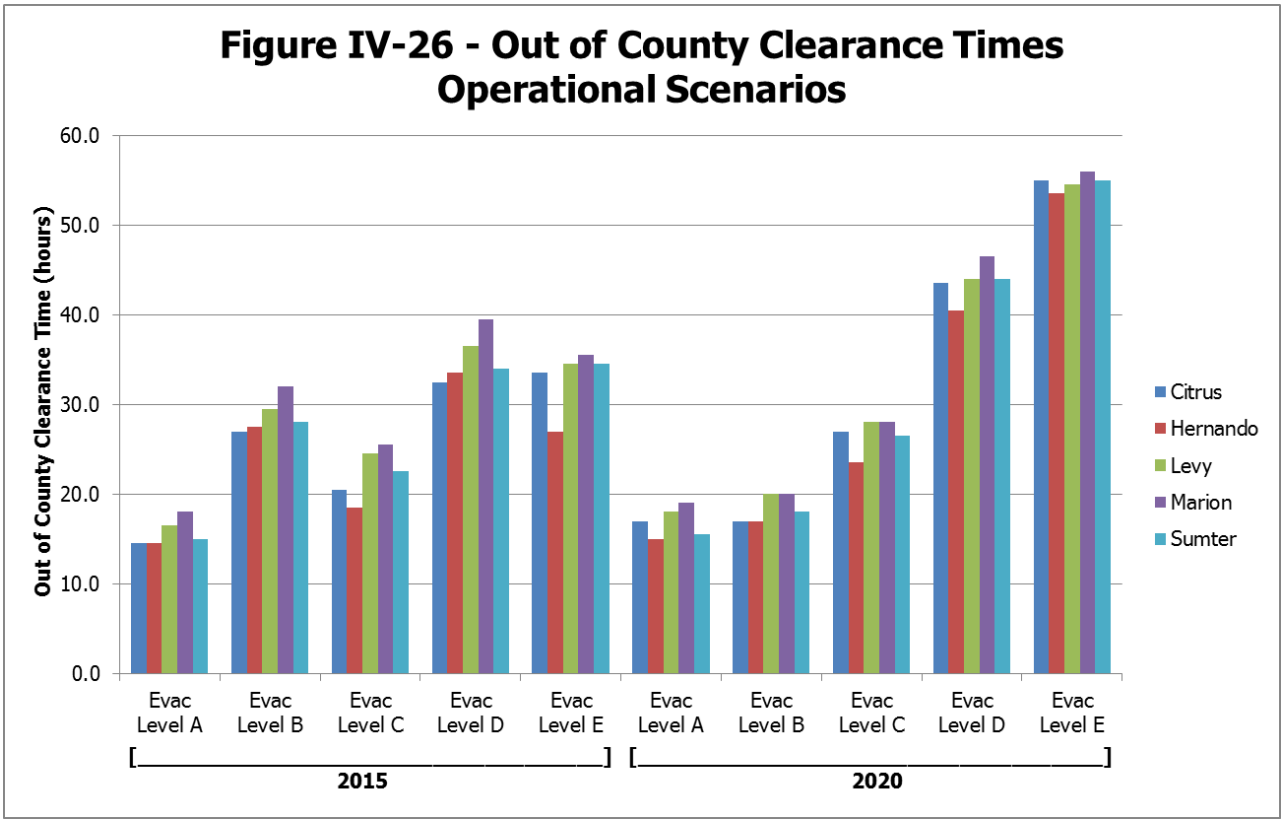


Figure IV-26 - Out of County Clearance Times
Operational Scenarios
Out of County Clearance Time (hours)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
2015
2020
Citrus
Hernando
Levy
Marion
Sumter

H. Maximum Evacuating Population Clearances

From an emergency management standpoint, it is important to get an understanding of the maximum proportion of the evacuating population that can be expected to evacuate at various time intervals during an evacuation. Should storm conditions change during an evacuation, emergency managers will need to be able to estimate what portion of the evacuating population is estimated to still remain within the county trying to evacuate.

Using the base scenarios, which assume 100% of the vulnerable population is evacuating, along with shadow evacuations and evacuations from adjacent counties, an estimate was made of the evacuating population actually able to evacuate out of each county by the time intervals of 12, 18, 24, and 36 hours. The estimated maximum evacuating population by time interval for 2015 is identified in **Table IV-32** and for 2020 in **Table IV-33**.

It is important to note that these estimates take into account many variables, including roadway capacity, in-county evacuating trips, out of county evacuating trips, evacuating trips from other counties, and background traffic that is impeding the evacuation trips. For this reason, the maximum evacuation population by time interval will vary slightly between evacuation level and either increase or decrease from one evacuation level to the next.

I. Sensitivity Analysis

As discussed previously, there are literally thousands of possible combinations of variables that can be applied using the evacuation transportation model, which will result in thousands of possible outcomes. As part of the analysis process, a sensitivity analysis was conducted using the prototype model to evaluate the effect of different response curves on the calculated evacuation clearance times. Calculated clearance times will never be lower than the designated response time, since some evacuating residents will wait to evacuate until near the end of the response time window. For example, using a 12-hour response curve in the analysis means that all residents will begin their evacuation process within 12-hours, and some residents will choose to wait and begin evacuating more than 11.5 hours from when the evacuation was ordered. This will generate a clearance time of more than 12 hours.

The sensitivity analysis identified that clearance times will vary by scenario and by any of the numerous parameters that can be chosen in a particular scenario model run (demographics, student population, tourist population, different counties that are evacuating, response curve, phasing, shadow evacuations, etc.). A few general rules of thumb did emerge from the sensitivity analysis that can provide some guidance to the region regarding the sensitivity of the response curve to the calculated clearance times:

- For low evacuation levels A and B, clearance time will vary by as much as 40 percent depending on the response curve. Low evacuation levels A and B have fewer evacuating vehicles that can be accommodated more easily on the transportation network. In most cases, clearance times typically exceed the response curve by one to two hours. Thus, a 12 hour response curve may yield a clearance time of 13 or 14 hours while an 18 hour response curve may yield a clearance time of 19 or 20 hours. This leads to a higher level of variability than larger evacuations;

Table IV-32 – Maximum Evacuating Population by Time Interval for 2015

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Citrus County					
12-Hour	42,016	34,137	27,593	30,909	32,564
18-Hour	61,273	51,205	41,389	46,364	48,846
24-Hour		66,851	55,186	61,818	65,128
36-Hour			72,431	85,000	93,622
Estimated Evacuating Population Clearing Hernando County					
12-Hour	26,910	24,293	22,911	33,931	39,093
18-Hour	40,365	36,440	34,367	50,896	58,639
24-Hour	47,092	48,586	45,822	67,861	78,186
36-Hour			60,142	93,309	114,021
Estimated Evacuating Population Clearing Levy County					
12-Hour	18,993	16,849	13,001	13,570	14,008
18-Hour	23,741	24,572	19,502	20,354	21,013
24-Hour			26,002	27,139	28,017
36-Hour				28,270	31,519
Estimated Evacuating Population Clearing Marion County					
12-Hour	60,782	57,673	51,132	53,649	50,669
18-Hour	91,173	86,509	76,698	80,474	76,003
24-Hour	111,434	115,346	102,264	107,298	101,337
36-Hour		124,958	138,482	152,006	152,006
Estimated Evacuating Population Clearing Sumter County					
12-Hour	16,530	16,211	14,223	15,074	15,629
18-Hour	24,796	24,316	21,334	22,611	23,444
24-Hour	29,617	32,421	28,445	30,148	31,258
36-Hour		33,772	37,927	42,081	46,236

Note: These estimates take into account many variables, including roadway capacity, in-county evacuating trips, out of county evacuating trips, evacuating trips from other counties, and background traffic that is impeding the evacuation trips. For this reason, the maximum evacuation population by time interval will vary between evacuation level and either increase or decrease from one evacuation level to the next.

Table IV-33 – Maximum Evacuating Population by Time Interval for 2020

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Citrus County					
12-Hour	36,680	39,103	30,067	33,143	31,701
18-Hour	55,021	58,654	45,100	49,715	47,552
24-Hour	65,719	71,688	60,134	66,287	63,403
36-Hour			77,673	91,144	100,388
Estimated Evacuating Population Clearing Hernando County					
12-Hour	28,331	25,713	25,262	36,307	39,680
18-Hour	42,496	52,120	37,893	54,461	59,520
24-Hour	51,940	49,447	50,524	72,615	79,360
36-Hour		53,568	66,313	102,871	125,653
Estimated Evacuating Population Clearing Levy County					
12-Hour	20,165	16,918	13,802	13,854	13,615
18-Hour	25,206	25,377	20,703	20,780	20,422
24-Hour		26,082	27,604	27,707	27,229
36-Hour				30,016	33,469
Estimated Evacuating Population Clearing Marion County					
12-Hour	63,886	63,375	56,188	57,271	51,397
18-Hour	95,829	95,062	84,282	85,906	77,095
24-Hour	122,448	126,750	112,376	114,542	102,794
36-Hour		137,312	152,176	167,040	167,040
Estimated Evacuating Population Clearing Sumter County					
12-Hour	18,842	18,956	16,963	17,457	17,187
18-Hour	28,262	28,434	25,445	26,186	25,781
24-Hour	35,328	37,912	33,926	34,914	34,375
36-Hour		40,282	45,235	50,189	55,143

Note: These estimates take into account many variables, including roadway capacity, in-county evacuating trips, out of county evacuating trips, evacuating trips from other counties, and background traffic that is impeding the evacuation trips. For this reason, the maximum evacuation population by time interval will vary between evacuation level and either increase or decrease from one evacuation level to the next.

- For mid-level evacuations such as C and sometimes D, clearance time varied by as much as 25 percent during the sensitivity analysis. The number of evacuating vehicles is considerably higher than for levels A and B, and lower response curves tend to load the transportation network faster than longer response curves. The variability in clearance times is less in these cases than for low evacuation levels; and,

- For high-level evacuations such as some level D evacuations and all E evacuations, clearance time variability is reduced to about 10 to 15 percent. Large evacuations involve large numbers of evacuating vehicles, and the sensitivity test identified that clearance times are not as dependent on the response curve as lower level evacuations since it takes a significant amount of time to evacuate a large number of vehicles.

The counties within the Withlacoochee Region are encouraged to test additional scenarios beyond what has been provided in this study. Each model run will provide additional information for the region to use in determining when to order an evacuation. Due to advancements in computer technology and the nature of the developed transportation evacuation methodology, this study includes a more detailed and time consuming analysis process than used in previous years studies. Counties interested in testing various response curves for each scenario can easily do so using the TIME interface to calculate clearance times for different response curves.

J. Summary and Conclusions

Through a review of the results of the 20 different scenarios (10 base and 10 operational), several conclusions could be reached regarding the transportation analysis, including the following:

- Critical transportation facilities within the WRPC region include I-75, US 19, US 301, and portions of SR 200 and US 41. For large storm events, such as level D and E evacuations, other State facilities also play an important role in evacuations;

- During the level A and B evacuation scenarios, the roadway segments with the highest vehicle queues are primarily concentrated along the major Interstate and State Highway system. During these levels of evacuation, State and County officials should coordinate personnel resources to provide sufficient traffic control at interchanges and major intersections along these routes;

- In contrast, for the higher level C, D, and E evacuation scenarios, many other roadway facilities, both within and outside of the region, will require personnel resources for sufficient traffic control at interchanges and major intersections;

- The WRPC counties, in coordination with the State, should continue public information campaigns to clearly define those that are vulnerable and should evacuate verses those who choose to evacuate on their own. During large storm events, evacuations by the vulnerable population are impacted by shadow evacuations occurring in other parts of the region;

- WRPC counties play a major role even when evacuations occur in other parts of the State, especially with Tampa Bay area storm events. For example, for the 2020

operational scenarios for level D and level E which include a major Tampa Bay region evacuation, total evacuating vehicles along I-75 in Sumter County totaled to around 81,000 vehicles. WRPC counties should continue their coordination efforts with the State and provide assistance even when WRPC counties are not evacuating;

- The Florida Department of Transportation should continue to work with local counties on implementing intelligent transportation system (ITS) technology, which will provide enhanced monitoring and notification systems to provide evacuating traffic with up to date information regarding expected travel times and alternate routes;

- The State can use the data and information provided in this report (specifically the evacuating vehicle maps in Volume 5-5) to estimate fuel and supply requirements along major evacuation routes to aid motorists during the evacuation process;

- For major evacuation routes that have signalized traffic control at major intersections, traffic signal timing patterns should be adjusted during the evacuation process to provide maximum green time for evacuating vehicles in the predominate north and west directions; and,

- The counties within the Withlacoochee Region are encouraged to test additional transportation scenarios beyond what has been provided in this study. Each model run will provide additional information for the region to use in planning for an evacuation. Counties interested in testing various response curves for each scenario can easily do so using the TIME interface to calculate clearance times for different evacuation conditions, such as different evacuation levels, different behavioral response assumptions, and different response curves.