APALACHEE REGION TRANSPORTATION ANALYSIS

FINAL REPORT

Prepared for:

US Army Corps of Engineers, Mobile District

Prepared by:

Post, Buckley, Schuh and Jernigan, Inc.
1901 Commonwealth Lane
Tallahassee, Florida 32303

August 2004

Project #091238

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TRANSPORTATION MODEL SUPPORT DOCUMENT (under separate cover)

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1.0 INTRODUCTION

1.1 OVERVIEW

With each new hurricane season, the Apalachee Region faces the potential for landfall of a tropical storm or hurricane. While major hurricanes are not a prevalent event in this area, most of the counties in the region in recent years have experienced the effects of a tropical storm, category one or two event on an annual basis. Since the last transportation analysis was performed for the Apalachee Region in 1994, the counties have faced evacuation decisions for no less than 13 storm threats. Not only were the region's counties in the National Hurricane Center's advisory average forecast error cone for those events, but also in most cases they experienced some of the impacts of those cyclones: storm surge; winds; flooding; and tornadoes.

Unfortunately, many of these tropical cyclones have exhibited very erratic "behavior" on their approaches towards the Apalachee Region coastline. Significant changes in forward movement and tracks, as well as increases in intensity and forward speed have characterized many of the storms that have threatened the region. This "forecast uncertainty" certainly complicates the job of most County Emergency Managers and first responders and thereby imposes a greater need for the decision making process to be efficient and based on the best available data. Among the tropical cyclones that have caused county emergency officials to respond in order to protect lives and property: Tropical Storm Barry in 2001; Tropical Storm Helene and Hurricane Gordon in 2000; Hurricane Earl in 1998; Tropical Storm Josephine in 1996; Tropical Storm Jerry and Hurricanes Opal, Erin and Allison in 1995; and Tropical Storms Beryl and Alberto in 1994.

The study area faces distinct challenges due to the special circumstances that exist in the region, all of which impose very specific requirements and restraints on local government officials during the evacuation decision making and implementation process. For example, the Apalachee Region's coastline has some of the highest storm surge elevations in the country as determined by the National Hurricane Center's Sea, Lake and Overland Surges from Hurricanes (SLOSH) model. Every coastal county in the region could experience storm surges in excess of 19 feet during a category five event.

To further complicate the growth issue for conducting hurricane evacuations in the region is the relatively sparse road coverage. There are large portions of the counties in the region that do not enjoy the benefits of an extensive or robust road system, therefore the evacuation roadway network will tend to channel most evacuees to the same road segments thereby increasing the likelihood of local and regional bottlenecks. It is also likely that the burgeoning coastal populations in the region will increasingly tax the evacuation network, well before the roads can be augmented to accommodate them.

Additionally, most of the coastal areas in the region are facing significant development pressure, which will only exacerbate the evacuation situation in the future. Since the 1990 Census, the counties in the region have collectively grown by 24%, and more coastal development projects are on the near horizon.

Unlike most of the rest of Florida, the entire Panhandle and Big Bend area experiences the highest seasonal occupancy rates from Memorial Day to Labor Day. This means that the hotels, motels and other seasonal vacation units are most likely to be filled with tourists and other non-residents during the peak hurricane season.

Finally, most of the counties in the region have a significant number of residents in mobile homes, all of whom will have to be evacuated even in lesser category storms. Leon, the regional destination for many evacuees from the region has more mobile home residents that must evacuate in a major hurricane than the entire surge populations of most of the coastal counties combined. The implications are that in major hurricanes coastal evacuees and in-county mobile home residents may have to compete with one another for the limited ARC 4496 compliant shelter spaces in Leon County, especially since most of the coastal counties in the region have no shelter spaces. With Leon County only 17 miles from the coast with little to no assurance of winds degrading due to inland effects, the shelters in that county must be structurally sound (i.e. at a minimum, ARC 4496 compliant) in order to provide a reasonable degree of safety. Unfortunately the other inland counties, Gadsden; Liberty; Calhoun; and Jackson have limited shelter facilities and can provide only very few “host” sheltering options for coastal evacuees in the region.

During a hurricane evacuation, a considerable number of vehicles will have to be moved across the local and regional road network. The quantity of evacuating vehicles will vary depending upon the magnitude of the hurricane, publicity and warnings provided about the storm, and particular behavioral response characteristics of the vulnerable population. In the event of an evacuation, the entry of vehicles onto the road network typically depends on the response of evacuees to an evacuation order or storm advisory. Conversely, vehicles exit the roadway network depending on both the planned destinations of evacuees and the availability of acceptable destinations such as public shelters, hotel/motel units and the homes of friends or relatives in non-surge prone areas. The speed at which vehicles on the road network can travel from origin to destination is dependent upon the rate of traffic loading on specific roadway segments and the ability of those segments to handle a particular volume of vehicles each hour. In order to produce accurate clearance times, the analysis of the study area must account for the impacts of evacuation traffic generated by neighboring counties using roadways within the study area.

This report documents the basic inputs and findings of the study analysis. A separately bound appendix entitled Transportation Model Support Document provides modeling information and data files too extensive for this report.

1.2 ANALYSIS OBJECTIVES AND SCOPE

Recognizing the importance of accurate clearance times, the US Army Corps of Engineers (USACE), Mobile District, hired Post, Buckley, Schuh and Jernigan, Inc. (PBS&J) as part of the Southeastern US Regional Hurricane Evacuation Study to perform the tasks necessary to update the area's hurricane evacuation clearance times. The major objectives of the study were as follows:

(1) Use recently revised evacuation zones and plans developed by the county for transportation modeling and clearance time calculations;

(2) Quantify the potential evacuation population for each plan using socioeconomic and behavioral data developed by PBS&J in conjunction with data and verification by the Regional Planning Council, as well as county Emergency Management, Planning and Zoning, and Building officials;

(3) Identify the existing evacuation roadway network, recognizing recent construction that has improved some of these roads;

(4) Develop hurricane evacuation clearance times using 2004 as the base year;

(5) Determine regional evacuation traffic that is expected to cross county lines and move inland in order to increase the accuracy of operational planning;

(6) Identify local and regional bottlenecks/critical roadway segments and where applicable, recommend general traffic control strategies;

(7) Develop zone and road network graphics in an ArcInfo/ArcView usable format;

(8) Using the evacuation zone graphic, develop GIS graphics displaying:

- ► Permanent occupied dwelling units by evacuation zone;
- ► Mobile home units by evacuation zone;
- ► Seasonal dwelling units by evacuation zone;
- ► Evacuating people by evacuation zone by plan; and
- ► Public shelter demand by evacuation zone by scenario

(9) Using the evacuation road network graphic, develop GIS graphics displaying:

- ► Directional service volume per roadway segment; and
- ► Evacuation traffic congestion by roadway segment by plan

(10) Use evacuation zones and plans developed by the county for transportation modeling and clearance time calculations; develop a simplistic abbreviated model in a spreadsheet format that can be used by the county to modify clearance times based on dwelling unit/population data and roadway capacity changes.

1.3 COORDINATION AND REVIEW ACTIVITIES

This study came to fruition through cooperation by state and local emergency management (EM) staff, and PBS&J. The effort included the collection of essential socioeconomic and behavioral data and locally developed hurricane evacuation zones, as well as coordination of the various technical inputs. Zones, input assumptions, and evacuation statistics used to form the foundation of the analysis were established through study organization and kickoff meetings with local Emergency management and other relevant officials held in November, 2003, and through subsequent phone coordination.

2.0 TRANSPORTATION ANALYSIS AND INPUT ASSUMPTIONS

The hurricane evacuation transportation modeling performed for the study area required a number of important data inputs and assumptions regarding anticipated evacuation behavior. All hurricanes differ from one another in some respect. Therefore, it is necessary to set forth clear assumptions about storm characteristics and the expected response from evacuees before this type of transportation modeling can begin. Not only does a storm vary in its track, intensity, and size, but also in the way residents in potentially vulnerable areas perceive it. These factors can cause a wide variance in the behavior of the vulnerable population. Even the time of day at which a storm makes landfall influences the parameters of an evacuation response.

The hurricane evacuation transportation analysis produces clearance times based on a set of assumed conditions and behavioral responses. It is likely that an actual storm will differ from a simulated storm for which clearance times are calculated in this report. Therefore, a sensitivity analysis was performed during the transportation modeling. Those variables having the greatest influence on clearance times were identified and then varied to establish the logical range within which the actual input assumption values may fall.

Key input assumptions guiding the transportation analysis include the following:

1. Traffic Evacuation Zones
2. Housing and Population Data
3. Behavioral Characteristics of the Evacuating Population
4. Roadway Network Assumptions

2.1 TRAFFIC EVACUATION ZONES

The foundation of the analysis is a system of evacuation zones developed by the county. The county, with technical guidance from the USACE and PBS&J, developed the boundaries of each zone in relation to well-known man-made or natural features, census boundaries, roadways, and SLOSH storm surge areas. The primary purpose of the evacuation zones is to target areas that will be asked to evacuate by local emergency management for select tropical cyclone scenarios. Gulf,

Franklin, Wakulla and Jefferson County EM staff put considerable effort into reviewing storm surge inundation mapping and revising existing zones, or delineating new areas they would evacuate for various intensities of hurricanes. PBS&J divided the evacuation areas into zones that could then be used for traffic clearance time modeling. Table 2-1 provides details on the number of evacuation zones and general vulnerability. The traffic evacuation zones are illustrated in Figure 2-1.

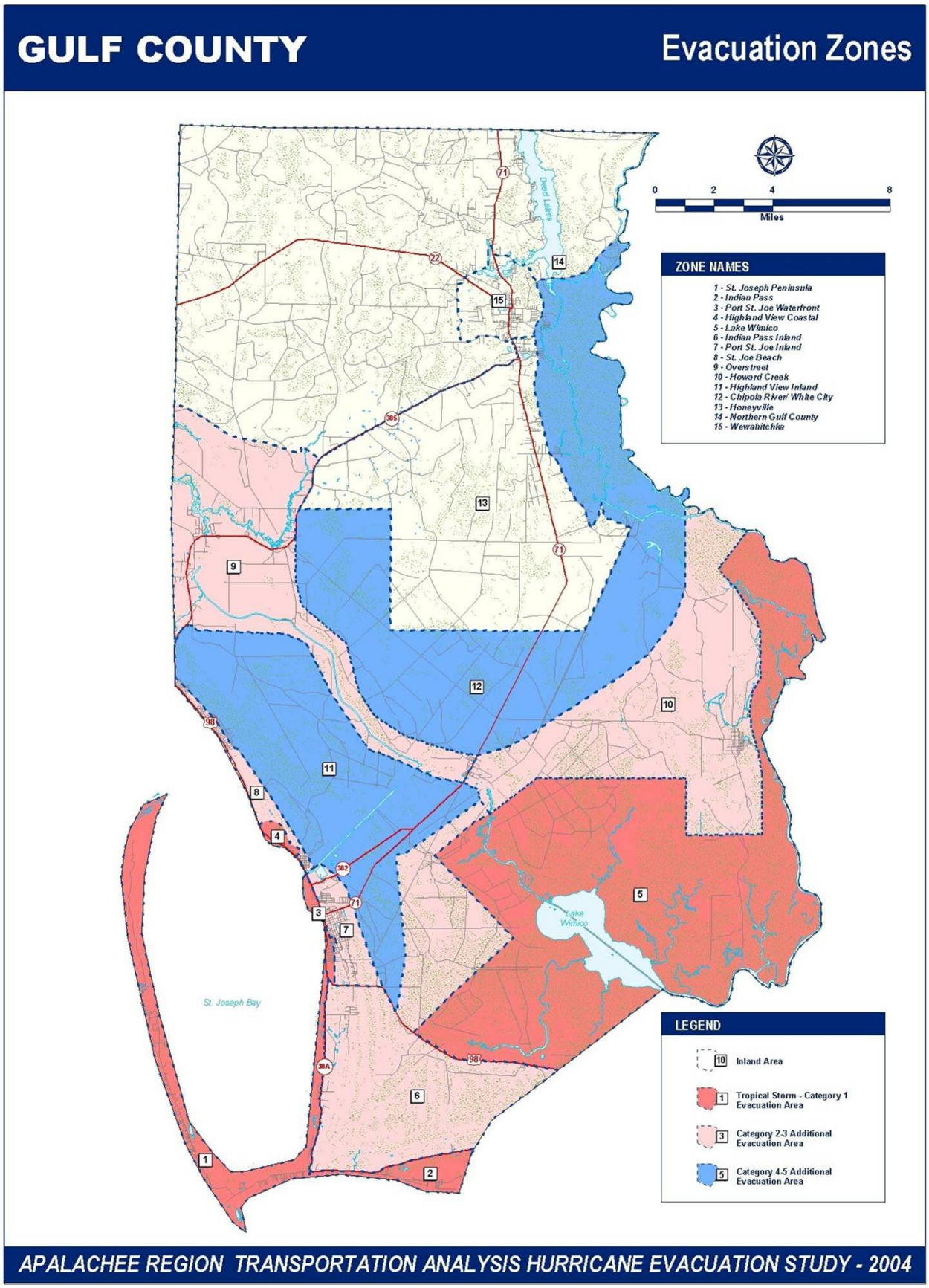
Table 2-1

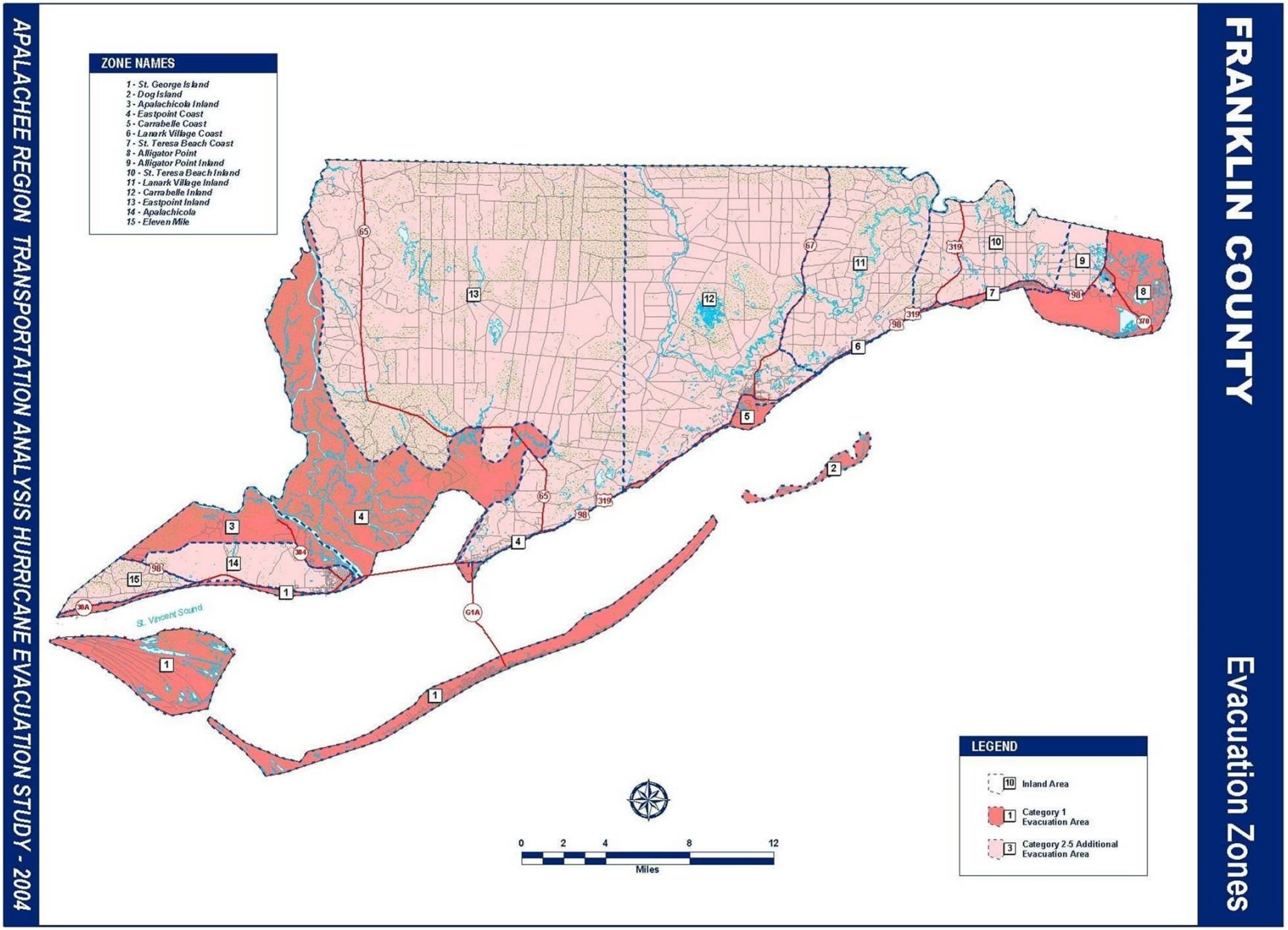
TRAFFIC EVACUATION ZONES

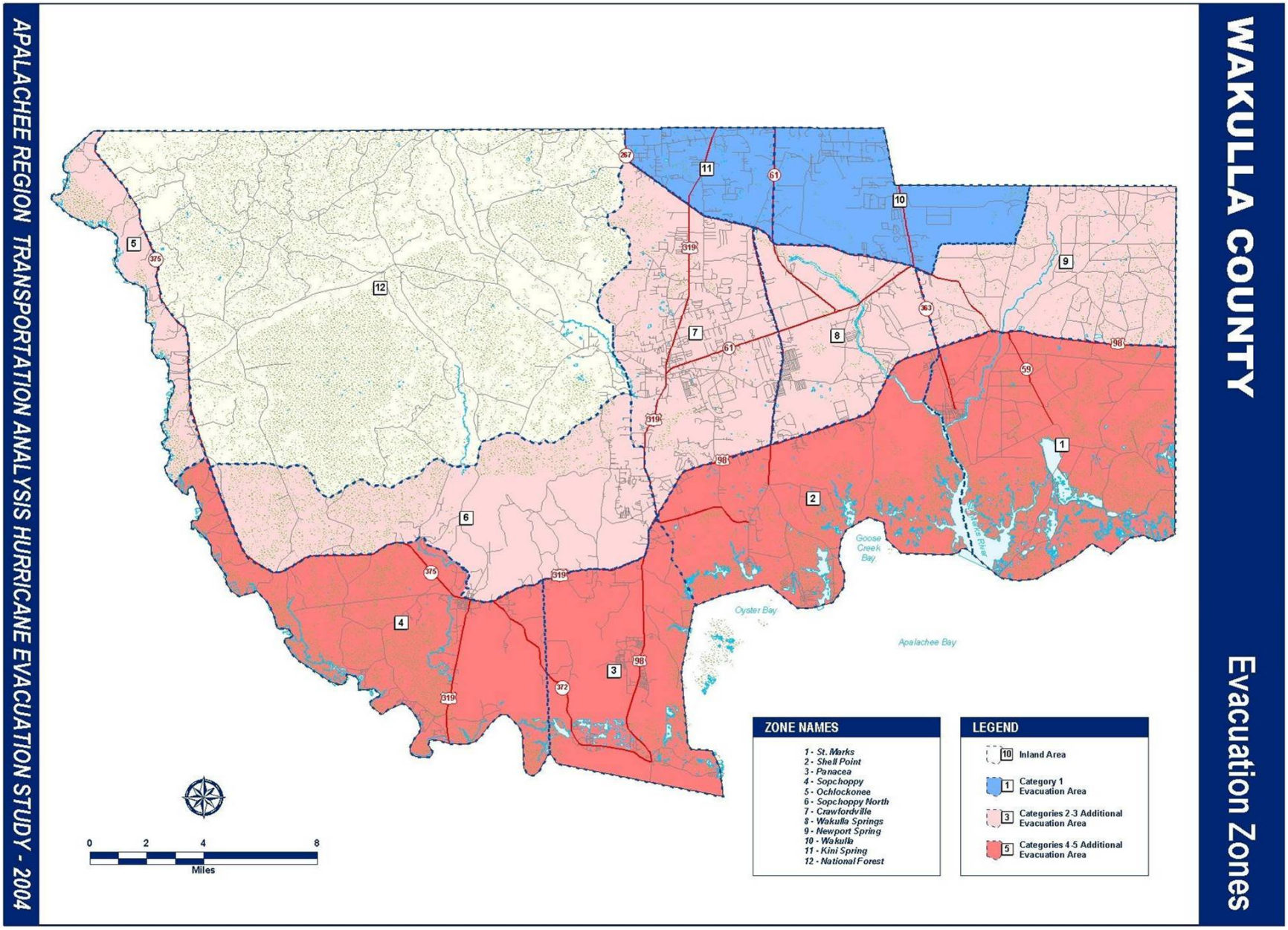
ASSUMED VULNERABILITY BY STORM PLAN

Apalachee Region Transportation Analysis

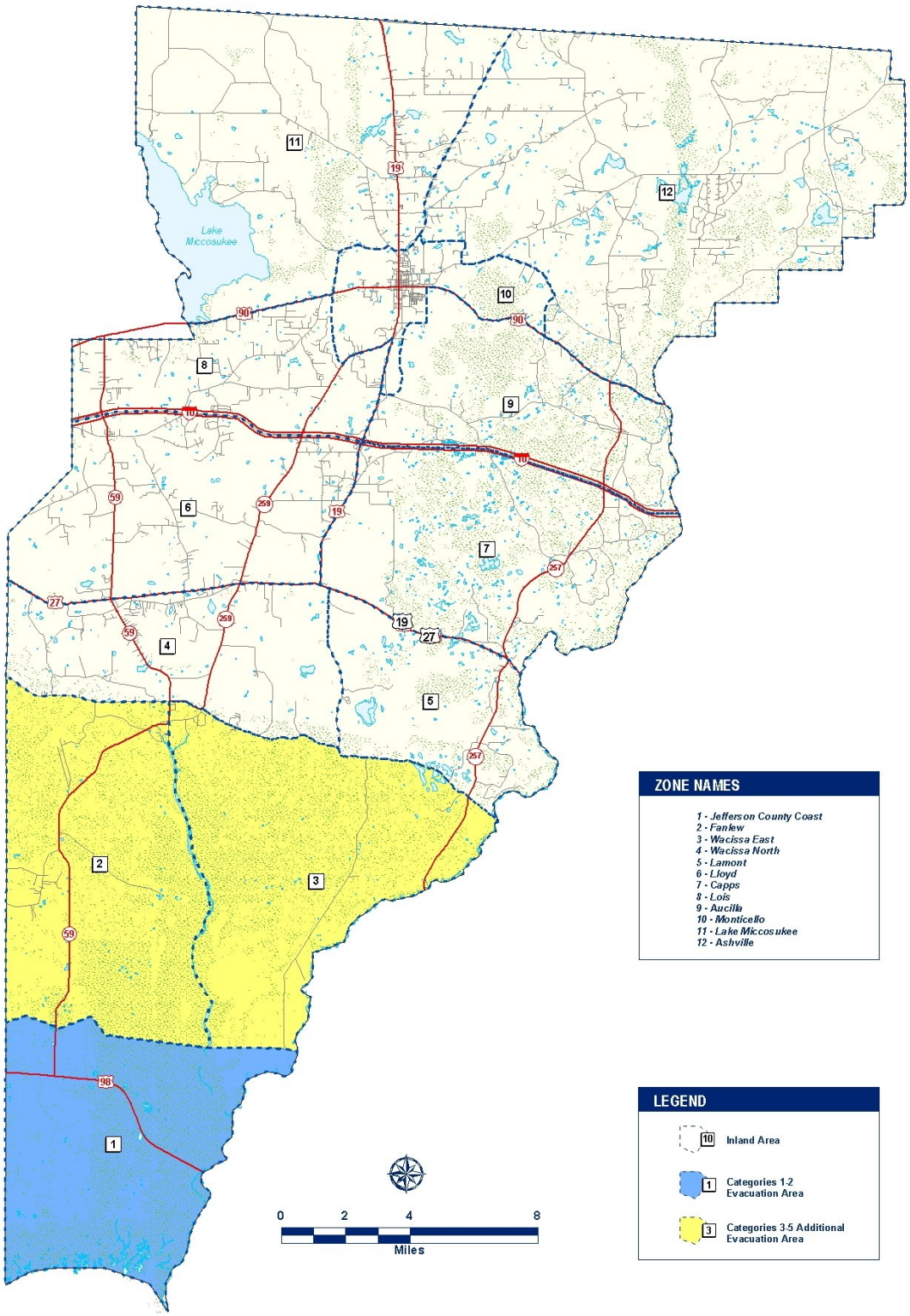
County	Number of Traffic Evacuation Zones	General Zone Vulnerability
Gulf County	15	Zones 1 thru 5 – Tropical storm and category 1 surge and mobile homes
		Zones 6 thru 10 – Category 2 and 3 surge and mobile homes
		Zones 11 & 12 – Category 4 and 5 surge and mobile homes
		Zones 13 thru 15 – Inland, predominantly mobile homes
Franklin County	15	Zones 1 thru 8 – Tropical storm and category 1 surge and mobile homes
		Zones 9 thru 15 – Category 2 thru 5 surge and mobile homes
Wakulla County	12	Zones 1 thru 4 – Tropical storm and category 1 surge and mobile homes
		Zones 5 thru 9 – Category 2 and 3 surge and mobile homes
		Zones 10 & 11 – Category 4 and 5 surge and mobile homes
		Zone 12 – Inland, predominantly mobile homes
Jefferson County	12	Zone 1 – Tropical storm, category 1 and 2 surge and mobile homes
		Zones 2 & 3 – Category 3 thru 5 surge and mobile homes
		Zones 4 thru 12 – Inland, predominantly mobile homes
Leon County	10	Zones 1 thru 10 – Inland, predominantly mobile homes


GULF COUNTY
Evacuation Zones
0 2 4 8
Miles
ZONE NAMES
1 - St. Joseph Peninsula
2 - Indian Pass
3 - Port St. Joe Waterfront
4 - Highland View Coastal
5 - Lake Wimico
6 - Indian Pass Inland
7 - Port St. Joe Inland
8 - St. Joe Beach
9 - Overstreet
10 - Howard Creek
11 - Highland View Inland
12 - Chipola River/ White City
13 - Honeyville
14 - Northern Gulf County
15 - Wewahitchka
Dead Lakes
Lake Wimico
St. Joseph Bay
LEGEND
Inland Area
Tropical Storm - Category 1 Evacuation Area
Category 2-3 Additional Evacuation Area
Category 4-5 Additional Evacuation Area
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004


FRANKLIN COUNTY
Evacuation Zones
ZONE NAMES
1 - St. George Island
2 - Dog Island
3 - Apalachicola Inland
4 - Eastpoint Coast
5 - Carrabelle Coast
6 - Lanark Village Coast
7 - St. Teresa Beach Coast
8 - Alligator Point
9 - Alligator Point Inland
10 - St. Teresa Beach Inland
11 - Lanark Village Inland
12 - Carrabelle Inland
13 - Eastpoint Inland
14 - Apalachicola
15 - Eleven Mile
St. Vincent Sound
LEGEND
Inland Area
Category 1 Evacuation Area
Category 2-5 Additional Evacuation Area
0 2 4 8 12
Miles
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004


WAKULLA COUNTY
Evacuation Zones
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004
ZONE NAMES
1 - St. Marks
2 - Shell Point
3 - Panacea
4 - Sopchoppy
5 - Ochlockonee
6 - Sopchoppy North
7 - Crawfordville
8 - Wakulla Springs
9 - Newport Spring
10 - Wakulla
11 - Kini Spring
12 - National Forest
LEGEND
10 Inland Area
1 Category 1 Evacuation Area
3 Categories 2-3 Additional Evacuation Area
5 Categories 4-5 Additional Evacuation Area
0 2 4 8
Miles
Goose Creek Bay
Oyster Bay
Apalachee Bay

JEFFERSON COUNTY Evacuation Zones



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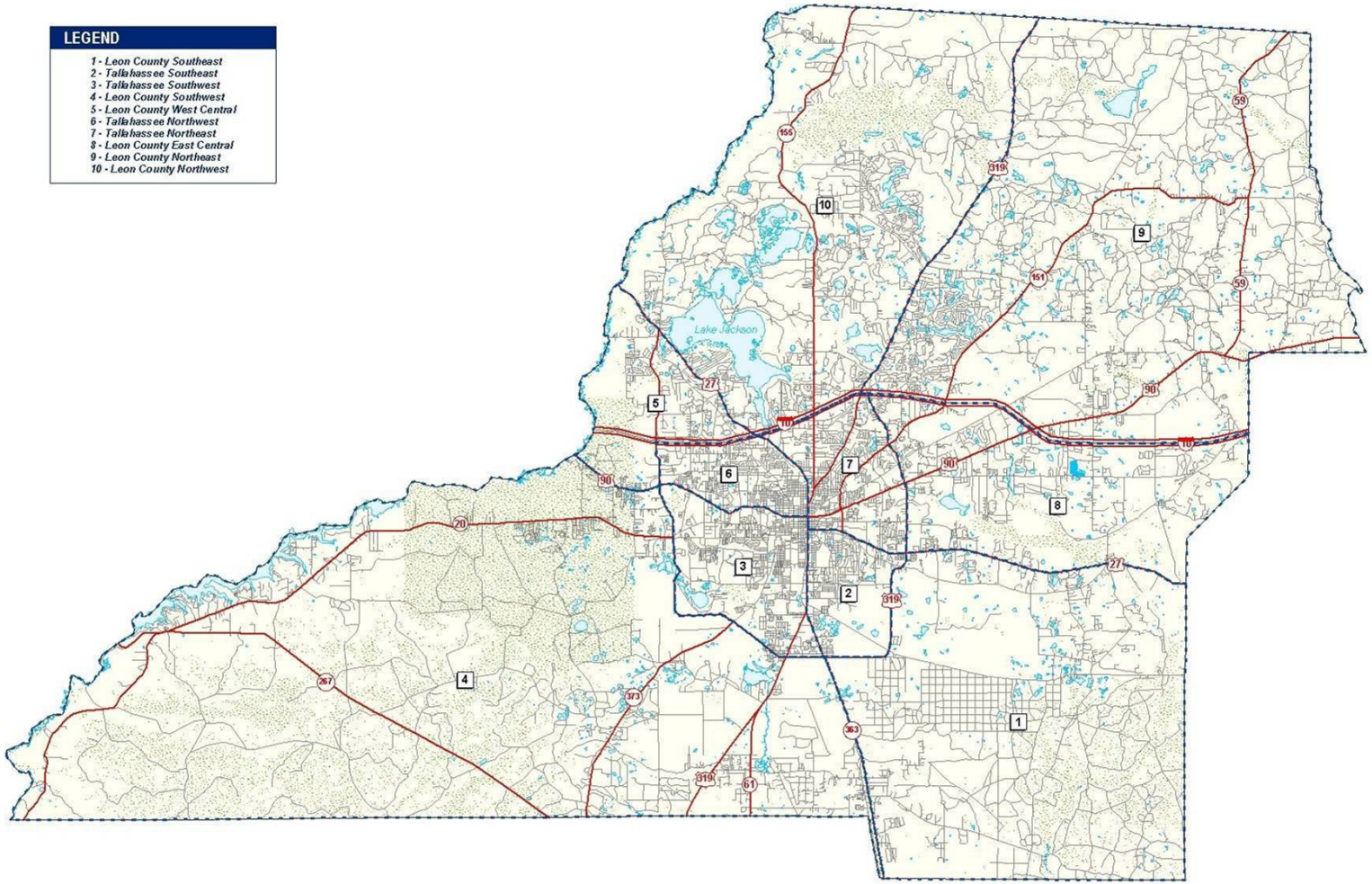
LEON COUNTY

Evacuation Zones



LEGEND

1 - Leon County Southeast
2 - Tallahassee Southeast
3 - Tallahassee Southwest
4 - Leon County Southwest
5 - Leon County West Central
6 - Tallahassee Northwest
7 - Tallahassee Northeast
8 - Leon County East Central
9 - Leon County Northeast
10 - Leon County Northwest

LEGEND

10 Inland Area

0 2 4 8 12
Miles

APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

2.2 SPECIAL NOTE ABOUT FRANKLIN COUNTY TRAFFIC EVACUATION ZONES AND MAP

During the November 2003 initial kickoff meetings with the counties in the region, the Franklin County Emergency Management Director indicated that the evacuation zone boundary for tropical storms through category 1 would roughly coincide with US 98 throughout the County. The entire rest of the county would be evacuated in category 2 through 5 hurricanes. Those evacuation zone boundaries were reiterated by the County Emergency Management Director during meetings with State and local government officials, as well as private concerns on November 20th, 2003, and February 11th, 2004.

The initial decision to use US 98 as a boundary for the tropical storm and category 1 evacuation zones was completely justified based on the corresponding surge elevations and inundation limits as established by the National Hurricane Center's Sea, Lake and Overland Surges from Hurricanes (SLOSH) Program. According to the Apalachee SLOSH Program basin and the subsequent storm tide atlas developed for Franklin County by the U.S. Army Corps of Engineers, an overwhelming amount of the area seaward of US 98 in Franklin County is subject to category 1 storm surge inundation. Much of the same land is predicted to be subject to surge flooding in tropical storms. Based on the high surge vulnerability of most of the property seaward of US 98, FEMA, the Corps of Engineers and the State of Florida Division of Emergency Management agreed that the roadway was a prudent boundary for up to category 1 events.

Nonetheless, on March 16th, the Franklin County Board of County Commissioners decided to overturn the previous category 1 evacuation zone boundary decision and instead agreed to retain the zones depicted in the 1997 Apalachee Bay Region Hurricane Evacuation Study. The decision was formalized in a letter signed by Cheryl Sanders, the Board Chairman, to John Eringman, dated March 17, 2004. The category 1 evacuation zone in the 1997 Study included only the barrier islands of St. George and Dog Islands; the entire mainland was designated as in the category 2 through 5 zones. The only exception to re-accepting the 1997 Study evacuation boundaries was in the Alligator Point area, which was converted to a category 1 evacuation zone.

The study sponsors, namely the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers do not agree with the Board of County Commissioners' decision, and thereby take no responsibility for that action. Repeated attempts by the above parties to convince local officials to adopt the initial zones delineated in November, 2003, have not been successful and there is no legal recourse at the State or Federal level to change that decision. Therefore, for the purposes of this study, in the interests of public safety, FEMA has elected to show the originally delineated evacuation zones in this study (see page 2-4), rather than those zones formally adopted by the Board of County Commissioners.

For transportation modeling purposes, all residents and tourists in zones seaward of US 98 are assumed to evacuate in a tropical storm or category 1 event, despite official local government pronouncements that they will not issue evacuation orders for those areas. Although the Board of County Commissioners for Franklin County have indicated that only the barrier islands (Part of Zone1, and all of Zone 2 in Table 2-1) will be directed to evacuate in a category 1 event, for the purposes of determining clearance times, the residents and tourists on the mainland in Zone 1, as well as Zones 2 through 8 are included in the tropical storm through category 1 vulnerable population figures and are assumed to evacuate in those events.

2.3 HOUSING AND POPULATION DATA

Socioeconomic parameters for each traffic evacuation zone, such as dwelling unit totals and persons per dwelling unit, were developed using Year 2000 data obtained from the United States Census Bureau and the 2002 Florida Statistical Abstract and validated by county emergency management, building, planning and zoning and other related officials. The key socioeconomic data for the county is summarized in Table 2-2, and this data is provided by traffic evacuation zone in the Transportation Model Support Document.

Table 2-2

KEY POPULATION / DWELLING UNIT SUMMARY

Apalachee Region Transportation Analysis

Gulf County	**County Totals**	**Wakulla County**	**County Totals**
Year 2004 Estimated Permanent Population	14,785 people	Year 2004 Estimated Permanent Population	28,486 people
Permanent occupied dwelling units	5,468 units	Permanent occupied dwelling units	10,528 units
Mobile homes	2,139 units	Mobile homes	5,206 units
Tourist/seasonal units	1,412 units	Tourist/seasonal units	639 units
People per permanent unit	2.63	People per permanent unit	2.94
Vehicles per permanent unit	1.69	Vehicles per permanent unit	1.81
Franklin County	**County Totals**	**Jefferson County**	**County Totals**
Year 2004 Estimated Permanent Population	12,057 people	Year 2004 Estimated Permanent Population	13,628 people
Permanent occupied dwelling units	4,466 units	Permanent occupied dwelling units	4,959 units
Mobile homes	1,583 units	Mobile homes	1,972 units
Tourist/seasonal units	1,486 units	Tourist/seasonal units	96 units
People per permanent unit	2.80	People per permanent unit	2.66
Vehicles per permanent unit	1.55	Vehicles per permanent unit	1.77

Table 2-2 (continued)

KEY POPULATION / DWELLING UNIT SUMMARY

Apalachee Region Transportation Analysis

Leon County	County Totals
Year 2004 Estimated Permanent Population	262,845 people
Permanent occupied dwelling units	105,951 units
Mobile homes	12,375 units
Tourist/seasonal units	6,312 units
People per permanent unit	2.52
Vehicles per permanent unit	1.70

Calhoun County	County Totals
Year 2004 Estimated Permanent Population	13,903 people
Mobile homes	2,149 Units

Gadsden County	County Totals
Year 2004 Estimated Permanent Population	46,749 people
Mobile homes	6,184 units

Jackson County	County Totals
Year 2004 Estimated Permanent Population	49,270 people
Mobile homes	6,602 units

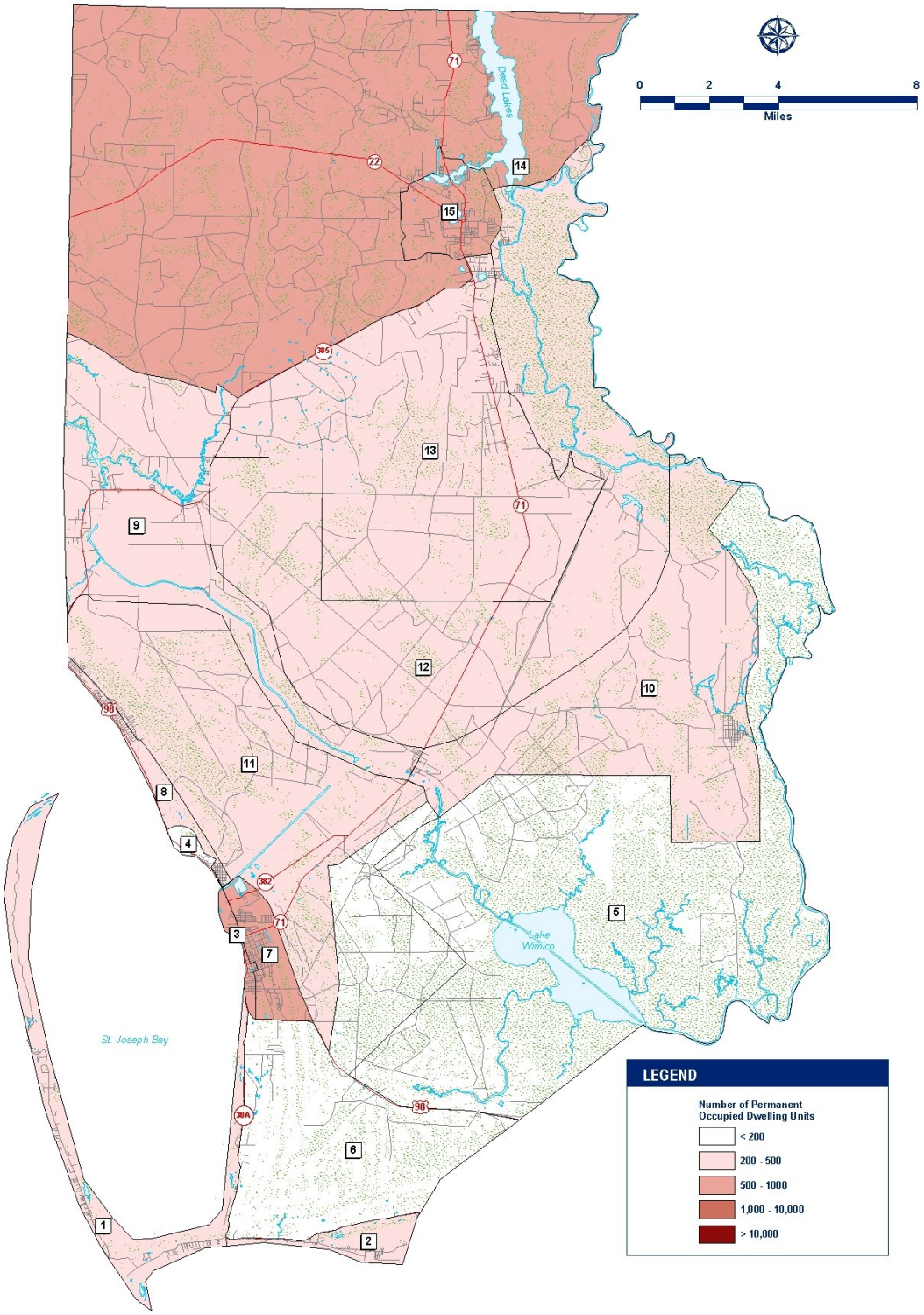
Liberty County	County Totals
Year 2004 Estimated Permanent Population	7,738 people
Mobile homes	1,619 units

- Year 2004 estimated base population and housing figures were developed using Year 2000 US Census data multiplied by an annualized growth factor
- Growth percentage was developed by averaging per year the difference between the Year 1990 US Census data and 2001 population estimate data from the 2002 Florida Statistical Abstract
- Population, housing and vehicle estimates per individual traffic evacuation zone for Year 2004 and 2009 are in Annex A of the accompanying Technical Support Document

The use of GIS technology (ArcInfo, ArcView) facilitated the production of study graphics, and was used for quality control and display of study inputs. Year 2004 permanent dwelling units by traffic evacuation zone are illustrated in Figure 2-2. Year 2004 mobile home units by traffic evacuation zone are shown in Figure 2-3. Figure 2-4 displays seasonal units by traffic evacuation zone. In looking at the GIS maps, Gulf County Emergency Management noted that the unusually high population and other evacuation variables for evacuation zone 14 are artificially high due to the location of a Federal correctional facility and its approximately 2000 inmates.

GULF COUNTY

Permanent Occupied Dwelling Units



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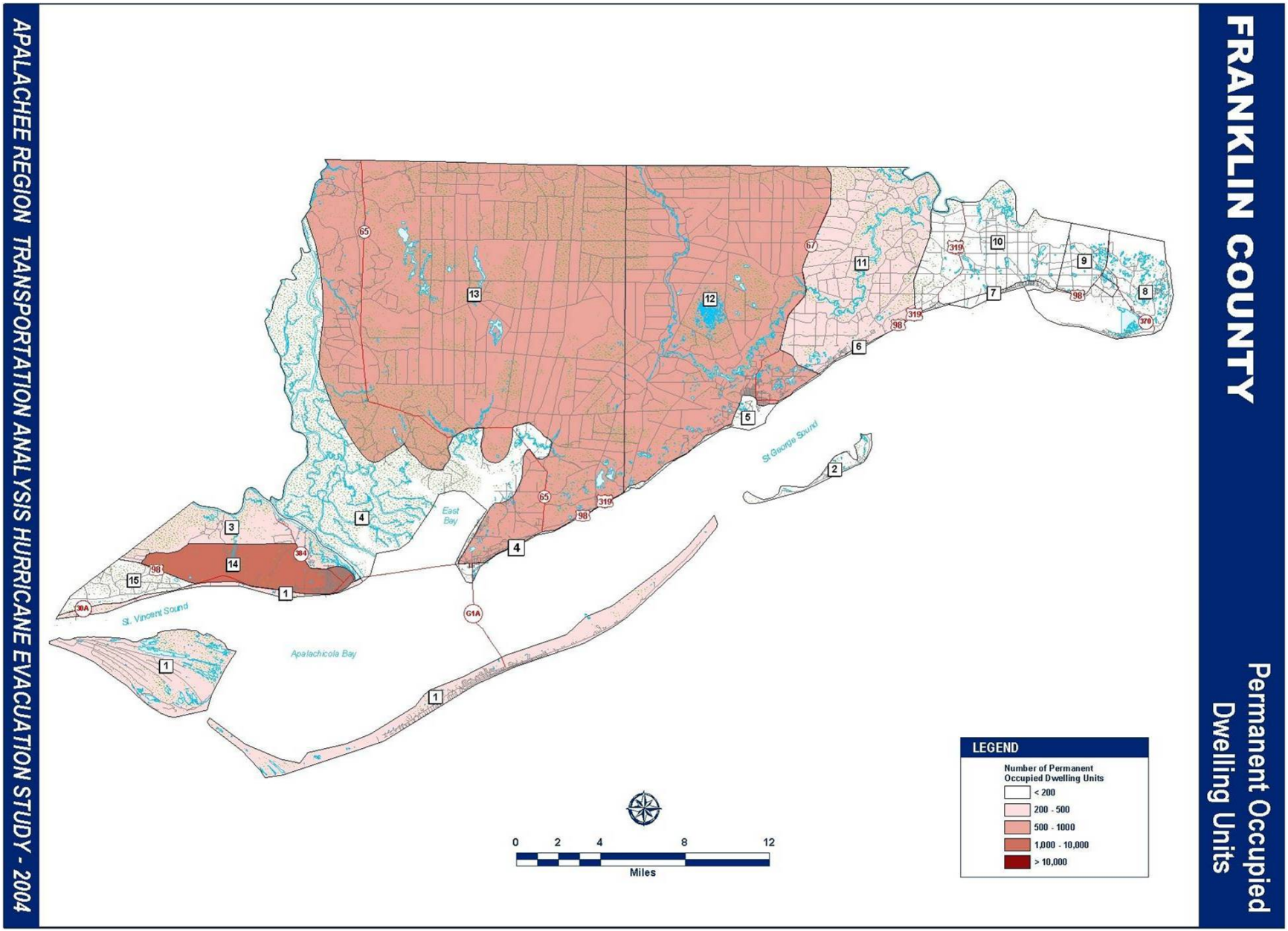
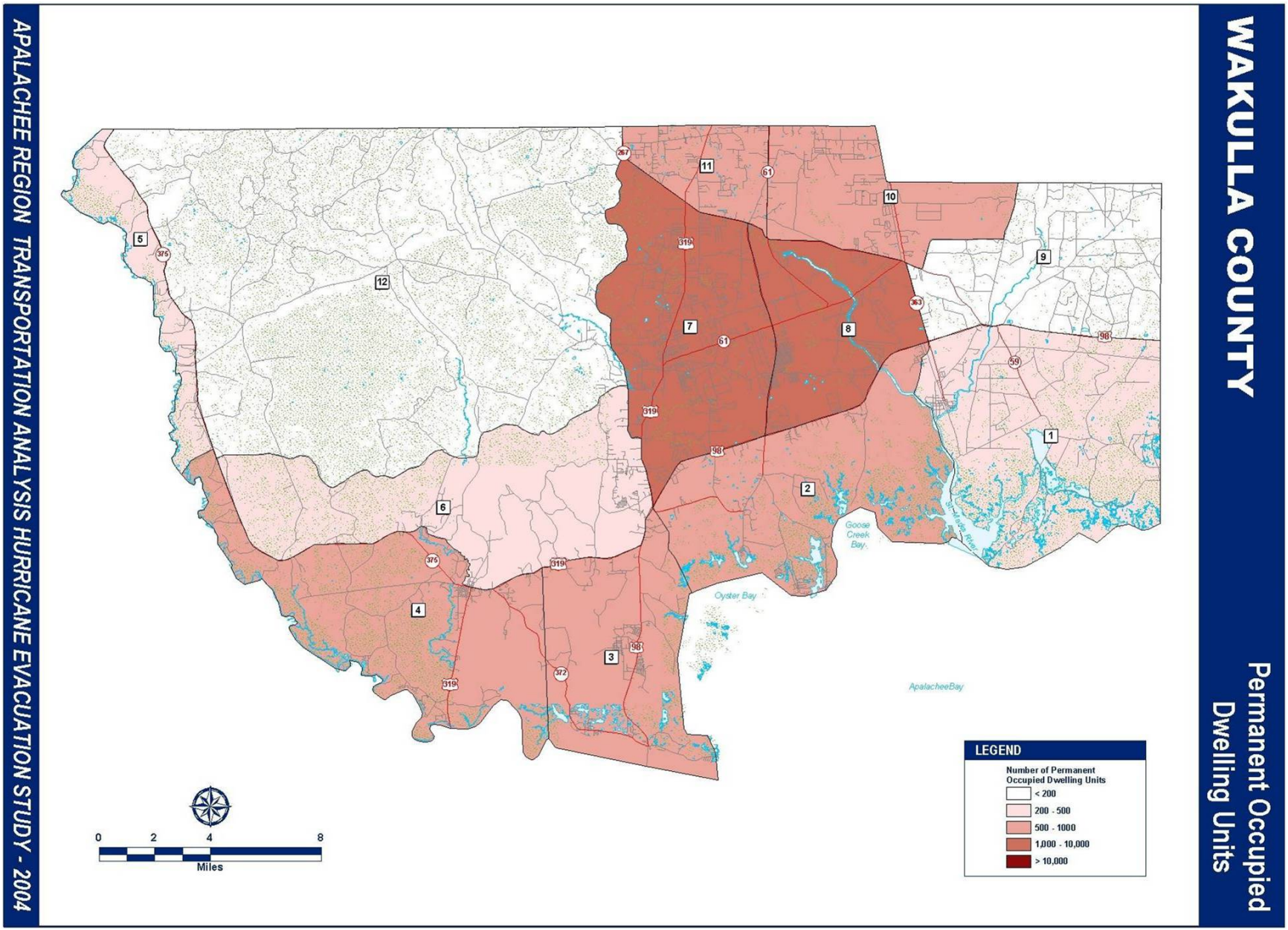

FRANKLIN COUNTY
Permanent Occupied Dwelling Units
LEGEND
Number of Permanent Occupied Dwelling Units
< 200
200 - 500
500 - 1000
1,000 - 10,000
> 10,000
0 2 4 8 12
Miles
St. Vincent Sound
Apalachicola Bay
East Bay
St George Sound
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004



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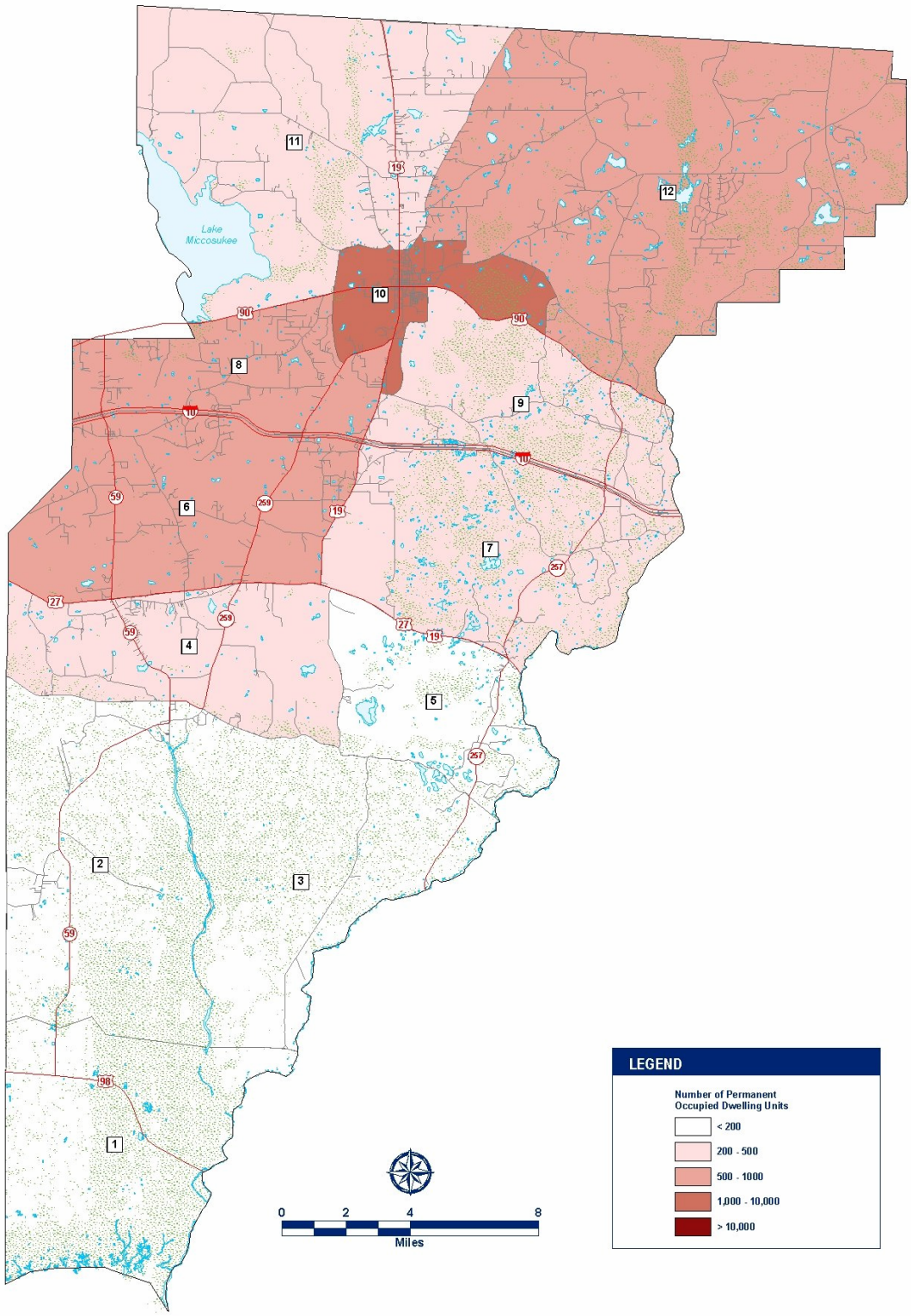
JEFFERSON COUNTY

Permanent Occupied Dwelling Units



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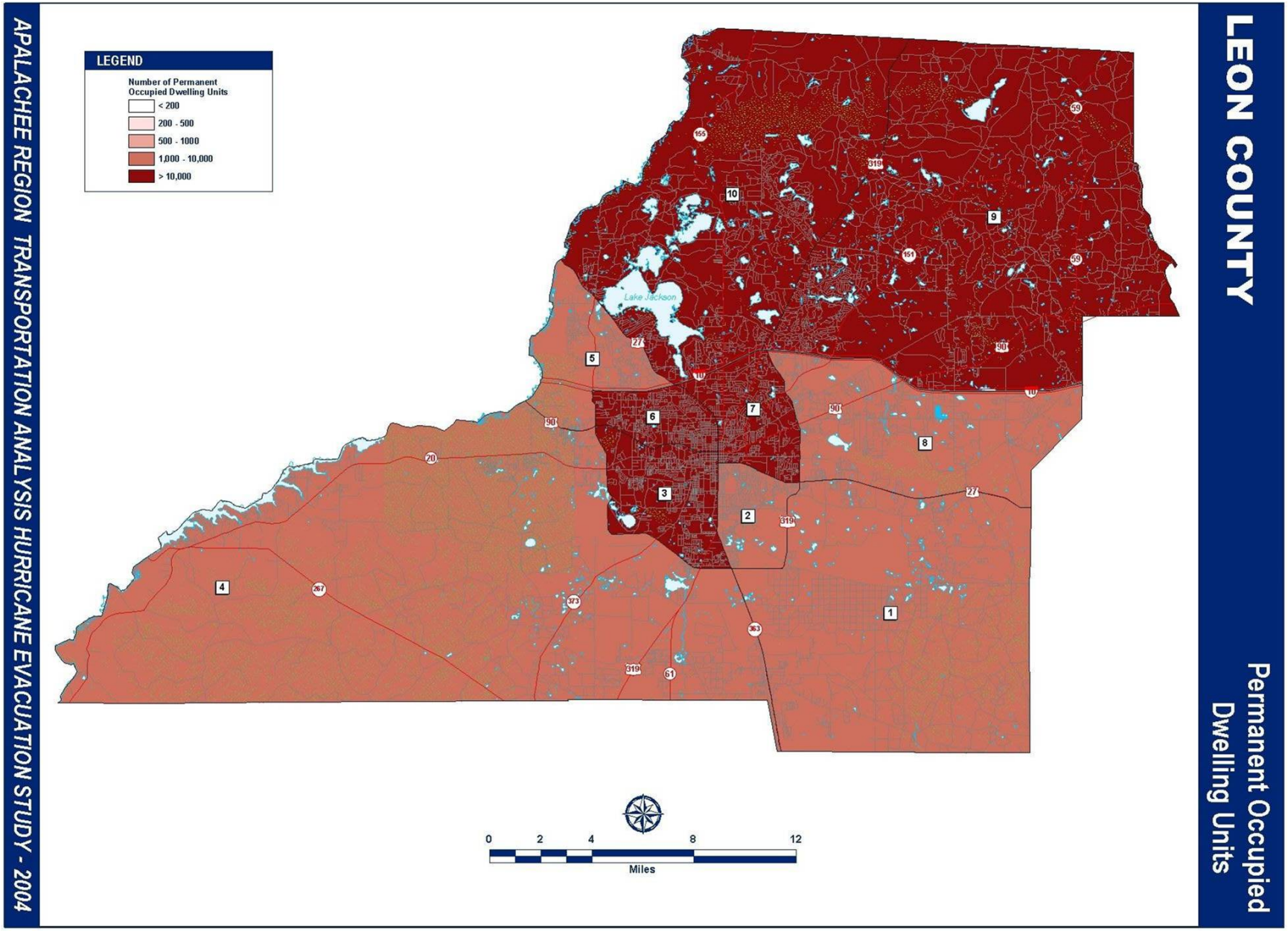
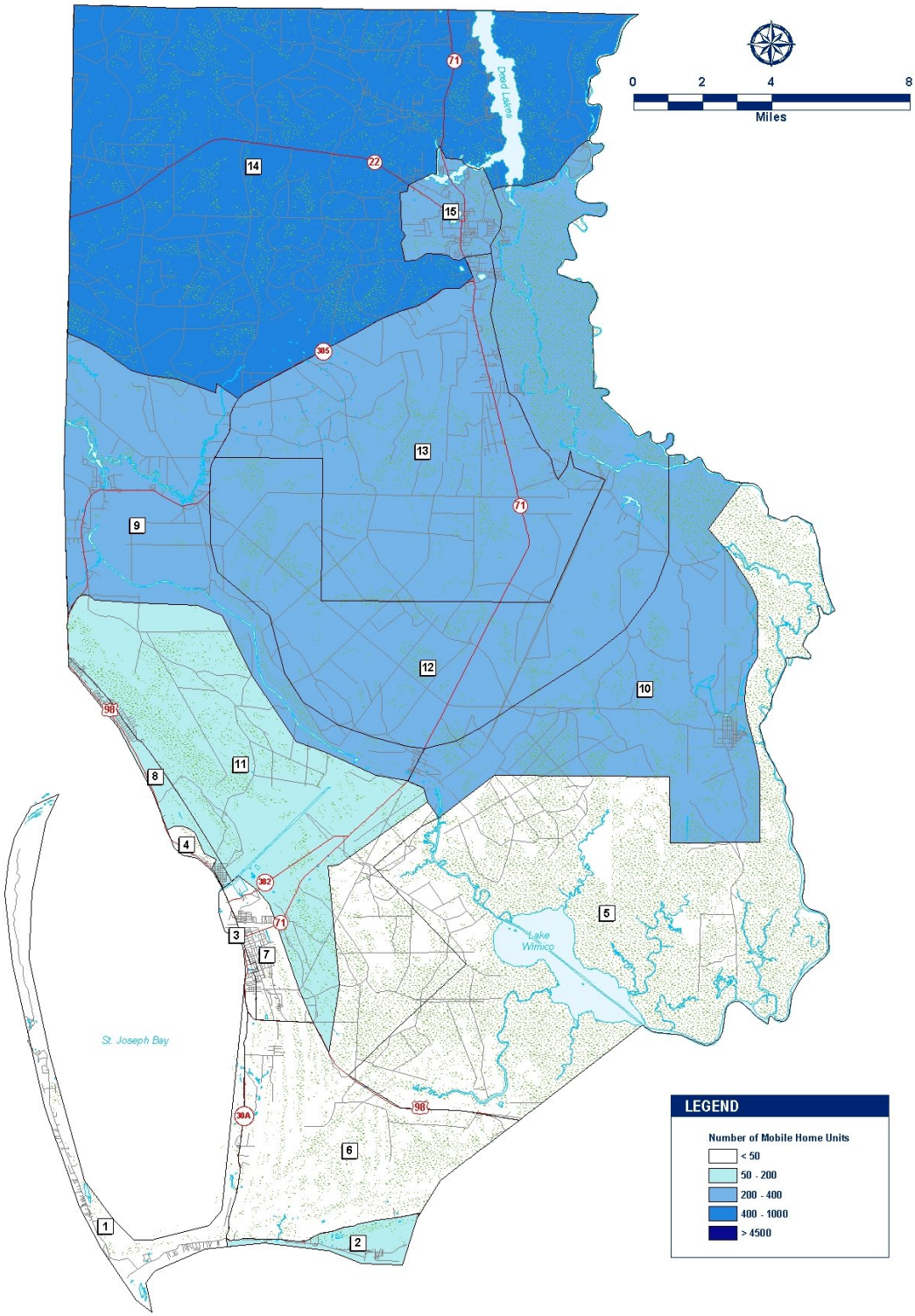

LEON COUNTY
Permanent Occupied Dwelling Units
LEGEND
Number of Permanent Occupied Dwelling Units
< 200
200 - 500
500 - 1000
1,000 - 10,000
> 10,000
Lake Jackson
1
2
3
4
5
6
7
8
9
10
0 2 4 8 12
Miles
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

GULF COUNTY

Mobile Home Units



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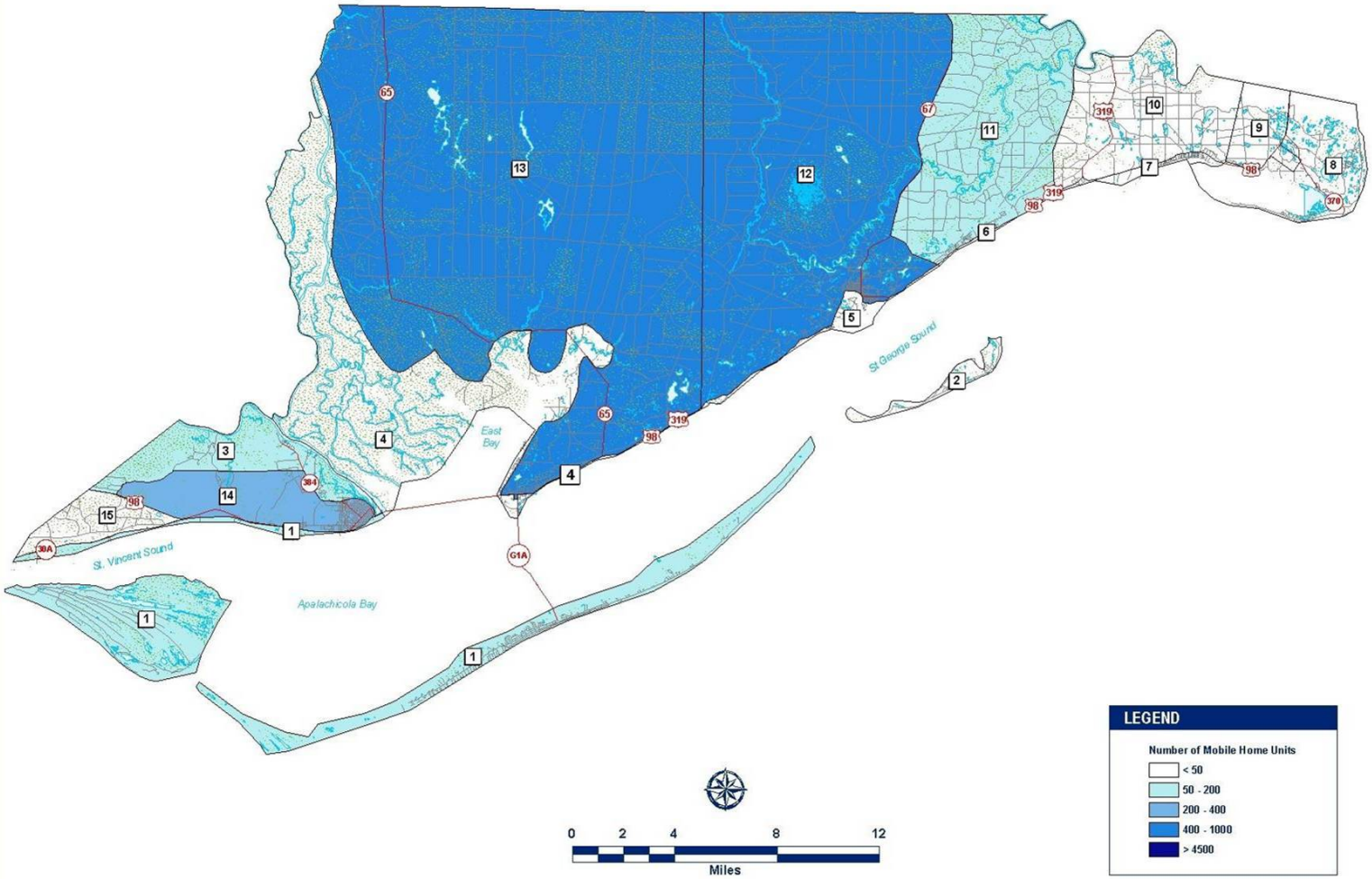
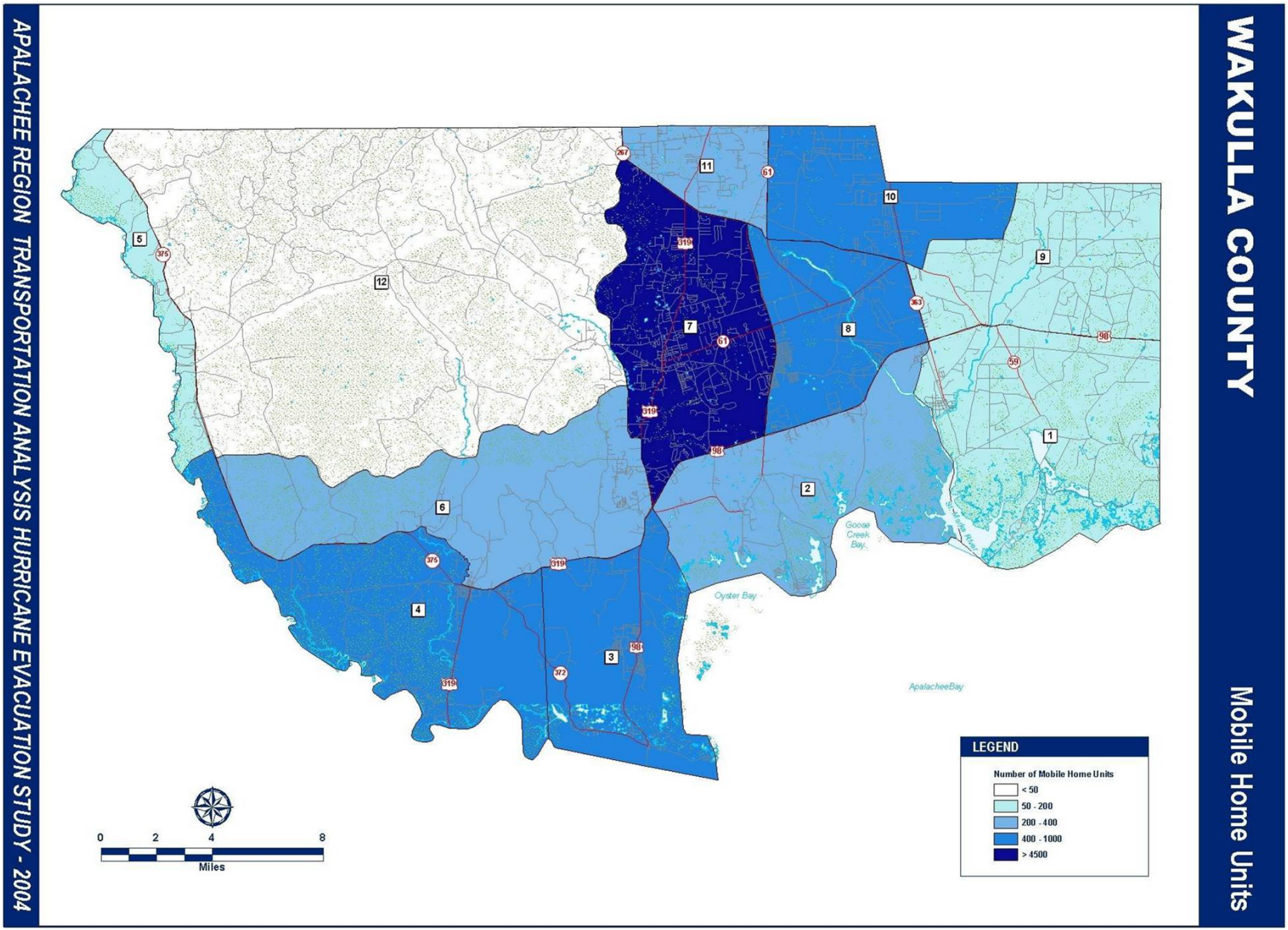
FRANKLIN COUNTY

Mobile Home Units

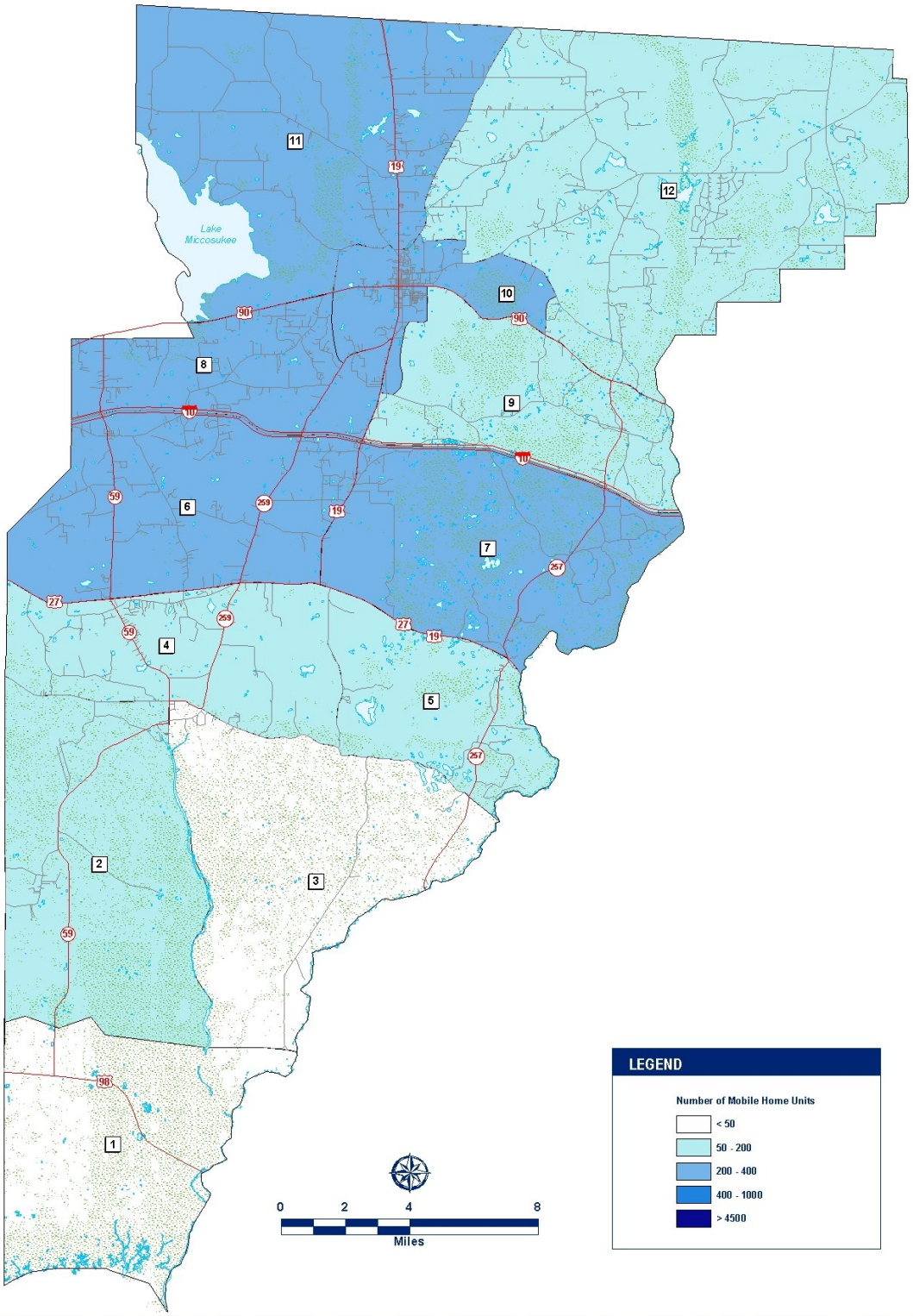


APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004


WAKULLA COUNTY
Mobile Home Units
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004
LEGEND
Number of Mobile Home Units
< 50
50 - 200
200 - 400
400 - 1000
> 4500
0 2 4 8
Miles
Goose Creek Bay
Oyster Bay
ApalacheeBay
1
2
3
4
5
6
7
8
9
10
11
12

JEFFERSON COUNTY

Mobile Home Units



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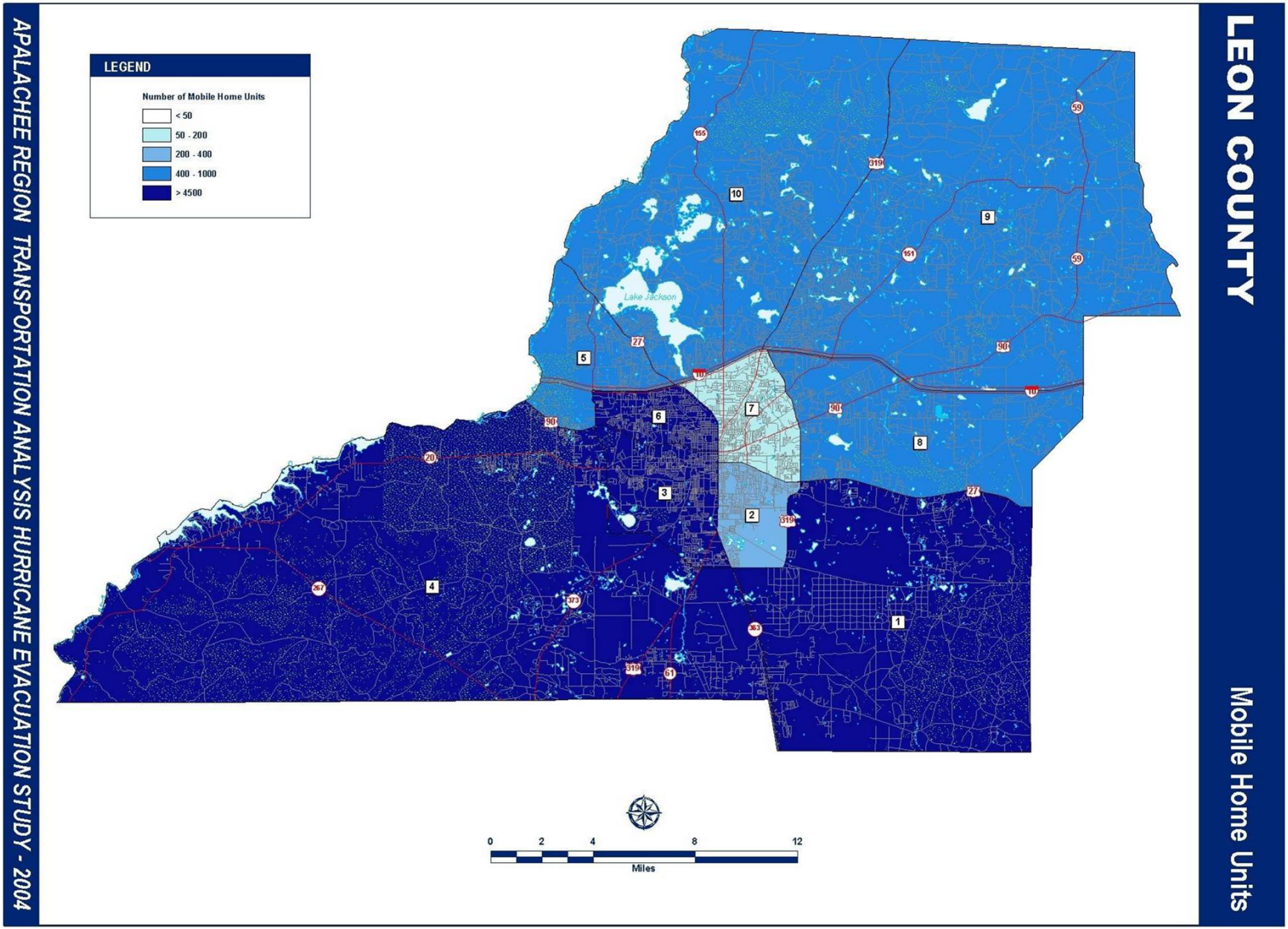
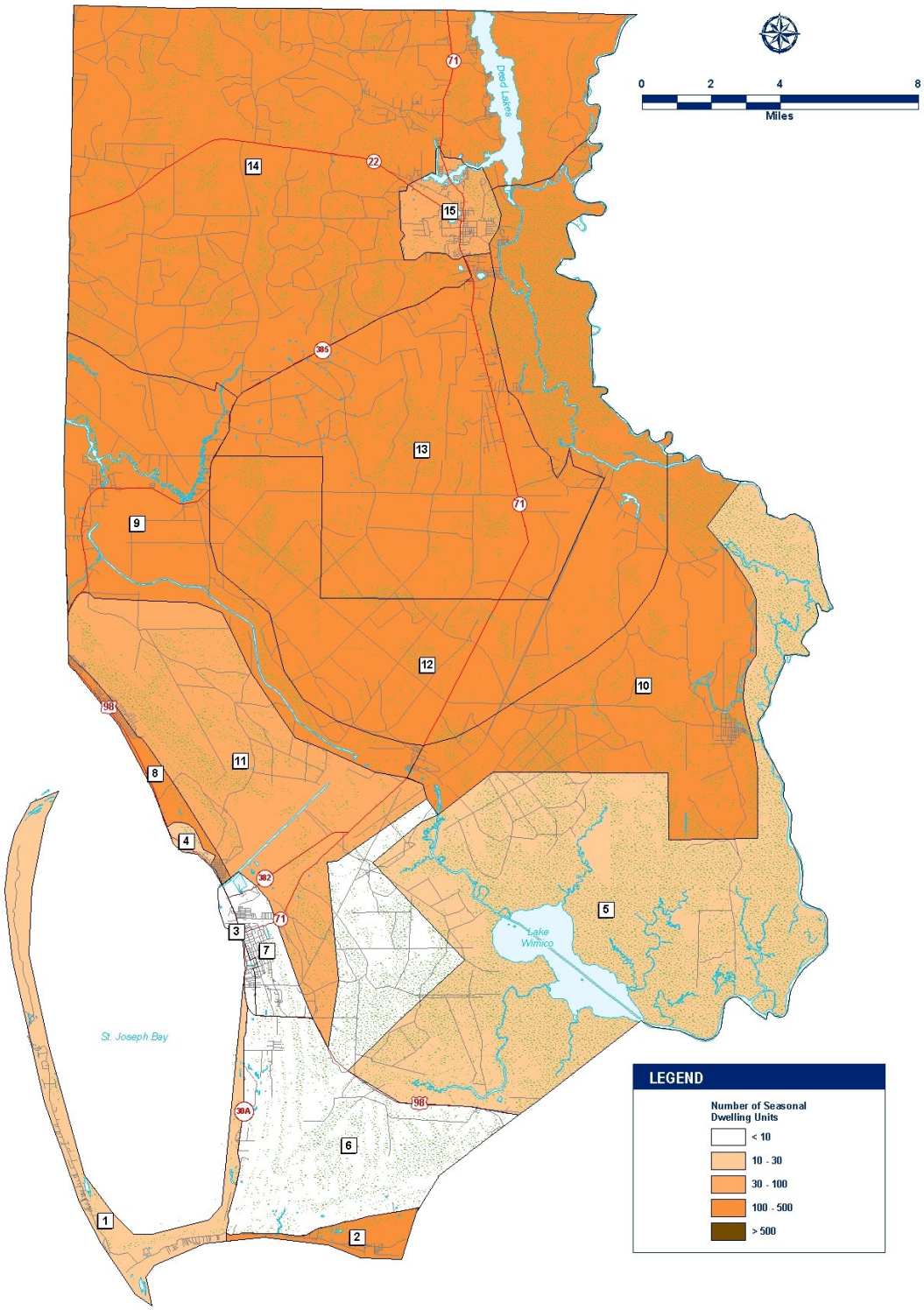

LEON COUNTY
Mobile Home Units
LEGEND
Number of Mobile Home Units
< 50
50 - 200
200 - 400
400 - 1000
> 4500
Lake Jackson
1
2
3
4
5
6
7
8
9
10
0
2
4
8
12
Miles
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

GULF COUNTY

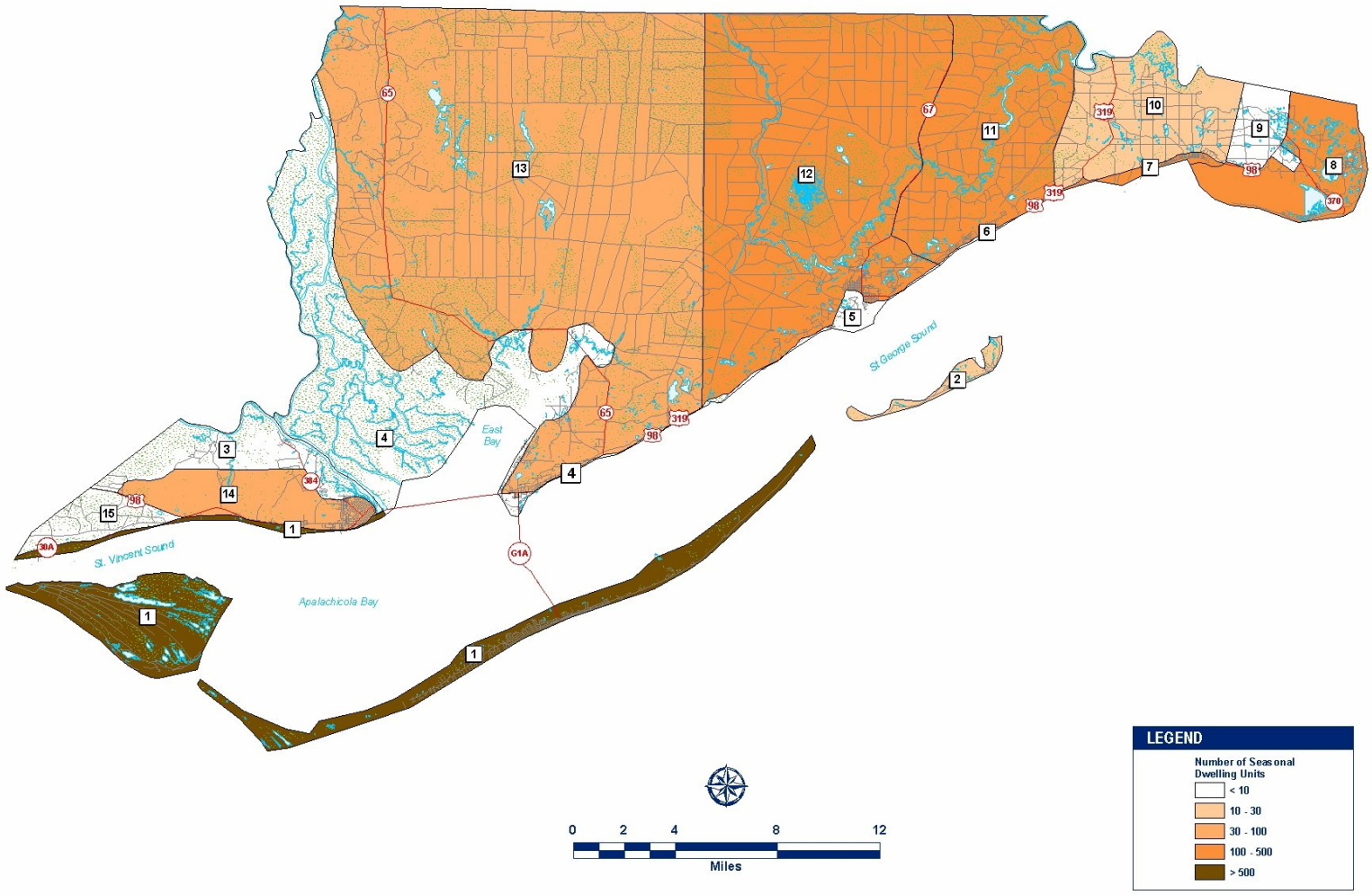
Seasonal Dwelling Units



APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

FRANKLIN COUNTY

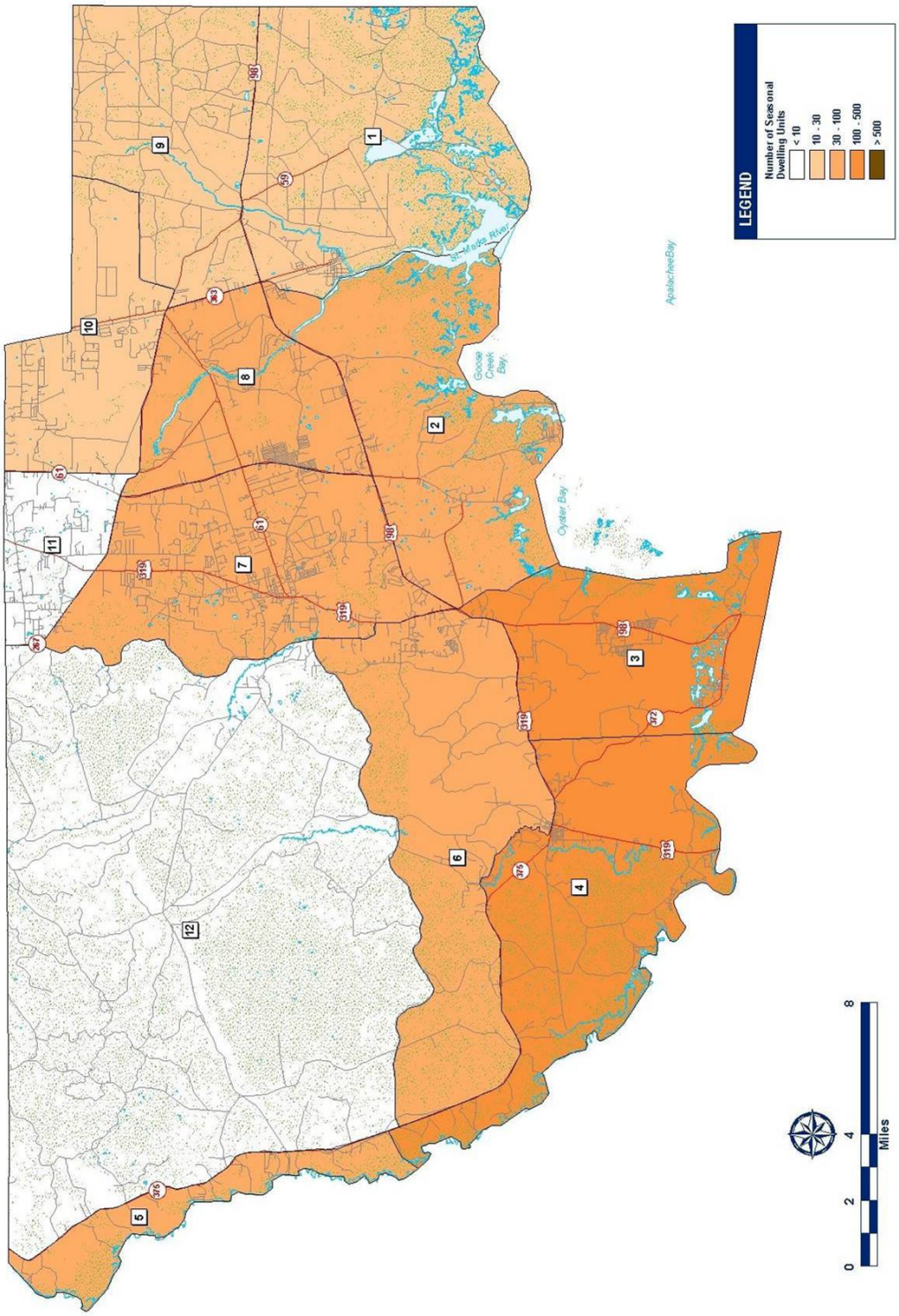
Seasonal Dwelling Units



APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

WAKULLA COUNTY

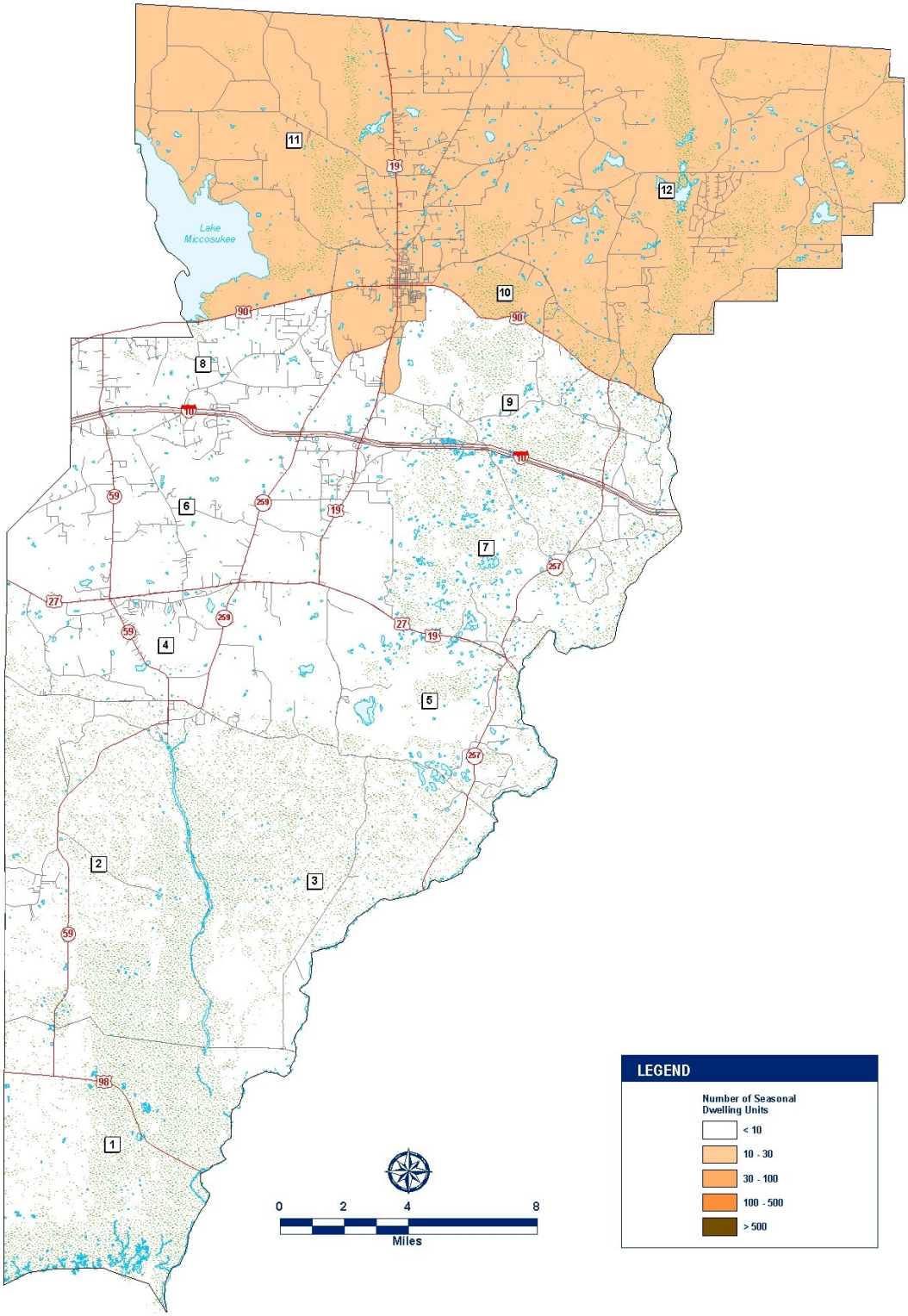
Seasonal Dwelling Units



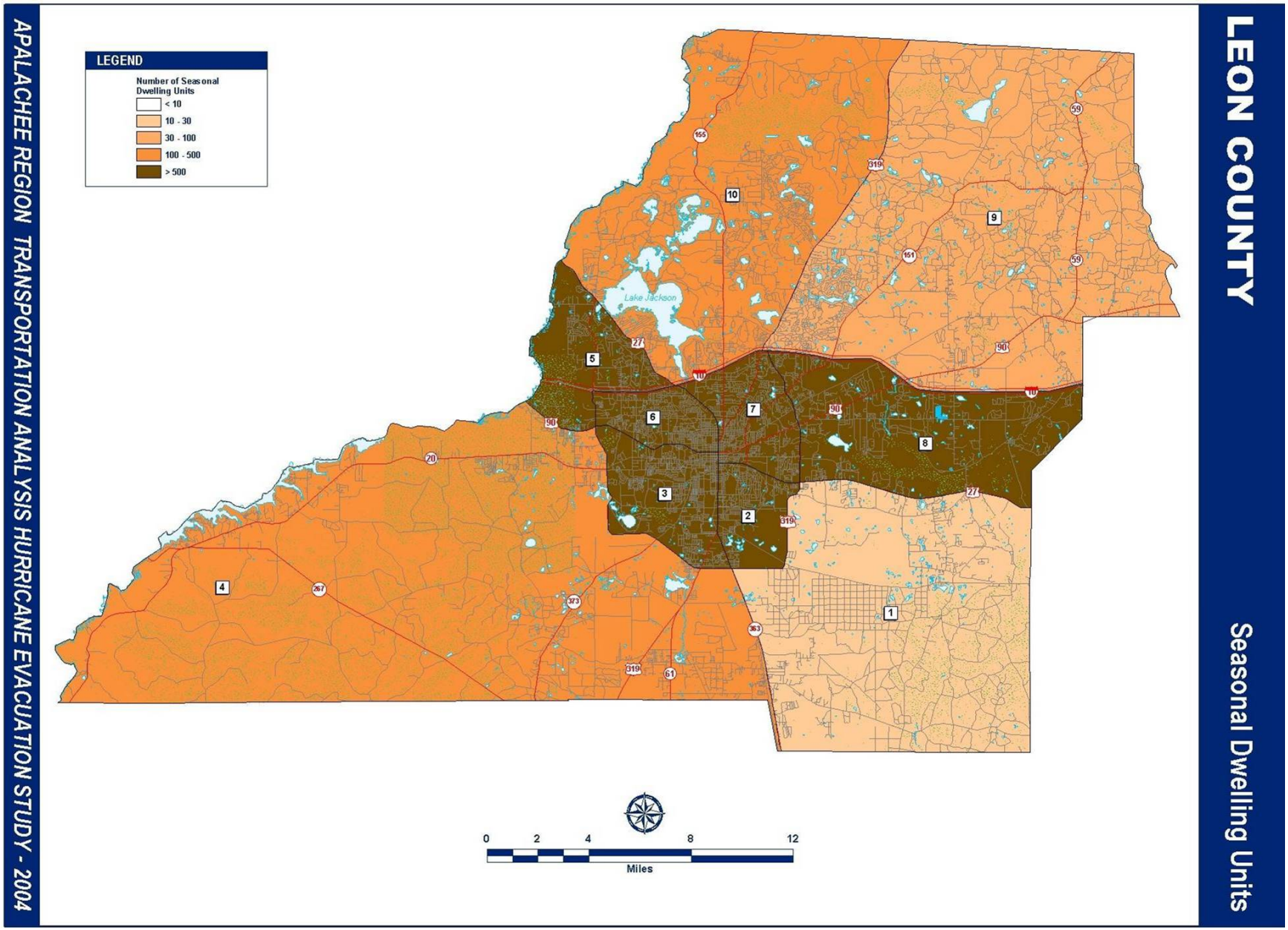
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

JEFFERSON COUNTY

Seasonal Dwelling Units



APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004


LEON COUNTY
Seasonal Dwelling Units
LEGEND
Number of Seasonal Dwelling Units
< 10
10 - 30
30 - 100
100 - 500
> 500
Lake Jackson
1
2
3
4
5
6
7
8
9
10
0 2 4 8 12
Miles
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

2.4 BEHAVIORAL ASSUMPTIONS

A future evacuation in the Apalachee Region will involve evacuation decision-making by thousands of individuals and households. In order to develop meaningful behavioral assumptions that account for variations in decision-making, PBS&J reviewed previous behavioral analyses conducted by Hazards Management Group (HMG). The PBS&J team then used this data source and nationwide experience to focus the transportation analysis on the following behavioral aspects:

- Participation rates - What percent of the population in different areas will evacuate their dwelling units for future hurricane threats;
- Evacuation rapidity of response rates - How quickly will evacuees respond to specific protective action instructions from local and or state officials;
- Destination percentages - What percent of the population sub-area will evacuate to local public shelters, local hotel/motels, homes of local friends and relatives, or out of the county entirely; and
- Vehicle usage - Of the vehicles available to evacuating households, what percent of those vehicles will be used in an evacuation.

PBS&J relied on the following sources of input to develop behavioral assumptions by evacuation zone:

- Discussions concerning expected behavioral response with county emergency management staff; and
- National hurricane behavioral trends ascertained by PBS&J and HMG in recent studies

A great deal of judgment was needed in order to develop the necessary parameters on a zone-by-zone basis. PBS&J has accumulated a wealth of experience both in Florida and around the country developing and applying behavioral parameters for evacuation analysis. This experience aided significantly in the process of generating assumptions.

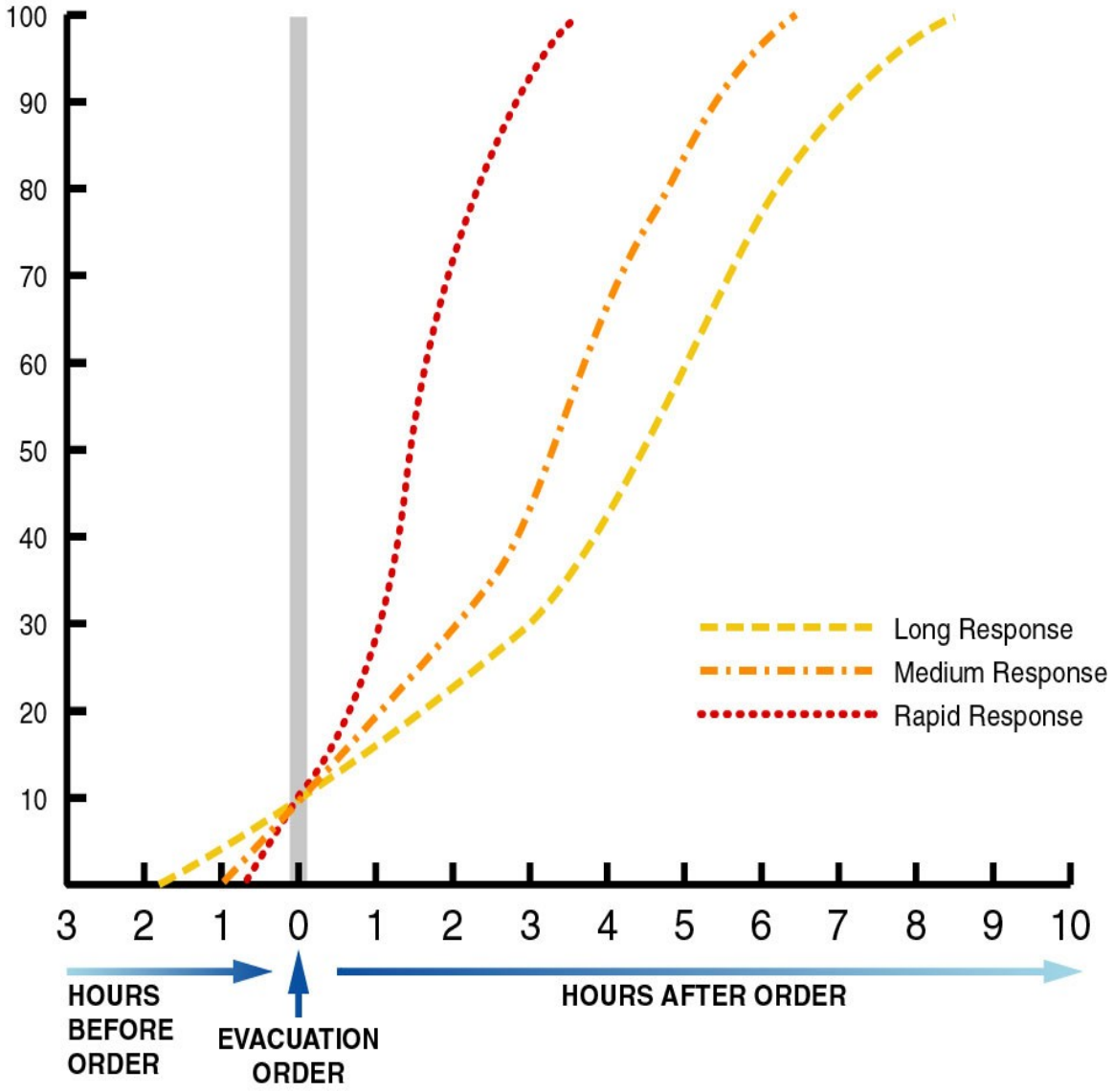
Early in the modeling process, the primary behavioral assumptions made by zone were developed and discussed with the county. These assumptions are provided in the evacuating people and

vehicle/trip generation portion of summary sheets located in the Transportation Model Support Document. In addition, the assumed participation rates developed by evacuation zones, and for each plan, are provided in the model support document as well. The primary participation assumptions are as follows:

- Zones that will be evacuated for storm surge were assumed to have a 100% participation rate, even though in actuality these rates will be lower, as a matter of public safety, the clearance times calculated in this study should allow those who are vulnerable to storm surge the opportunity to evacuate whether they choose to or not (ANNEX C of the Transportation Model Support Document provides data related to these plans).
- All mobile homes lying in inland zones are assumed to evacuate, although in the lesser storm categories slightly less than 100% were assumed to evacuate to make the analysis more realistic.
- A portion of the theoretically non-vulnerable population (shadow evacuees) is also assumed to evacuate in the model; in an actual evacuation, the percentages could be higher than the figures used for modeling purposes (1% - 20%), particularly for more intense hurricanes; this difference however will balance out with less than 100% of surge residents participating in an actual event.

One set of critical behavioral assumptions included in the transportation analysis involves the rapidity of evacuation response by the evacuating population, or establishing how quickly the vulnerable population will respond to an evacuation order or advisory. Behavioral data from past hurricane evacuation research demonstrates that mobilization and actual departures of the evacuating population can occur over a very brief time, or over a period of many hours. To account for this variation, clearance times were tested for three evacuation response rates represented by different behavioral response curves. The response curves in Figure 2-5 reflect rapid, medium and long responses and are designed to include the range of mobilization times that may be experienced in a hurricane evacuation situation. For this analysis, the mobilization/traffic loading time varied between 5 and 10 hours.

Figure 2-5 Behavioral Response Curves



A second essential input into the transportation analysis involved the percentage of evacuees assumed to travel to one of four general destination types by plan. These assumptions include the expected percent of evacuees from each zone traveling to local public shelters, hotel/motel units, the home of a friend or relative, or out of the county entirely. Destination percentages were varied for each traffic evacuation zone in the county depending on the category of risk (distance from the coastline), or special characteristics of a zone such as a high number of mobile home units. Assumptions were also varied for permanent residents versus tourists.

One important behavioral aspect built into the rates is that a larger percentage of evacuees will go out of county for each successive step in storm intensity. Also, in the lower intensity hurricanes, most of the evacuees in non-surge areas are mobile home residents who have a higher propensity to use public shelters. This is reflected in the assumptions as well.

The final set of behavioral assumptions concerns vehicle usage rates during an evacuation. Vehicle usage rates pertain to the percentage of vehicles available at the home origin, assumed to be used in the evacuation. Vehicle usage percentages are 70% to 80% (depending on distance from the coastline) for this transportation analysis.

The key behavioral concepts and assumptions used for the study are summarized in Table 2-3. The precise parameters used for each zone for all plans are included in Annex C of the Transportation Model Support Document.

Table 2-3
SUMMARY OF BEHAVIORAL ASSUMPTIONS
Apalachee Region Transportation Analysis

Participation Rates

Even in a scenario involving an intense, Category 4-5 hurricane, it is unlikely that the evacuation participation rate will be as high as 100%. However, conservative assumptions had to be made regarding the percentage of the population that would evacuate with the threat of a storm in each Category 1-5 plan. In general, the following was assumed for all counties:

► In cat 1 surge zones, all permanent, mobile home and tourist units were assumed to evacuate in all categories of storms.

► For cat 2-3 surge zones, all mobile home and tourist units evacuated in all scenarios; and 15 to 20% of permanent units in those surge zones evacuated in a category 1 event (even though they would probably not be specifically directed to by local officials). All permanent units were assumed to evacuate in all category 2 through 5 scenarios.

► In the cat 4-5 surge zones, the participation rate for permanent units was 2 to 10% in category 1 scenarios and for category 2-3 storms 90 % in Wakulla and 20% in Gulf. The reason for the wide disparity between the two counties is that the Gulf County 4-5 evacuation zones are significantly further away from the coast than those in Wakulla County. All other residents and tourists evacuated in all categories in these zones.

► Additionally a portion of the theoretically non-vulnerable population was also assumed to evacuate including: Gulf – 1% to 5%, Jefferson – 5% to 30% , Wakulla – 5% to 10%, and Leon – 0% to 5%. The range in values is due to proximity to the coast and intensity of storm (i.e. the values diminish with distance from the coast and lower storm intensities).

Clearance times calculated in this transportation analysis will provide residents located in vulnerable areas the opportunity to evacuate, whether or not they choose to evacuate.

Refuge Percentages

Refuge percentages include estimates of the percentage of evacuees traveling to each refuge type. These estimates include the number of evacuees traveling to in-county shelters, in county homes of friends/relatives (including churches), in-county hotels/motels, or out of the county destinations. Evacuation zones containing similar characteristics, such as ocean front or inland areas were grouped together by assumptions that were developed using data gathered from current and past observations of the Apalachee Region and other coastal areas around the country. Major factors in accounting for the wide differences in these figures are that two counties in the region are completely evacuated in higher category storms and the absence of any local shelters in three of the coastal counties.

Of those evacuating:

Percent to Local Public Shelter:

► 5% of high-risk areas (ocean front)
► 10% of moderate risk areas (category 2 through 5 surge evacuation zones)
► 20% of low risk areas (outside all surge evacuation zones) depending upon income

Percent to Out-of-County:

► 30-90% in a strong storm depending upon risk area and income
► 20-80% in a weak storm depending upon risk area and income
► Of those going out-of-county, a majority are expected to go to Tallahassee, Georgia and Alabama.

In-County Friends and Relatives Homes:

► 5-55% in strong storm depending upon risk area and income
► 10-70% in a weak storm depending upon risk area and income

Vehicle Utilization

Depending on the risk area, evacuees will use 70%-80% of the vehicles available at the household level. This is generally a constant from one evacuation to another.

2.5 ROADWAY NETWORK CHARACTERISTICS

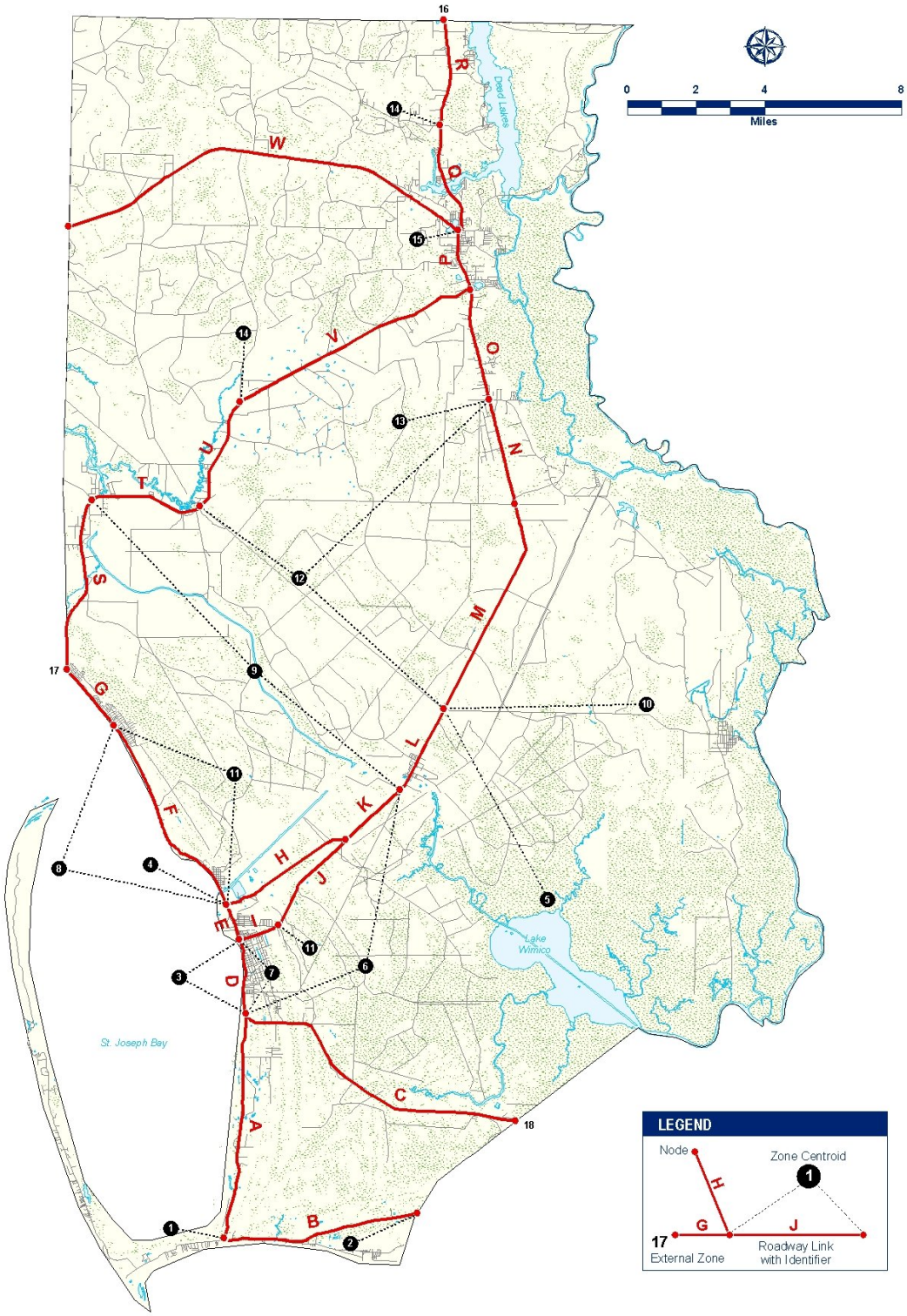
A final group of assumptions used for input to the transportation analysis is related to the roadway system chosen for the evacuation network and traffic control measures considered for traffic movement. Although the assumptions developed for the transportation analysis are general, the efforts at the county and municipal level regarding traffic control and roadway selection must be quite detailed. In urbanized areas throughout the Apalachee Region such as Port St. Joe; Apalachicola; Crawfordville and Tallahassee, most intersections will be controlled by existing traffic signals. However, as resources permit, traffic control officers will be stationed at bottlenecks identified in this study, as well as other local locations of concern. A detailed law enforcement assignment to major bottlenecks involves extensive coordination among local and state officials. This study does not presume to replace those efforts, but seeks to quantify the time elements within such personnel would operate.

The counties reviewed draft evacuation network maps, and roadways were added to the analysis where appropriate. In choosing roadways to be used for the evacuation network, an effort was made to include street facilities with sufficient elevations, substantial shoulder width and surface, and roadways already contained in existing hurricane evacuation plans. Additionally, all roadways included in the Regional Evacuation Procedures (REVAC) were modeled as part of the county evacuation roadway network.

In order to determine the routing of evacuation traffic, a representation of the roadway system was developed using a "link-node" system to identify roadway segments. Nodes are used to identify the intersection of two roadways or changes in roadway characteristics. Links are the roadway segments between nodes. Each link is identified by a letter designation. Figure 2-6 illustrates the coded evacuation network with link letters and zone connections to the links shown by the numbered circles and dashed lines.

GULF COUNTY

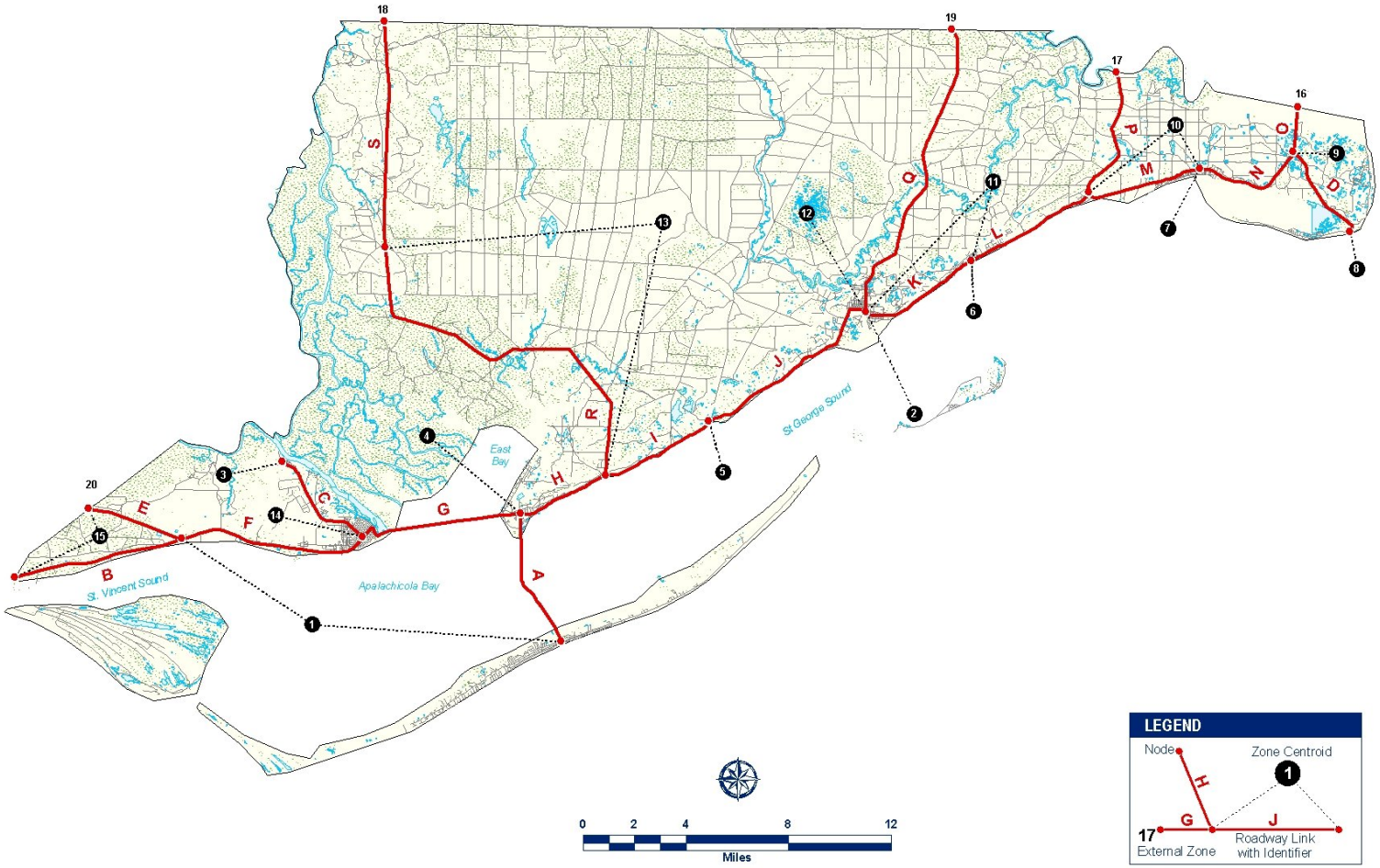
Evacuation Roadway Network



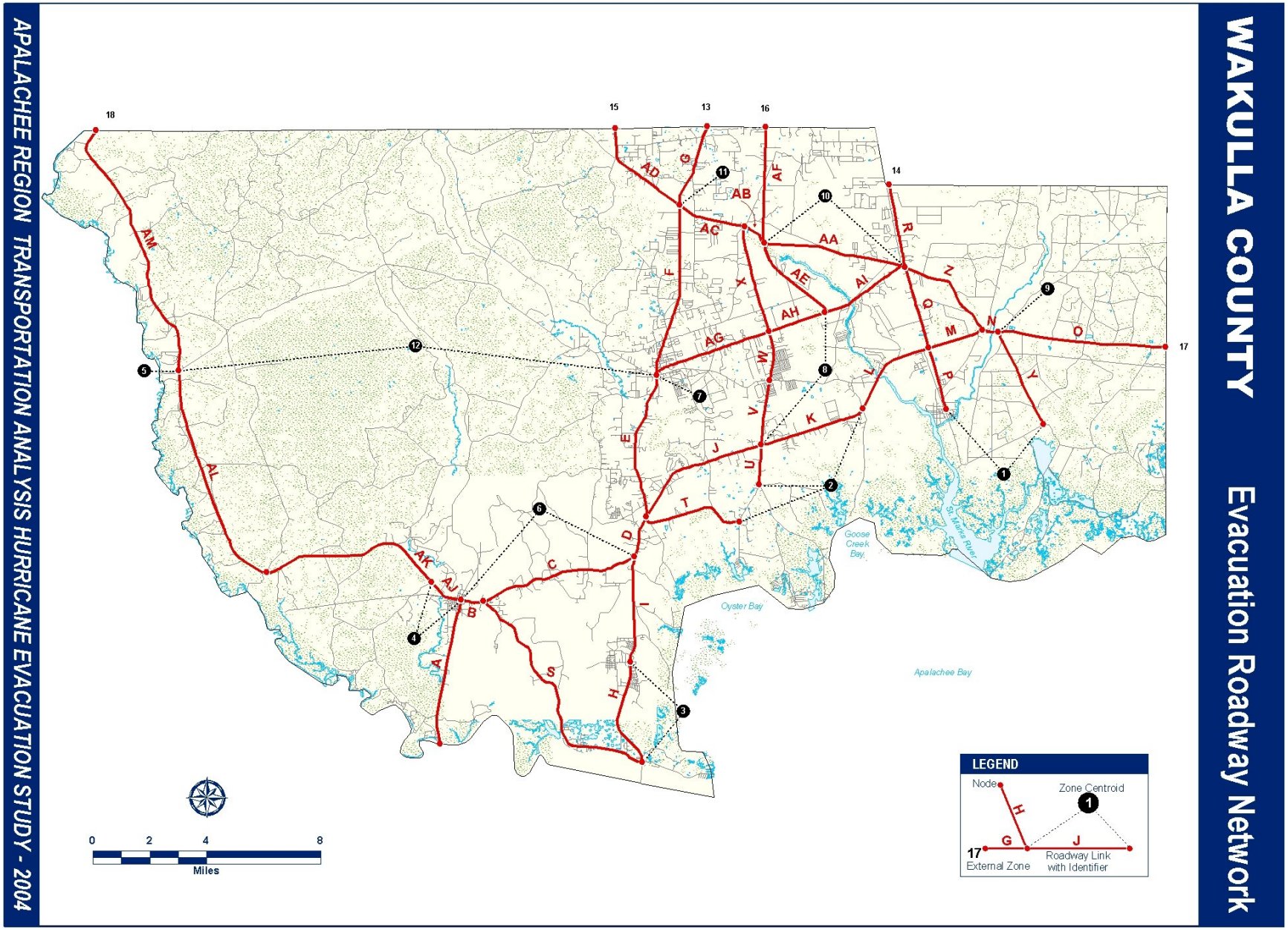
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

FRANKLIN COUNTY

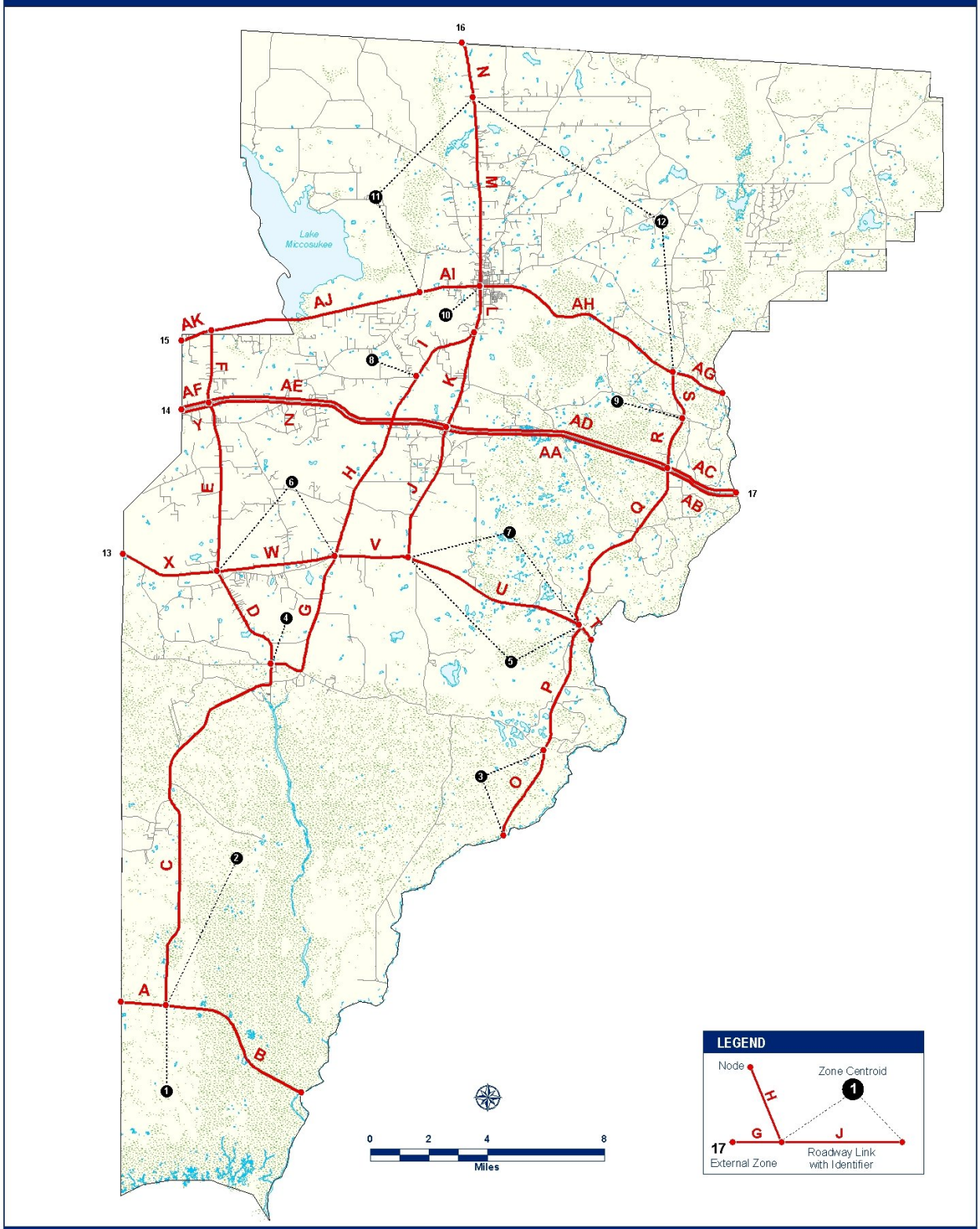
Evacuation Roadway Network



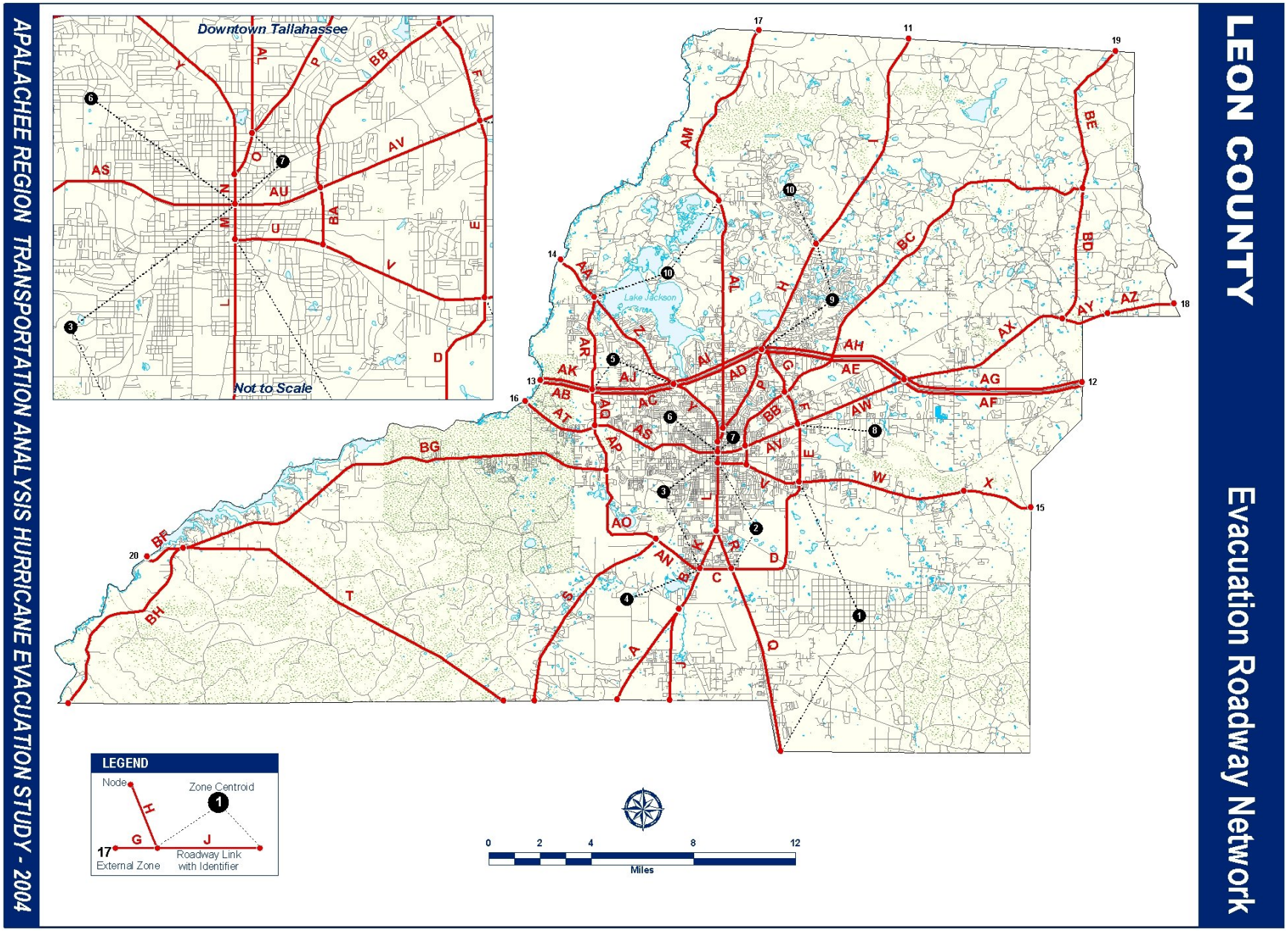
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004


WAKULLA COUNTY
Evacuation Roadway Network
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004
Oyster Bay
Goose Creek Bay
St. Marks River
Apalachee Bay
LEGEND
Node
Zone Centroid
Roadway Link with Identifier
External Zone
0 2 4 8
Miles

JEFFERSON COUNTY Evacuation Roadway Network



APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004


LEON COUNTY
Evacuation Roadway Network
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004
Downtown Tallahassee
Not to Scale
Lake Jackson
LEGEND
Node
Zone Centroid
Roadway Link with Identifier
External Zone
0 2 4 8 12
Miles

Once the links and nodes were established for the evacuation routes, directional traffic service volumes appropriate for evacuations were established for each link for the Year 2004. This was accomplished by determining number of lanes, facility type, and area type information from highway maps available from the county, as well as field check updating performed by PBS&J. Tables were then used to specify a directional evacuation service volume based on link characteristics. The primary link characteristics used were number of lanes by direction and facility type. Figure 2-7 shows the Year 2004 directional service volumes and number of lanes for the evacuation clearance time analysis.

Important assumptions concerning the evacuation road network for the analysis that must be mentioned are:

- The evacuation of all vehicles will occur prior to the arrival of sustained gale storm winds (39 mph) and storm inundation of evacuation routes.

- Provisions will be made for the removal of vehicles in distress on the network through aggressive incident management and agreements worked out with tow truck operators.

- Signal timings will be "actuated" to provide the most “green time” for westbound movements away from the coast

- The U.S. Coast Guard will be contacted to “lock down" drawbridges before the arrival of hazardous conditions

- Capacity on drawbridges will be “restrained” to account for marine movement during an evacuation

GULF COUNTY

Directional Service Volume

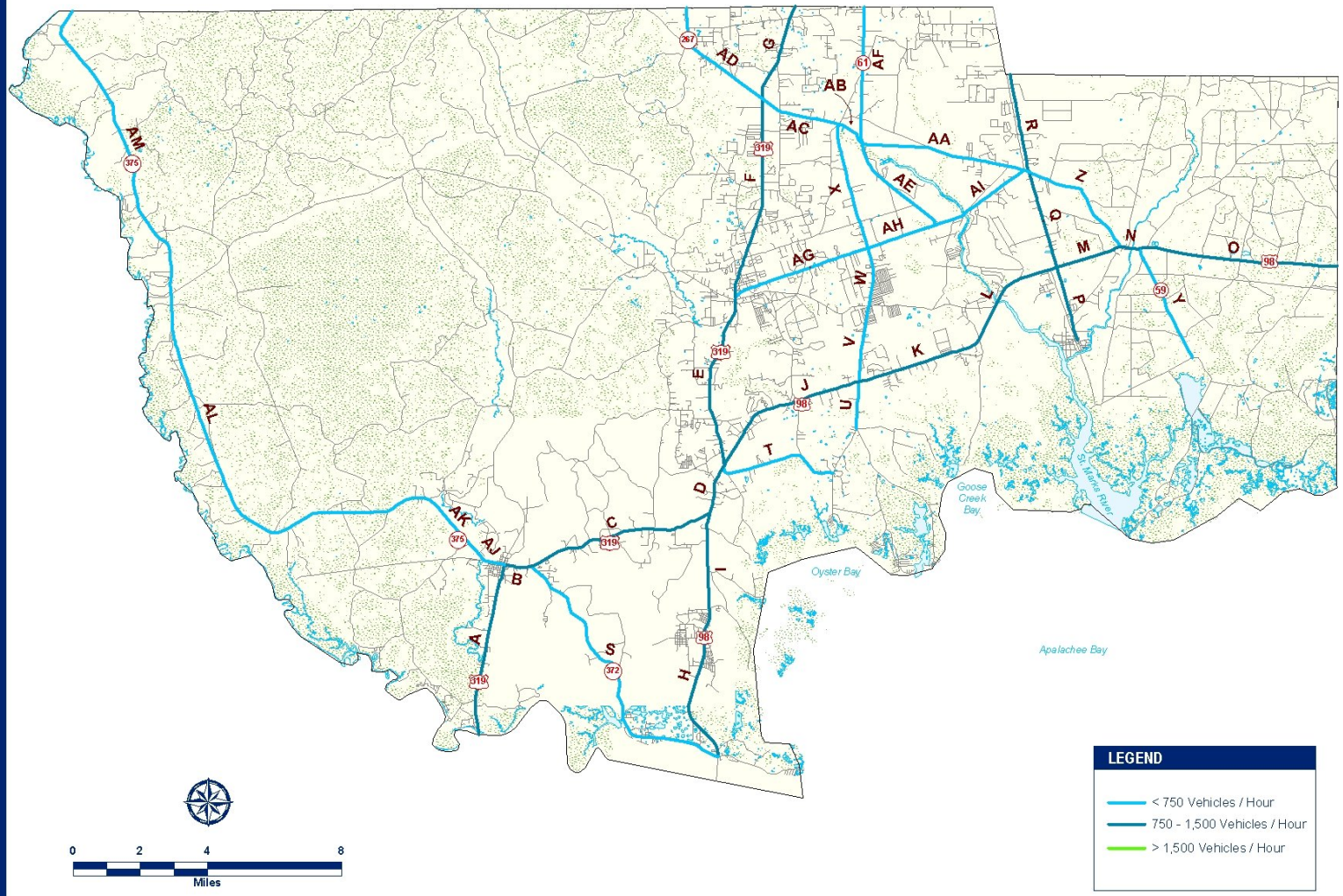
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

FRANKLIN COUNTY

Directional Service Volume

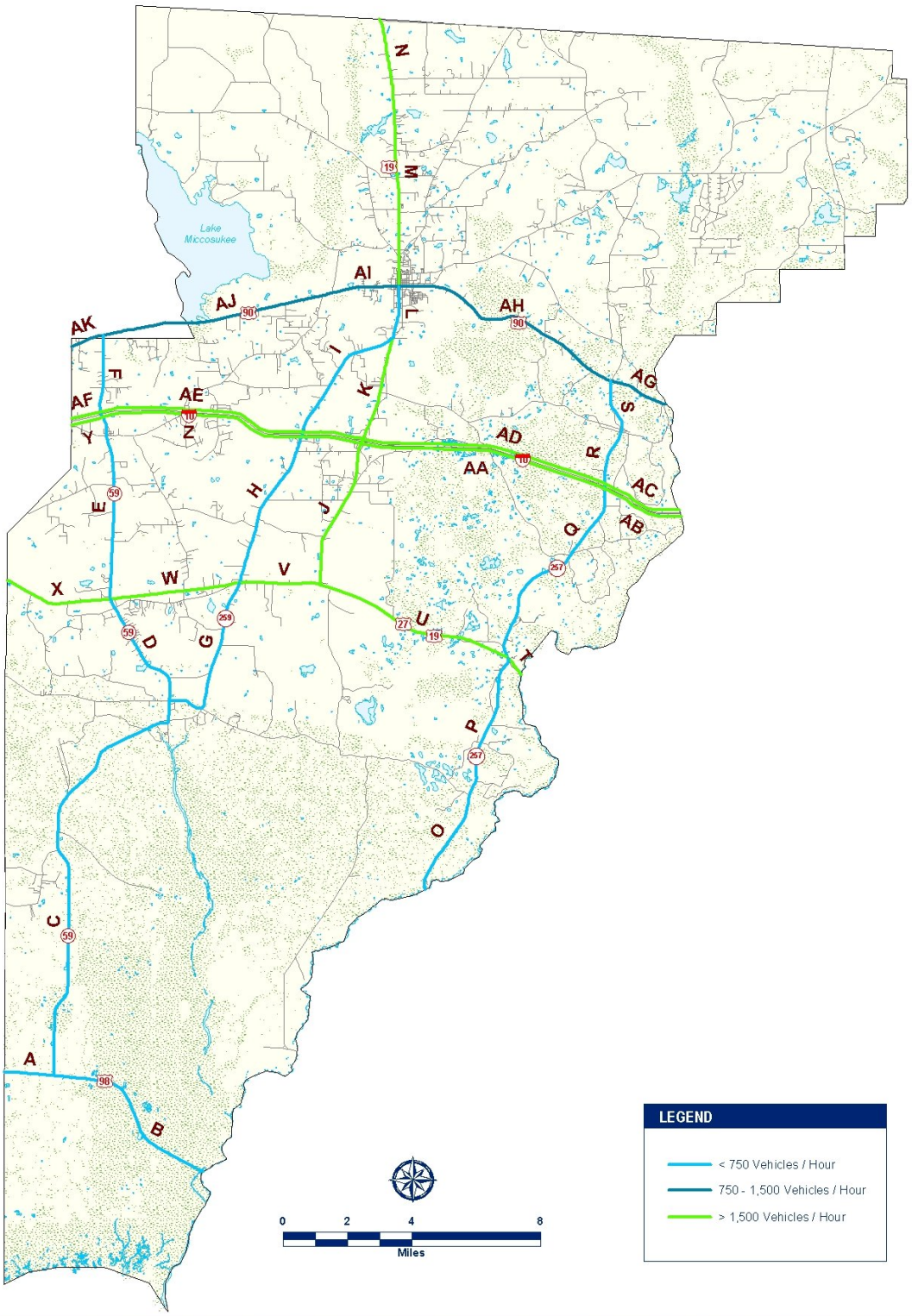
WAKULLA COUNTY

Directional Service Volume

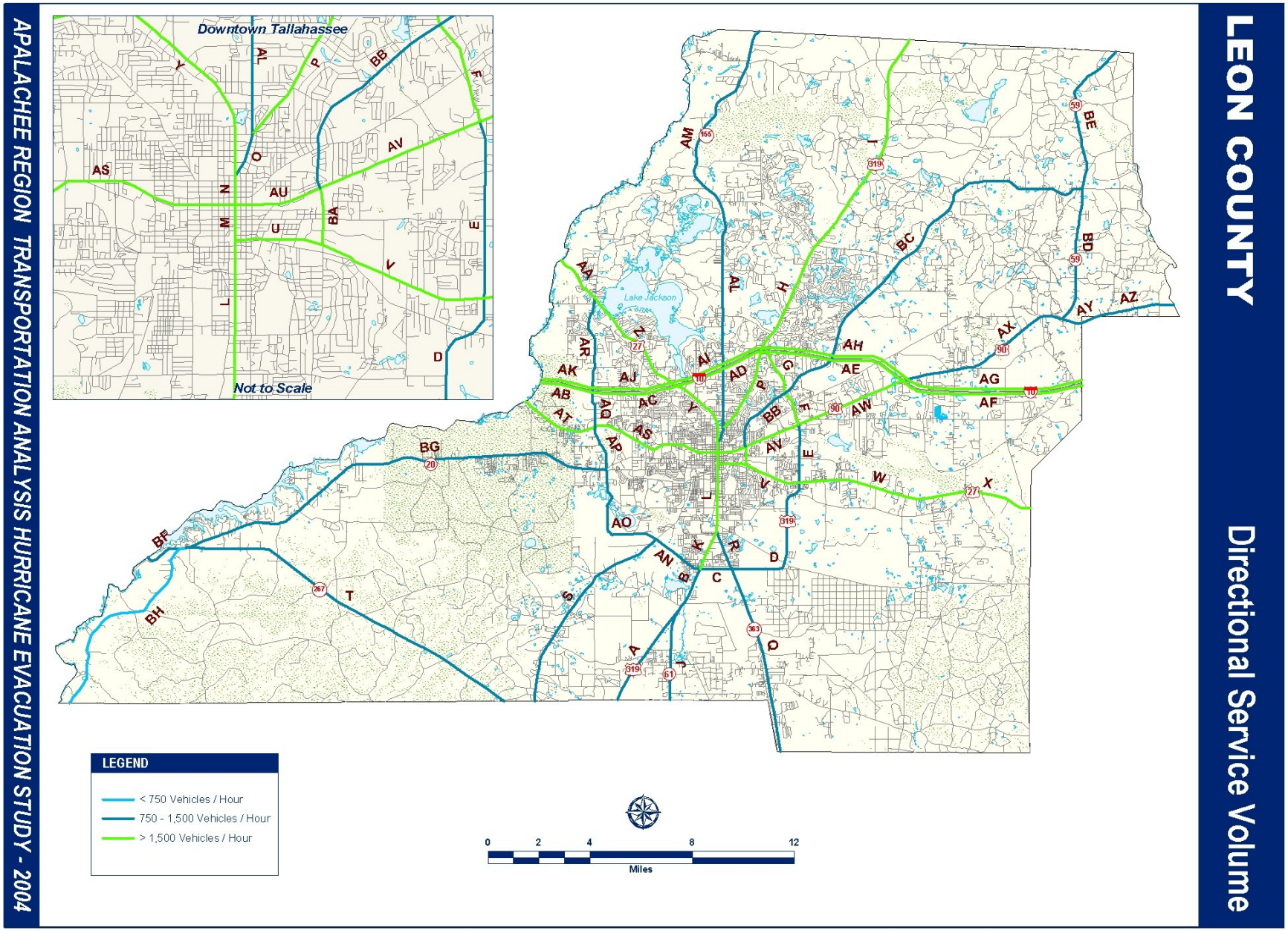


APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

JEFFERSON COUNTY Directional Service Volume



APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004


LEON COUNTY
Directional Service Volume
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004
Downtown Tallahassee
Not to Scale
Lake Jackson
LEGEND
< 750 Vehicles / Hour
750 - 1,500 Vehicles / Hour
> 1,500 Vehicles / Hour
0
2
4
8
12
Miles

3.0 EVACUATION CLEARANCE TIME MODEL APPLICATION/SYSTEM FORECASTS

Application of PBS&J's transportation modeling methodology for hurricane evacuations, using the inputs and assumptions discussed in Chapter 2, produced several key data items and forecasts for hurricane evacuation planning and preparedness. Completion of the transportation modeling process for the Year 2004 base year produced the following:

- Evacuating people and vehicle statistics by evacuation zone by storm scenario;
- Shelter demand and capacity considerations by scenario;
- Traffic volumes and critical roadway segments by scenario; and
- Estimated clearance times by scenario.

Although an extensive amount of data is generated through the transportation analysis (as provided in the Transportation Model Support Document), the items listed above constitute the most critical outputs for planning relative to identifying shelter needs, anticipating bottlenecks and defining the timing constraints of an evacuation.

3.1 CLEARANCE TIME MODEL DESCRIPTION

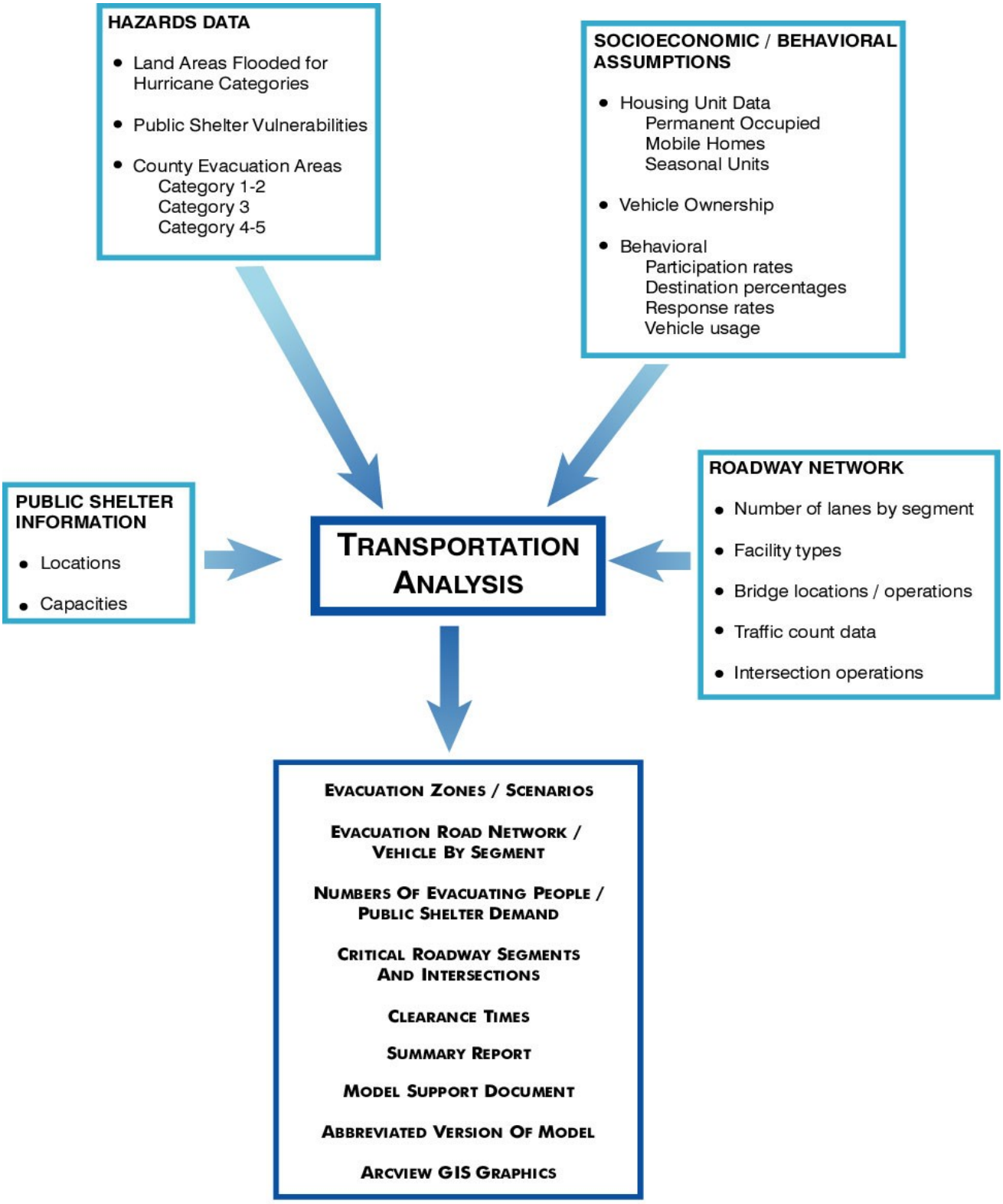
The general philosophy supporting all of PBS&J's hurricane evacuation clearance time work around the country is that the analysis must be technically complex enough to produce reliable estimates of hurricane evacuation clearance times, yet clear enough for the emergency management community to be able to review key modeling assumptions and products. A brief overview of the steps in the modeling process and a description of the computer program framework used in the modeling steps are discussed in this section.

The key modeling steps used in the analysis are as follows:

- Development of Evacuation Zones and Data - Identifies who is vulnerable and who is evacuating;
- Trip Generation - Calculates how many evacuees will move for a particular plan;
- Trip Distribution - Determines where evacuees will go;
- Development of Evacuation Road Network –
  - Establishes which roads can be used for evacuation; and
  - Quantifies the carrying capacity of each evacuation roadway segment; and
- Trip Assignment - Determines what route(s) evacuees will use to get from their point of origin to their destination.
- Calculation of Clearance Time - Determines how much time it will take for all evacuees to clear the evacuation network

The major inputs and outputs of the overall process are illustrated in Figure 3-1. PBS&J developed an in-house set of computer programs to facilitate the transportation modeling steps described above. Programs are in a Lotus for Windows environment and were originally developed in late 1993/early 1994 by PBS&J. The model was updated dramatically in 2000 and the Apalachee Region Transportation Study is one of the earliest beneficiaries of that update. At the conclusion of the study, PBS&J will provide local governments, state agencies, the USACE, and the local Regional Planning Council with a spreadsheet tool that will allow them to retroactively add the impacts of large developments, or road construction restrictions to the evacuation transportation model. This abbreviated model is designed to facilitate analysis of the clearance time impacts caused by development and other changes to evacuation related characteristics in the modeled counties and regions.

Figure 3-1


HAZARDS DATA
Land Areas Flooded for Hurricane Categories
Public Shelter Vulnerabilities
County Evacuation Areas
Category 1-2
Category 3
Category 4-5
SOCIOECONOMIC / BEHAVIORAL ASSUMPTIONS
Housing Unit Data
Permanent Occupied
Mobile Homes
Seasonal Units
Vehicle Ownership
Behavioral
Participation rates
Destination percentages
Response rates
Vehicle usage
PUBLIC SHELTER INFORMATION
Locations
Capacities
TRANSPORTATION ANALYSIS
ROADWAY NETWORK
Number of lanes by segment
Facility types
Bridge locations / operations
Traffic count data
Intersection operations
EVACUATION ZONES / SCENARIOS
EVACUATION ROAD NETWORK / VEHICLE BY SEGMENT
NUMBERS OF EVACUATING PEOPLE / PUBLIC SHELTER DEMAND
CRITICAL ROADWAY SEGMENTS AND INTERSECTIONS
CLEARANCE TIMES
SUMMARY REPORT
MODEL SUPPORT DOCUMENT
ABBREVIATED VERSION OF MODEL
ARCVIEW GIS GRAPHICS

The Transportation Model Support Document Appendix to this report provides details about the components of the model, file nomenclature and management and model application. One important aspect of operating in the Lotus environment for this study is the ability to import data files directly into the initial programs. In addition, the outputs of other programs are easily captured and exported to ArcView GIS for displays and mapping. Overall, the use of GIS by PBS&J significantly enhanced the process of technical data development and documentation in the study.

3.2 EVACUATING PEOPLE AND VEHICLES BY PLAN

Using the trip generation module of PBS&J's battery of hurricane programs, total evacuating people and vehicles produced by each evacuation zone were calculated and split by general destination type (trip purpose). The four general destination types are: in-county public shelter, in-county hotel/motels, in county home of a friend or relative, and out-of-county. This was accomplished for the Year 2004 base year, the various storm intensities and for two levels of assumed tourist occupancy. Low tourist occupancy was assumed to be 35% and high tourist occupancy was assumed to be 95%. The zone-by-zone statistics resulting from this process can be found in the Transportation Model Support Document in Annex C.

Table 3-1 shows the number of residents and tourists estimated to leave dwelling units for each evacuation area by scenario. **The number of people involved in an actual evacuation will likely total less than these figures** due to the assumed 100 percent participation rate of people from units in storm surge vulnerable areas and mobile homes for each evacuation scenario. Even with door-to-door evacuation notification, it will be difficult to convince all who should leave to do so, even for the most intense storm threats. Participation rates in tropical storm/weak Category 1-2 hurricanes can be quite low even in potential surge areas. Conversely, for Category 4 and 5 hurricanes, media hype and continual coverage on The Weather Channel will tend to cause high participation rates from residents that local officials would rather have stay in county, or shelter in place.

Figure 3-2 and Figure 3-3 graphically represent a category one evacuation with the lowest evacuating population and low tourist occupancy for each modeled county, as well as the highest category scenario with the greatest evacuating population and high tourist occupancy levels.

Table 3-1
EVACUATING PEOPLE STATISTICS BY CATEGORY
Apalachee Region Transportation Analysis

County/Scenario	Year 2004 Estimated Permanent Population*	Maximum People/ Vehicles Evacuating	Maximum Public Shelter Demand	Local Public Shelter Capacity [1]
Gulf County	**14,785 People**			
Low Tourist Occupancy		Includes up to 1,483 seasonal people countywide		
Category 1		10,191 / 4,642	968 People	0 People
Category 2 & 3		13,259 / 6,196	1,279 People	0 People
Category 4 & 5		13,720 / 6,429	878 People [2]	0 People
High Tourist Occupancy		Includes up to 4,024 seasonal people countywide		
Category 1		13,368 / 5,752	968 People [3]	0 People
Category 2 & 3		16,434 / 7,308	1,279 People [3]	0 People
Category 4 & 5		16,895 / 7,541	878 People [2] [3]	0 People
	Includes 6,191 mobile home residents countywide			
Franklin County	**12,057 People**			
Low Tourist Occupancy		Includes up to 1,560 seasonal people countywide		
Category 1		8,657 / 3,826	480 People	0 People
Category 2 thru 5		13.612 / 5,901	976 People	0 People
High Tourist Occupancy		Includes up to 4,235 seasonal people countywide		
Category 1		11,330 / 4,761	480 People [3]	0 People
Category 2 thru 5		16,285 / 6,835	976 People [3]	0 People
	Includes 4,331 mobile home residents countywide			

* All socioeconomic data developed by PBS&J using Year 2000 US Census and 2002 Florida Statistical Abstract data for input into the transportation analysis effort. The totals presented in this table are for the entire county. Totals by individual zone may be found in Annex C of the Model Support document.

Footnotes on page 3-8

Table 3-1 (Continued)
EVACUATING PEOPLE STATISTICS BY CATEGORY
Apalachee Region Transportation Analysis

County/Scenario	Year 2004 Estimated Permanent Population*	Maximum People/ Vehicles Evacuating	Maximum Public Shelter Demand	Local Public Shelter Capacity [1]
Wakulla County	**28,486 People**			
Low Tourist Occupancy		Includes up to 383 seasonal people countywide		
Category 1		18,284 / 9,151	1,408 People [4]	650 People
Category 2 & 3		27,460 / 13,430	934 People [4]	650 People
Category 4 & 5		28,800 / 14,042	1,001 People [4]	650 People
High Tourist Occupancy		Includes up to 1,821 seasonal people countywide		
Category 1		19,723 / 9,653	1,408 People [3] [4]	650 People
Category 2 & 3		28,900 / 13,933	934 People [3] [4]	650 People
Category 4 & 5		30,239 / 14,545	1,001 People [3] [4]	650 People
	Includes 14,180 mobile home residents countywide			
Jefferson County	**13,628 People**			
Low Tourist Occupancy		Includes up to 101 seasonal people countywide		
Category 1 & 2		4,783 / 2,139	707 People	626 People
Category 3 thru 5		6,847 / 3,062	1,017 People	626 People
High Tourist Occupancy		Includes up to 274 seasonal people countywide		
Category 1 & 2		4,954 / 2,199	713 People	626 People
Category 3 thru 5		7,020 / 3,119	1,024 People	626 People
	Includes 5,322 mobile home residents countywide			

* All socioeconomic data developed by PBS&J using Year 2000 US Census and 2002 Florida Statistical Abstract data for input into the transportation analysis effort. The totals presented in this table are for the entire county. Totals by individual zone may be found in Annex C of the Model Support document.

Footnotes on page 3-8

Table 3-1 (Continued)

EVACUATING PEOPLE STATISTICS BY CATEGORY

Apalachee Region Transportation Analysis

County/Scenario	Year 2004 Estimated Permanent Population*	Maximum People/ Vehicles Evacuating	Maximum Public Shelter Demand	Local Public Shelter Capacity [1]
Leon County [5]	**262,845 People**			
Low Tourist Occupancy		Includes up to 6,629 seasonal people countywide		
Category 1		9,646 / 4,230	1,216 People	1,550 People [6]
Category 2 & 3		29,316 / 12,931	3,747 People	1,550 People [6]
Category 4 & 5		50,128 / 22,371	8,766 People	1,550 People [6]
High Tourist Occupancy		Includes up to 17,992 seasonal people countywide		
Category 1		12,487 / 5,222	1,243 People	1,550 People [6]
Category 2 & 3		37,270 / 15,714	3,829 People	1,550 People [6]
Category 4 & 5		61,489 / 26,347	8,879 People	1,550 People [6]
	Includes 31,185 mobile home residents countywide			
Calhoun County	**13,903 People**	6,261 / 2,469	1,064 People [7]	0 People
Gadsden County	**46,749 People**	17,572 / 7,085	2,987 People [7]	2,853 People
Jackson County	**49,270 People**	18,573 / 7,783	3,157 People [7]	3,401 People
Liberty County	**7,738 People**	5,115 / 1,944	870 People [7]	600 People

* All socioeconomic data developed by PBS&J using Year 2000 US Census and 2002 Florida Statistical Abstract data for input into the transportation analysis effort. The totals presented in this table are for the entire county. Totals by individual zone may be found in Annex C of the Model Support document.

Table Footnotes below

Table 3-1 (Continued)

EVACUATING PEOPLE STATISTICS BY STORM PLAN

Apalachee Region Transportation Analysis

[1] Shelter capacity figures from 2004 Statewide Emergency Shelter Plan and include only ARC 4496 compliant "Risk" shelter spaces

[2] Because no shelter spaces will be made available in Gulf County, lower public shelter use figures for category 4 & 5 scenarios reflect a higher percentage of evacuees electing to leave the county entirely.

[3] No difference in low and high tourist occupancy shelter use numbers is a reflection that no tourists are assumed to elect to use public shelter, favoring instead to evacuate out of county.

[4] These figures reflect an assumption that 5% of evacuees from the cat 1 zone and 10% for all other zones will seek public shelter in a category one scenario, while in the cat 2 / 3 and 4 / 5 scenarios only 5% percent for the cat 2 through 5 surge zones and non-evacuation zones will seek public shelter. Therefore, these numbers show a reduction between cat 1 and 2 / 3 scenarios due to a lower percentage electing to go to public shelter for higher categories of storms, as well as account for an increase in the overall number of evacuees between cat 2 / 3 and cat 4 / 5 scenarios, even though the shelter use percentages for those two scenarios remain the same.

[5] The categories in this table for Leon County do not reflect specific evacuation scenarios used by emergency management, but rather account for the behavioral variations in public response caused by increasing storm intensities.

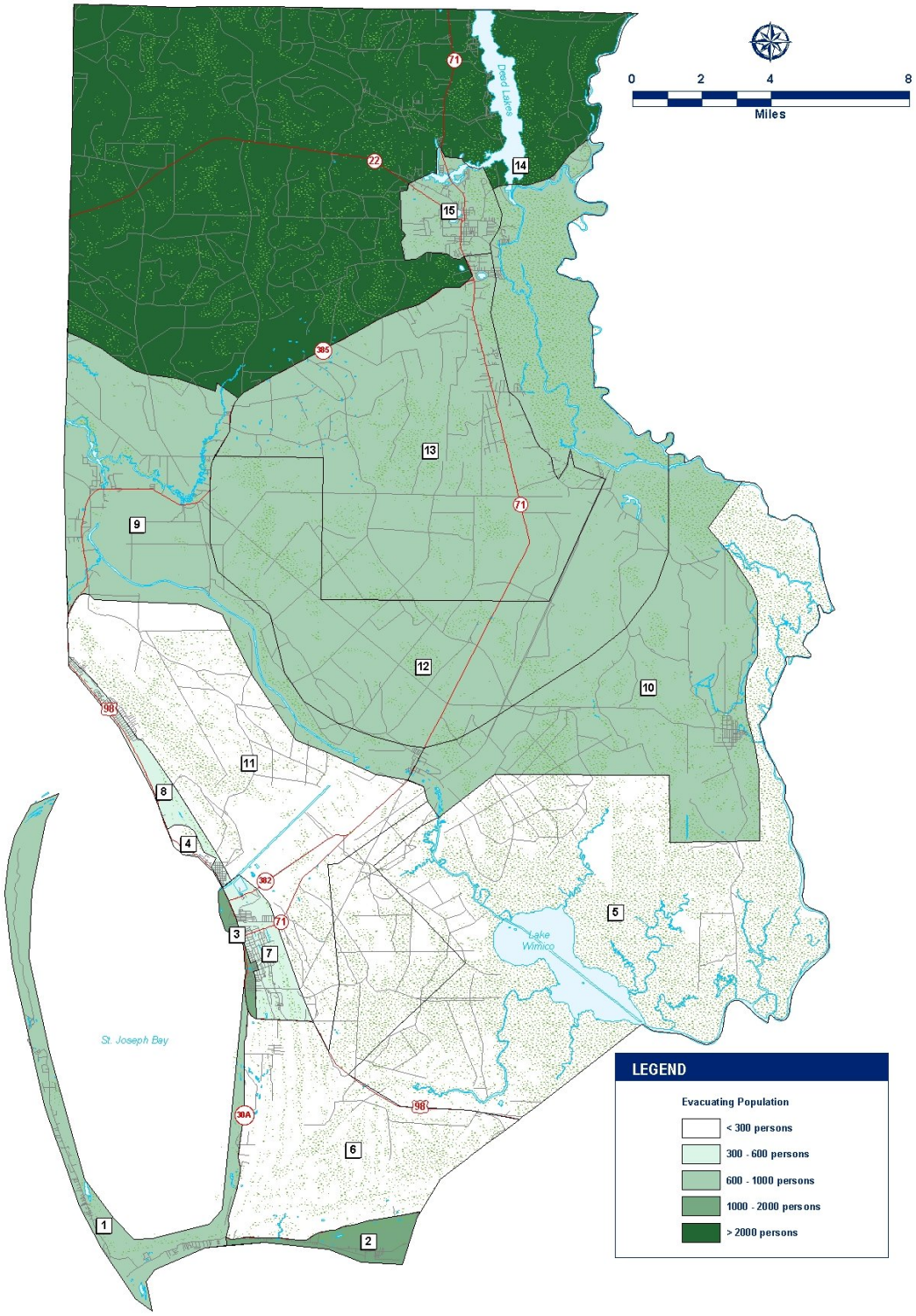
[6] Leon County is shown to only have 821 shelter spaces in the 2004 Statewide Emergency Shelter Plan, but the Emergency Management office informed us that three other facilities are currently being retrofitted to ARC 4496 criteria and that they will be available for use during the 2004 hurricane season.

[7] Public shelter demand for inland counties, except Leon County, was computed based on 17% of the total mobile home population.

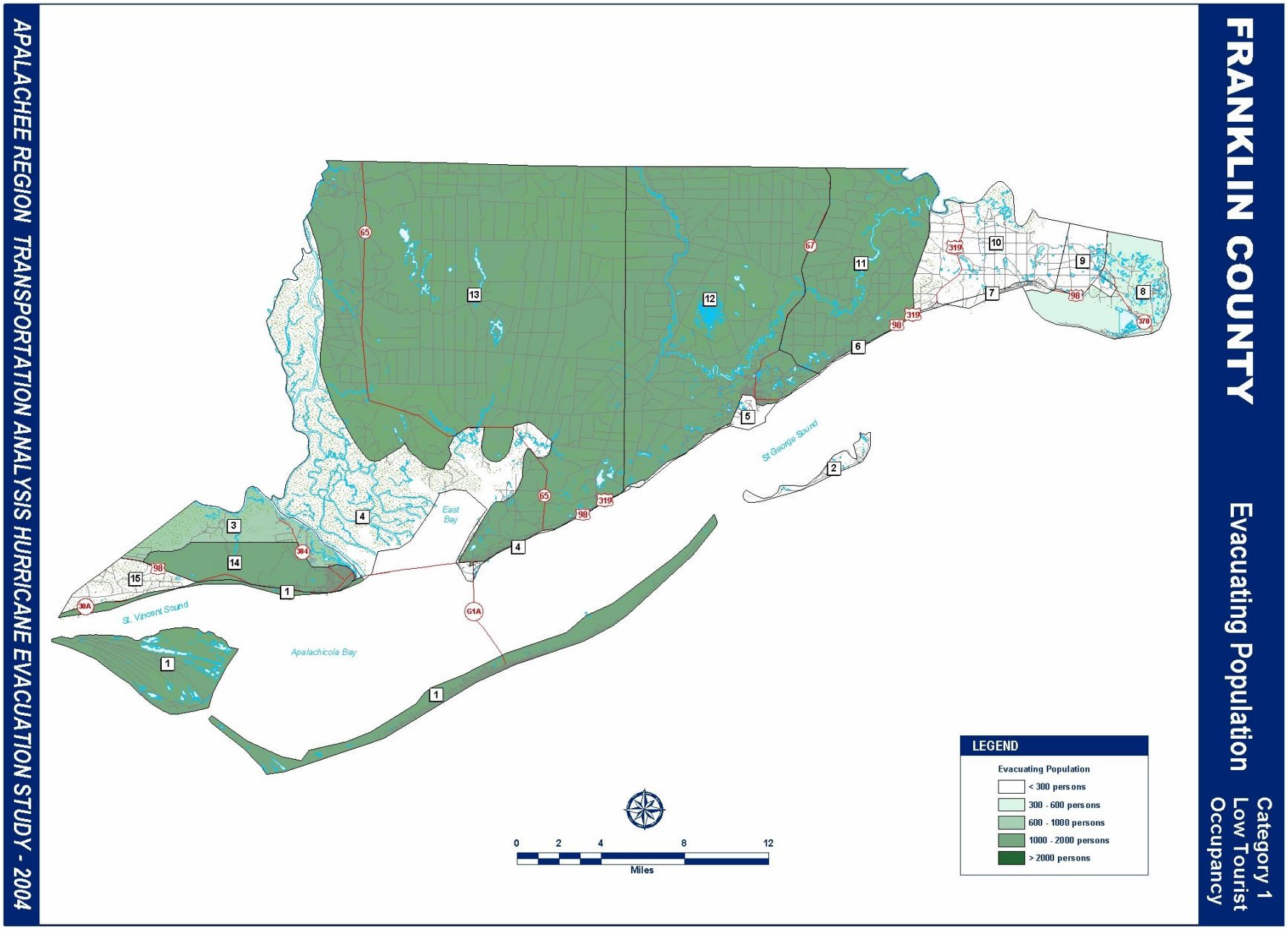
GULF COUNTY

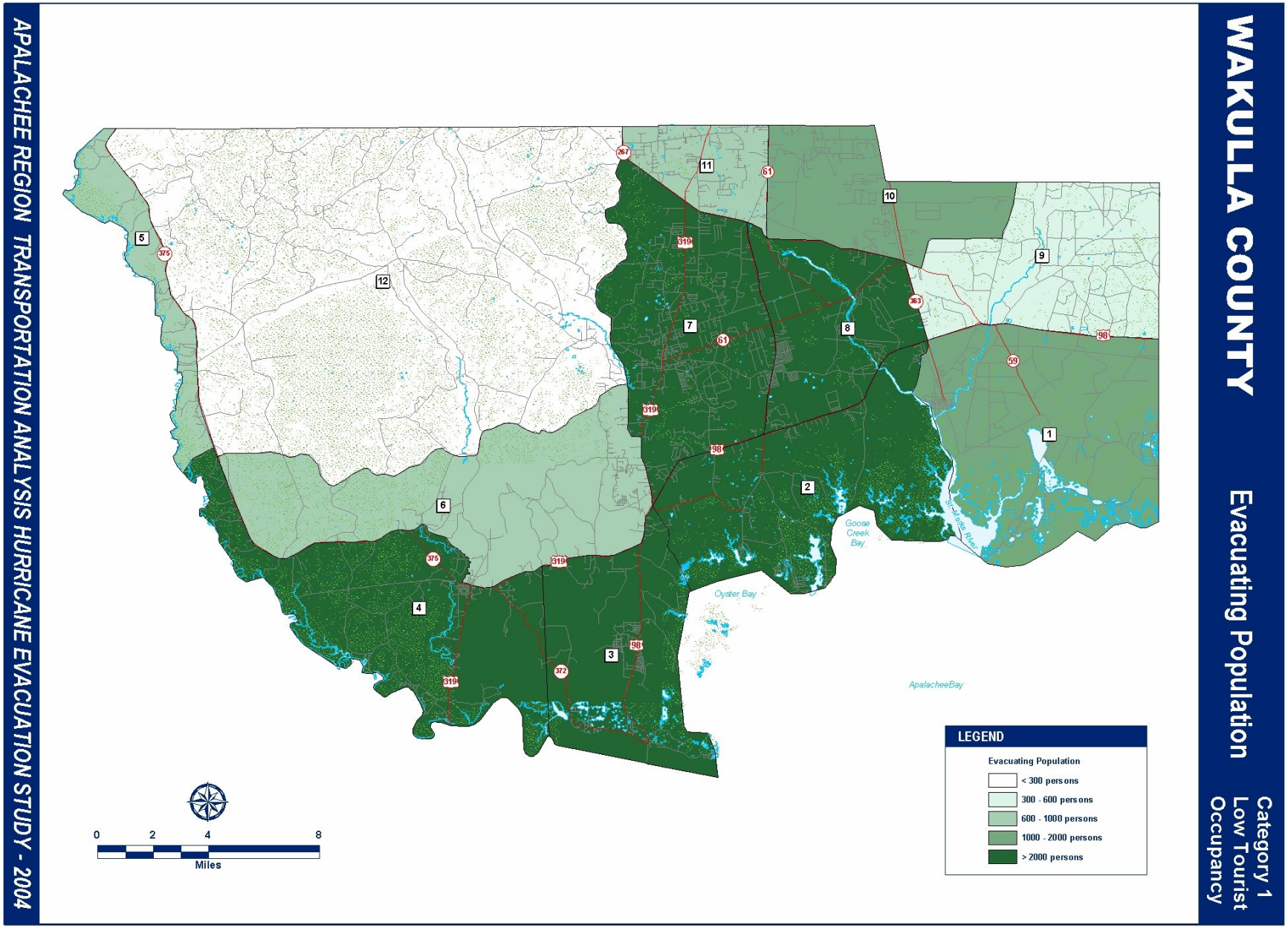
Evacuating Population

Category 1
Low Tourist
Occupancy



APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004


FRANKLIN COUNTY
Evacuating Population
Category 1
Low Tourist
Occupancy
St. Vincent Sound
Apalachicola Bay
East
Bay
St George Sound
LEGEND
Evacuating Population
< 300 persons
300 - 600 persons
600 - 1000 persons
1000 - 2000 persons
> 2000 persons
0
2
4
8
12
Miles
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

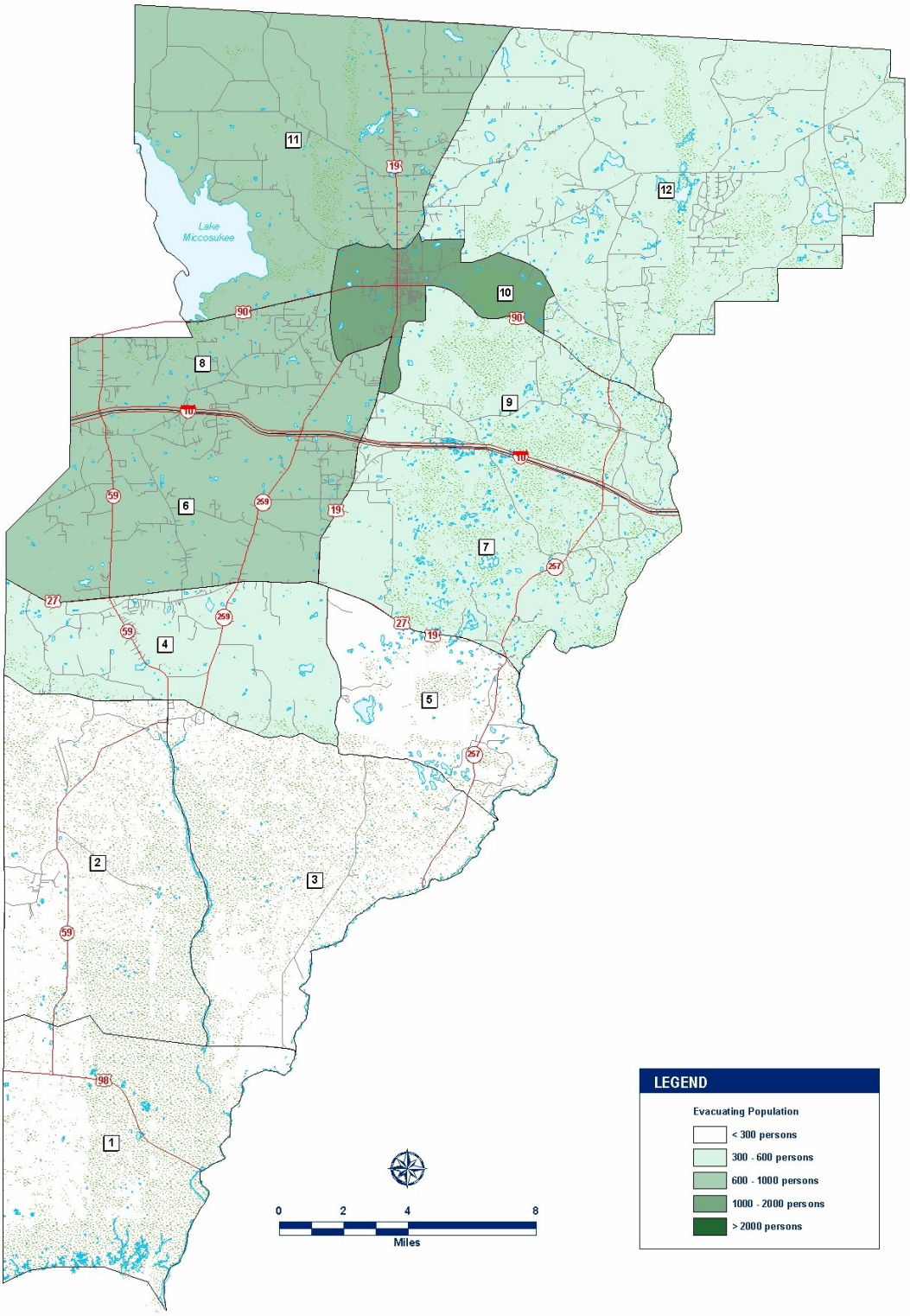


APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

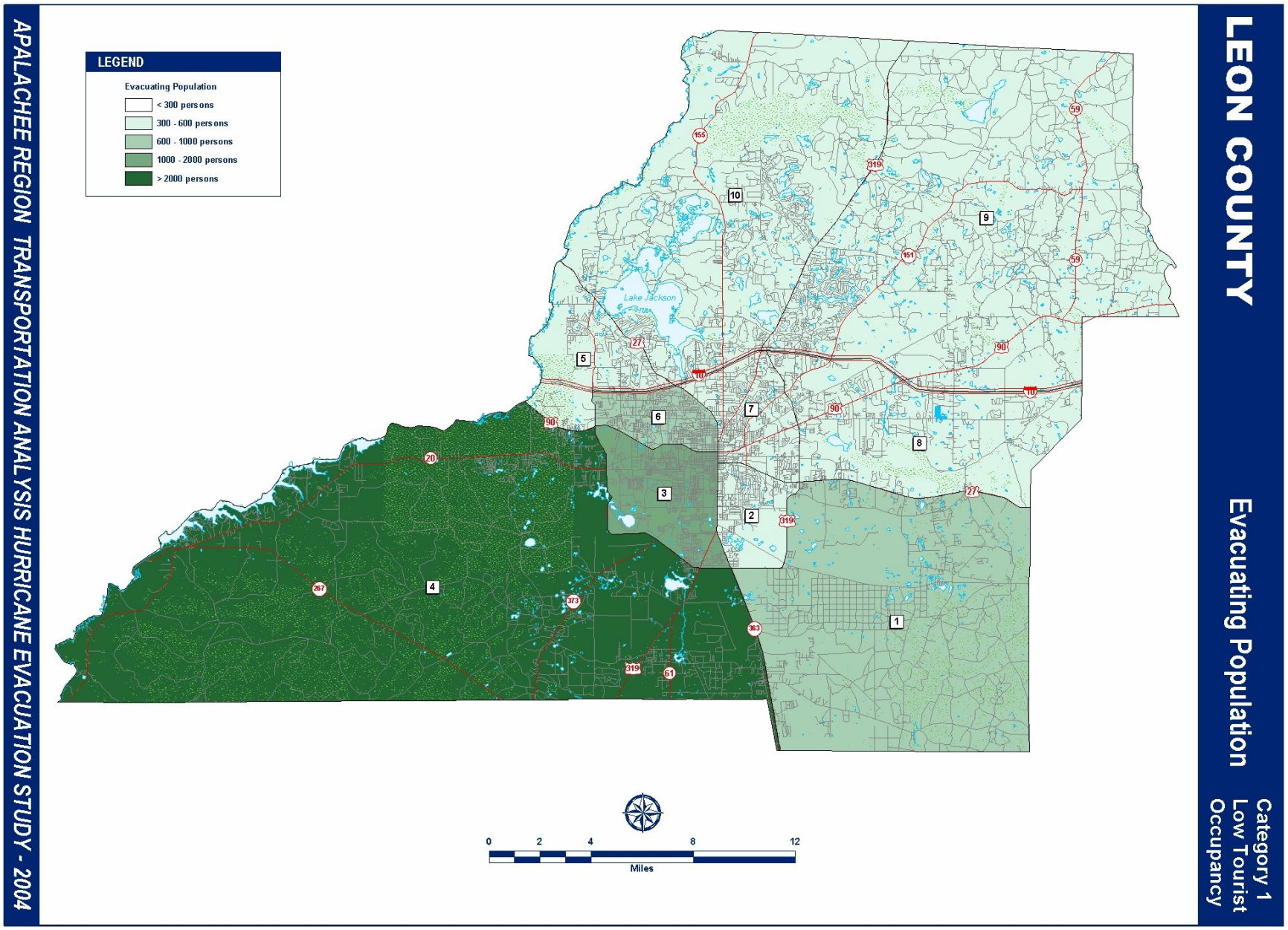
JEFFERSON COUNTY

Evacuating Population

Category 1
Low Tourist
Occupancy



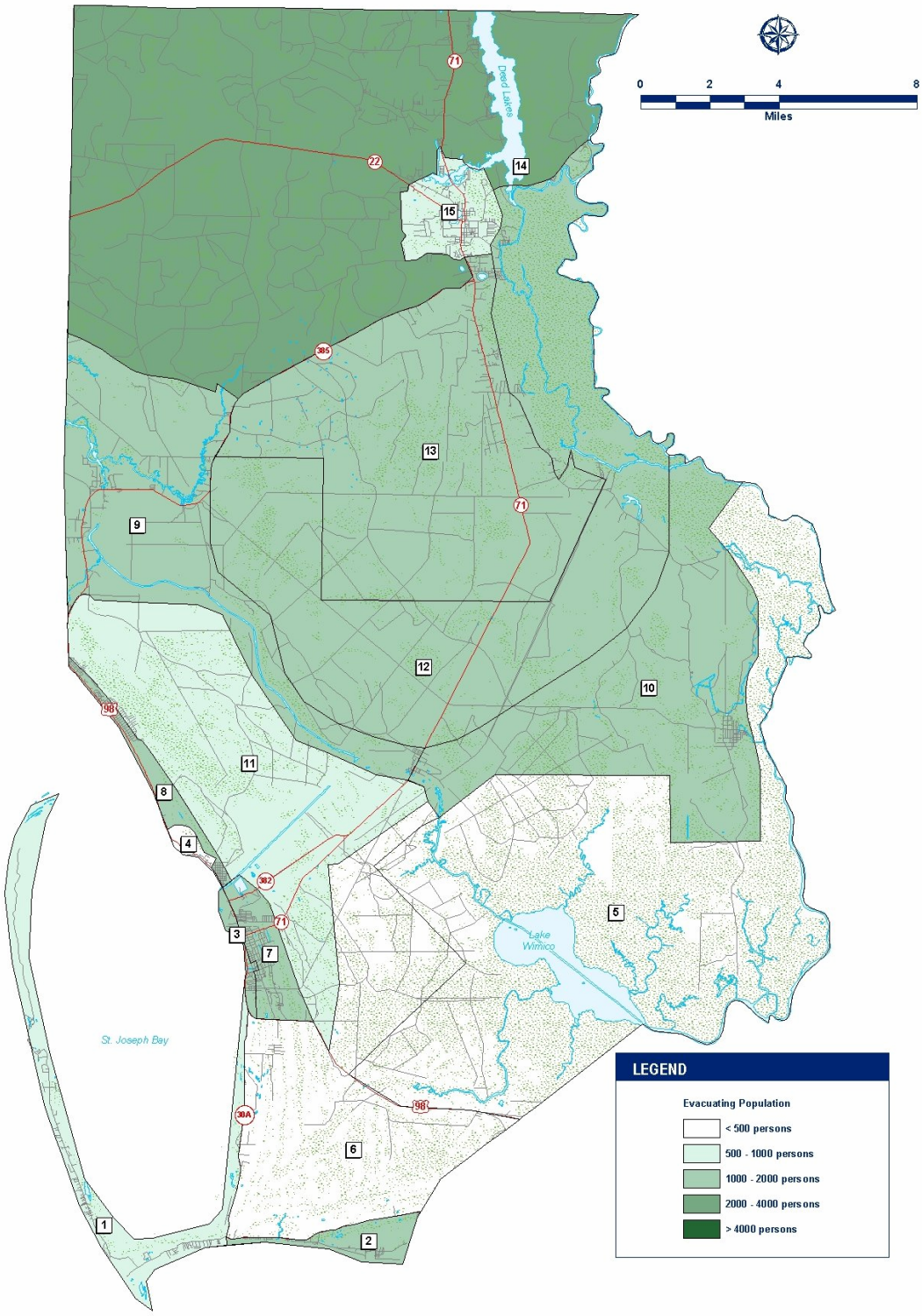
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004


LEON COUNTY
Evacuating Population
Category 1
Low Tourist
Occupancy
LEGEND
Evacuating Population
< 300 persons
300 - 600 persons
600 - 1000 persons
1000 - 2000 persons
> 2000 persons
Lake Jackson
0
2
4
8
12
Miles
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

GULF COUNTY

Evacuating Population

Category 4-5
High Tourist
Occupancy

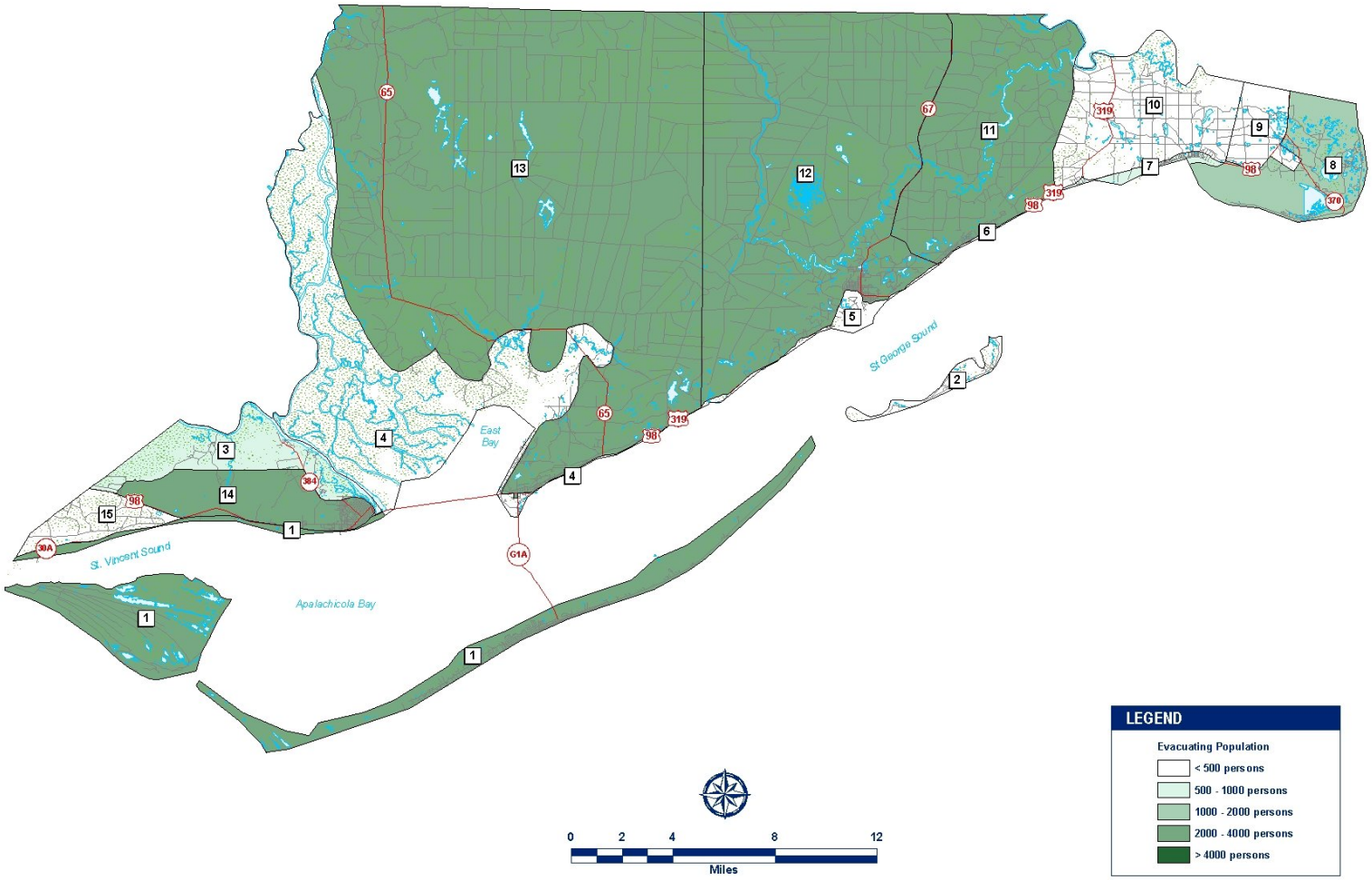


APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

FRANKLIN COUNTY

Evacuating Population

Category 2-5
High Tourist
Occupancy

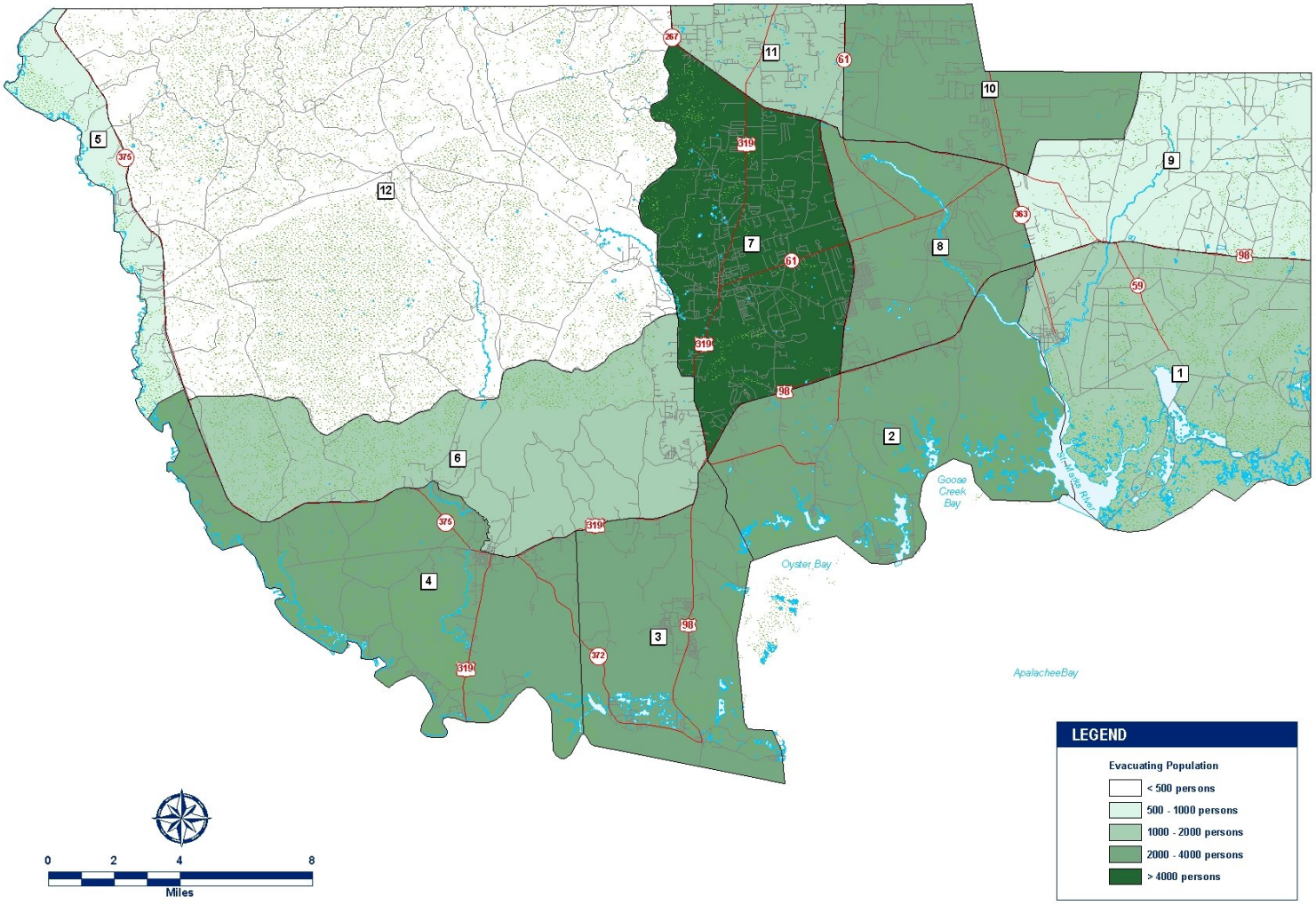


APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

WAKULLA COUNTY

Evacuating Population

Category 4-5
High Tourist
Occupancy

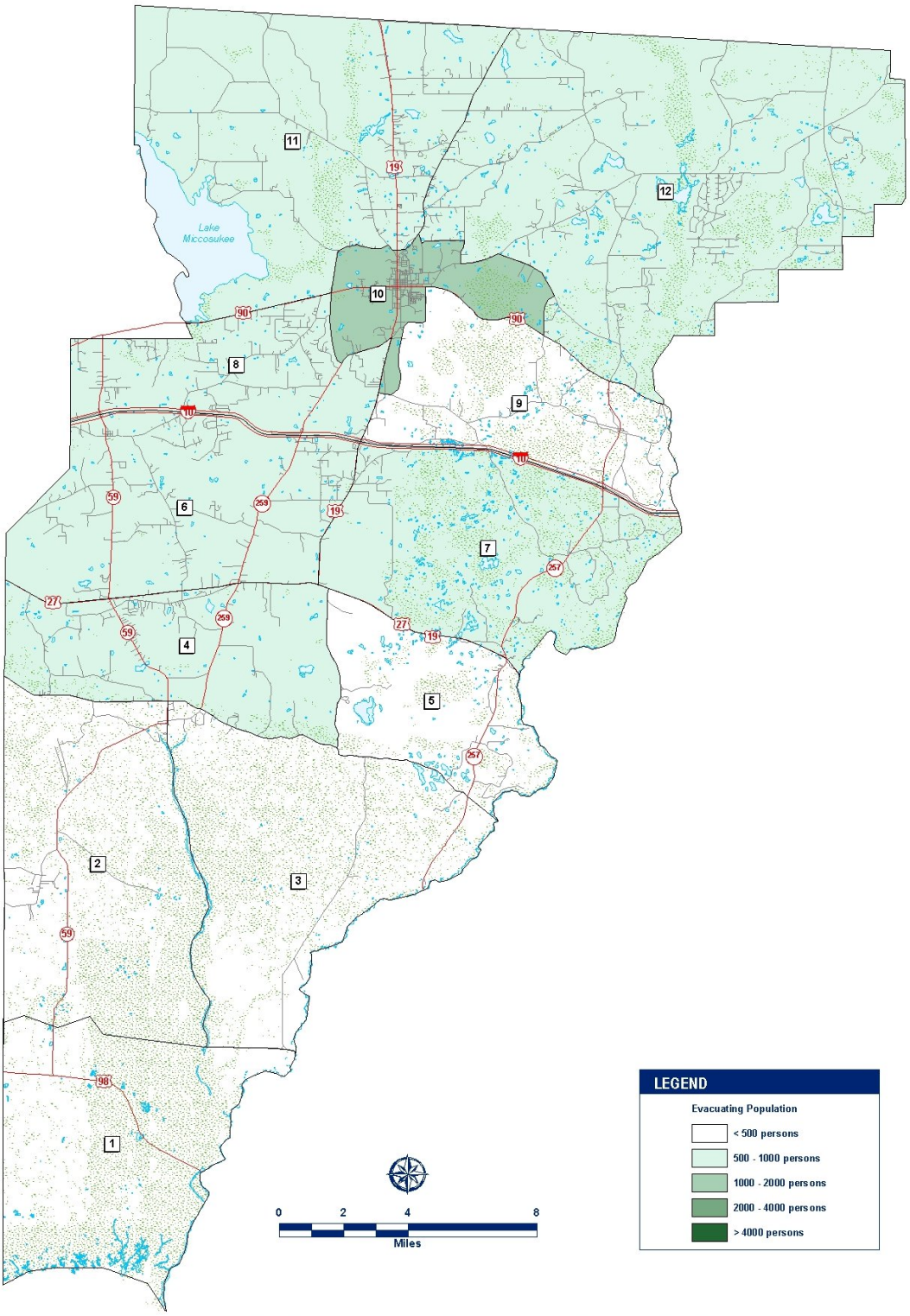


APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

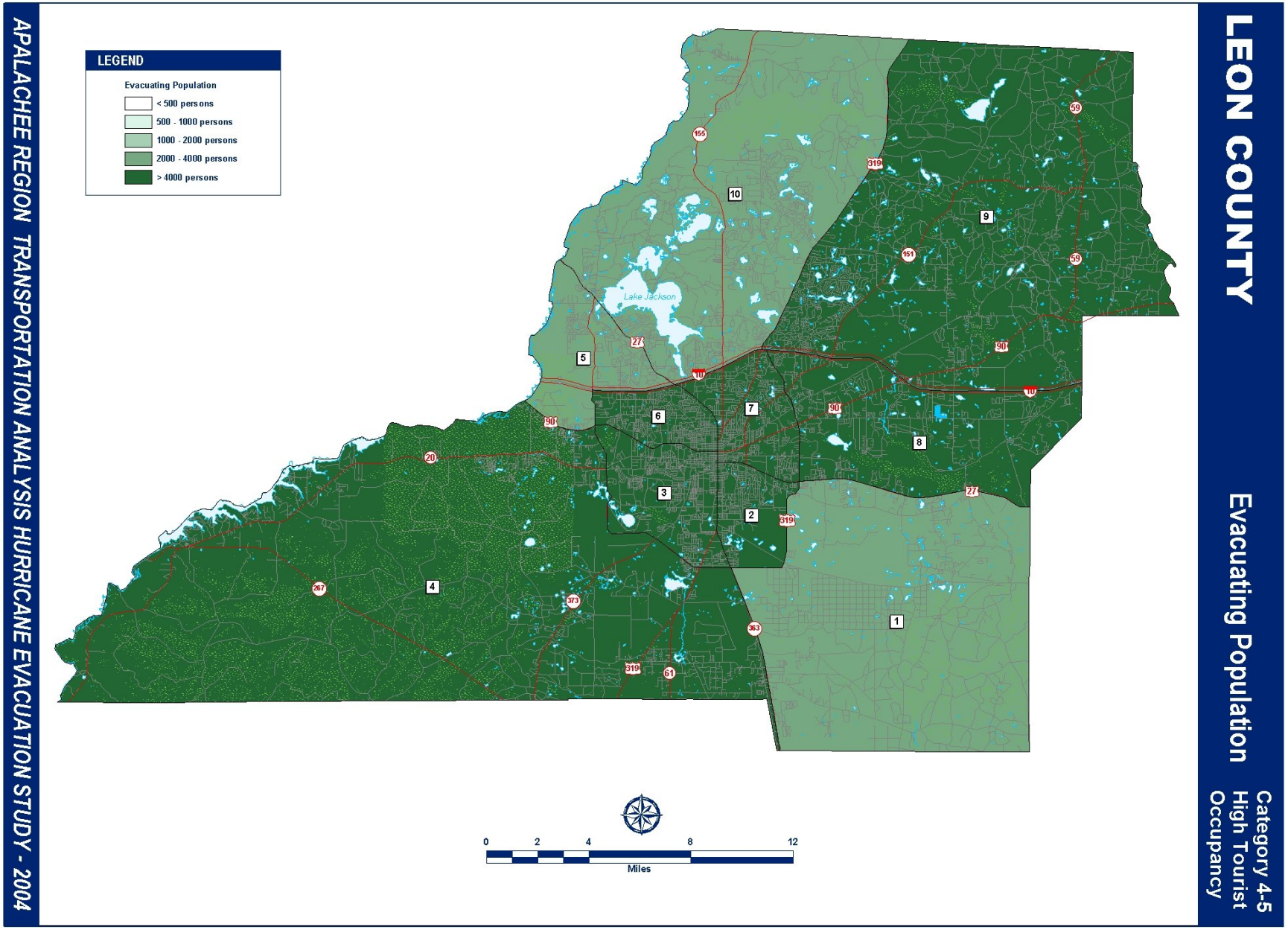
JEFFERSON COUNTY

Evacuating Population

Category 2-5
High Tourist
Occupancy



APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004


LEON COUNTY
Evacuating Population
Category 4-5
High Tourist
Occupancy
LEGEND
Evacuating Population
< 500 persons
500 - 1000 persons
1000 - 2000 persons
2000 - 4000 persons
> 4000 persons
Lake Jackson
1
2
3
4
5
6
7
8
9
10
0
2
4
8
12
Miles
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

3.3 PUBLIC SHELTER DEMAND/CAPACITY CONSIDERATIONS

One crucial aspect of hurricane evacuation planning involves the coordination of shelter locations and capacity to meet the shelter demand of evacuees in any given storm plan. Gulf and Franklin Counties do not have ARC 4496 compliant shelters within their jurisdictions and therefore do not intend to open any facilities for their residents. Where applicable, public shelter locations and capacities were provided to PBS&J by the county directly or obtained from the shelter listings tables in the 2004 Statewide Emergency Shelter Plan. Table 3-1 (shown previously) shows potential public shelter demands and reported capacities at each shelter.

One aspect of evacuations that PBS&J and HMG have observed nationally over the last five to ten years is the extremely low public shelter demand that communities are experiencing relative to expected demand from the study processes. In that regard, shelter demand numbers shown in Table 3-1 should be considered high estimates of people seeking shelters.

Normally, public shelter demand generally increases slightly from low to high tourist occupancy for lesser category storms. This demand between low and high tourist occupancy usually remains the same for more intense storms. In the Apalachee region however, tourist demand for public shelters in three of the four coastal counties is assumed to be zero since no shelter facilities are available in two of the coastal counties. Also tourist shelter demand is assumed to be low because a large number of hotel and motel rooms are available in Tallahassee, within a nearby inland county which is a likely destination for most evacuees from the Region anyway.

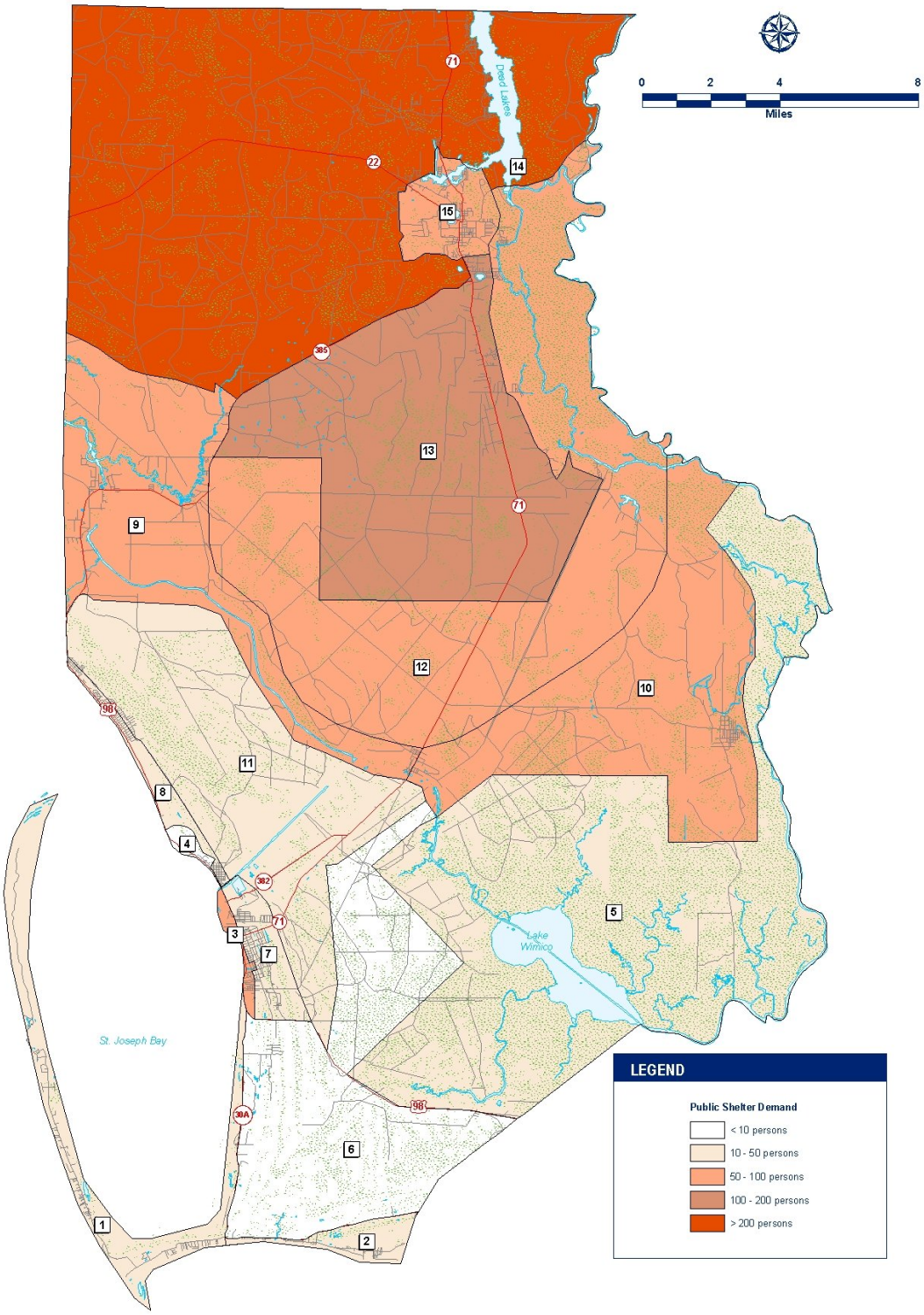
Figures 3-4 and 3-5 illustrate the range of current public shelter demand by evacuation zone for each storm category. Since mobile home residents typically have a higher propensity to use local public shelter space more than other residents, the high mobile home population may increase shelter demand. Growth in special needs and elderly populations could also add to the increased demand in this region.

It should be noted that not all shelters will be opened and available for use during all storms.

GULF COUNTY

Public Shelter Demand

Category 1
Low Tourist
Occupancy

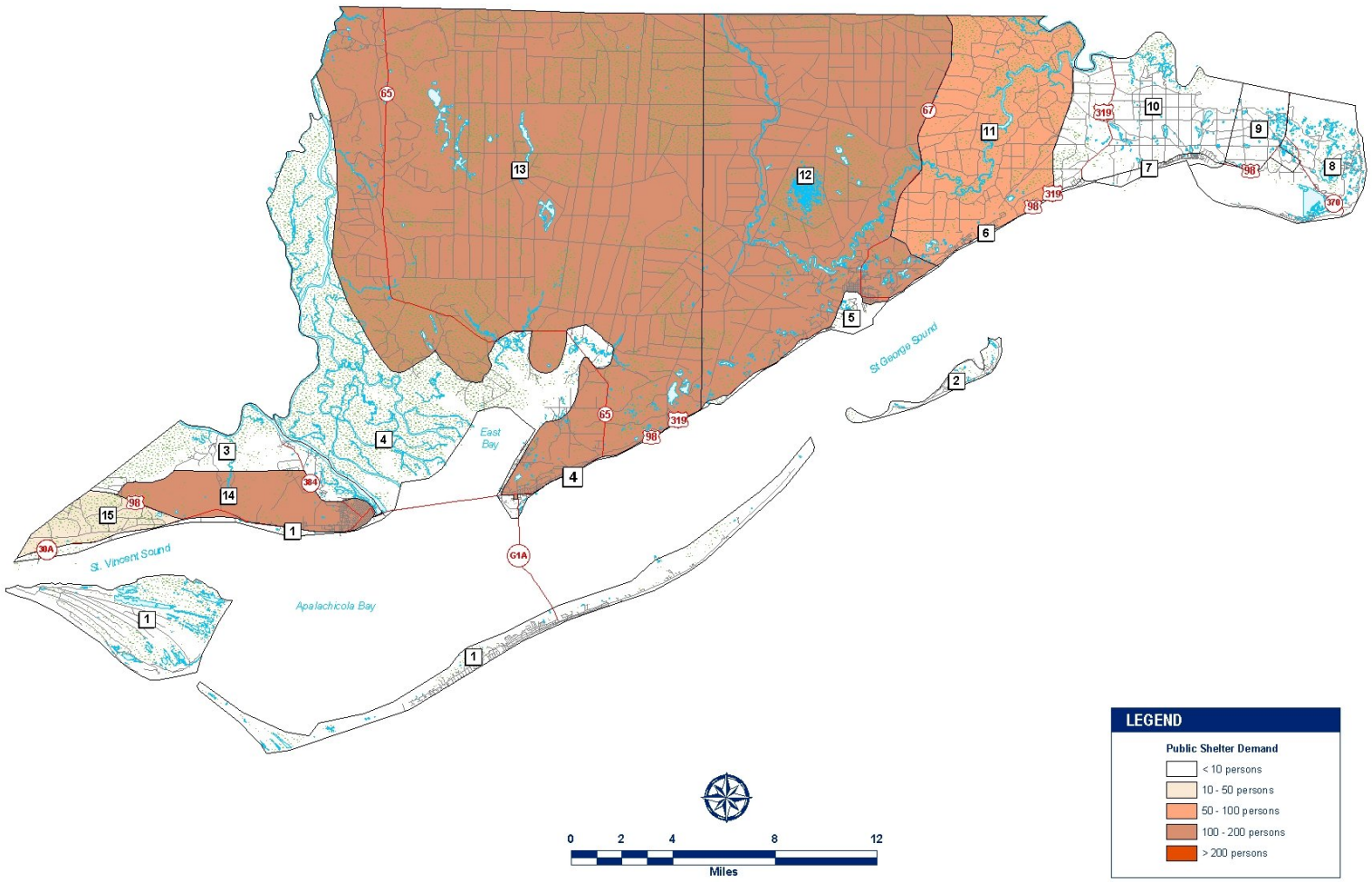


APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

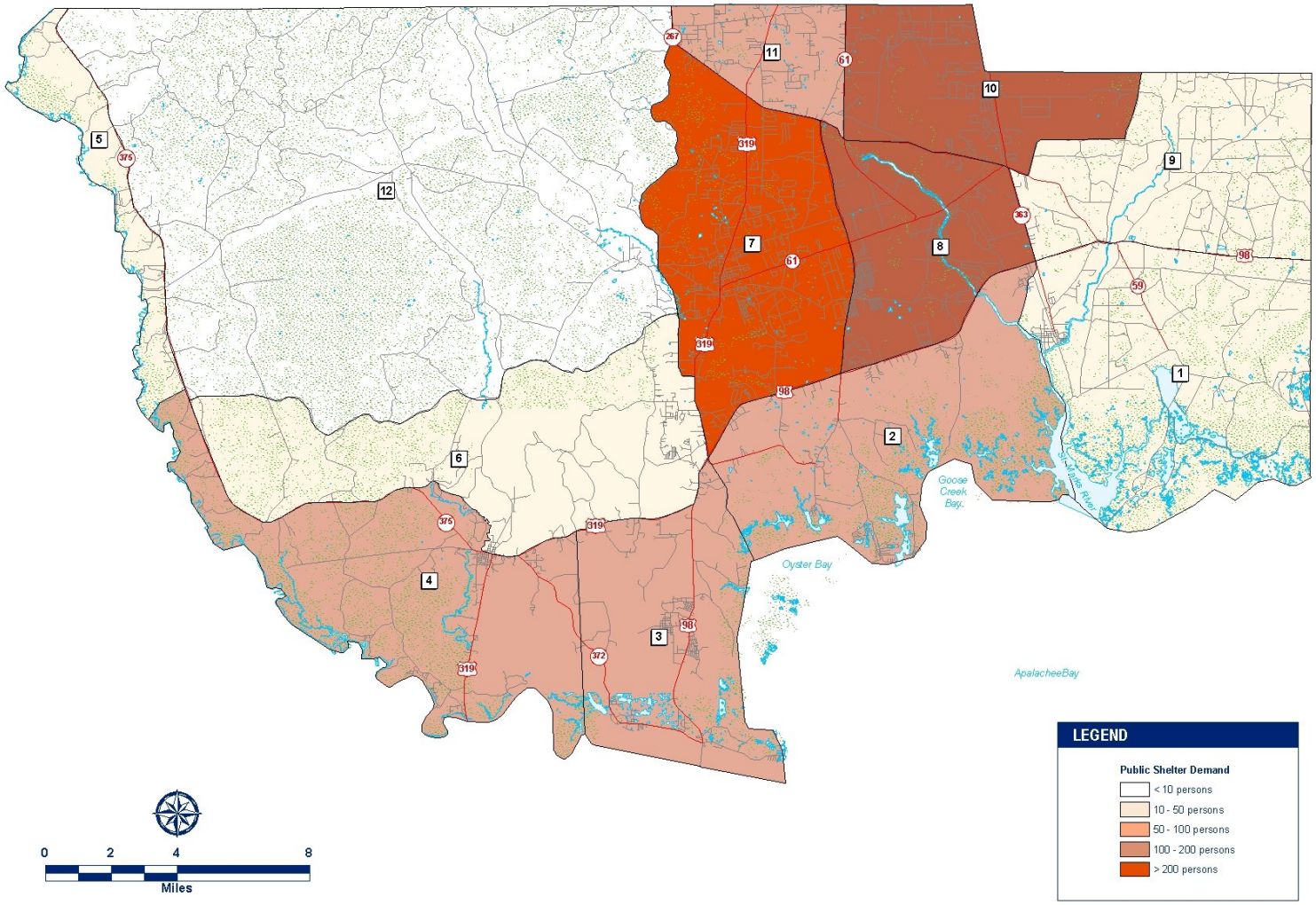
FRANKLIN COUNTY

Public Shelter Demand

Category 1
Low Tourist
Occupancy



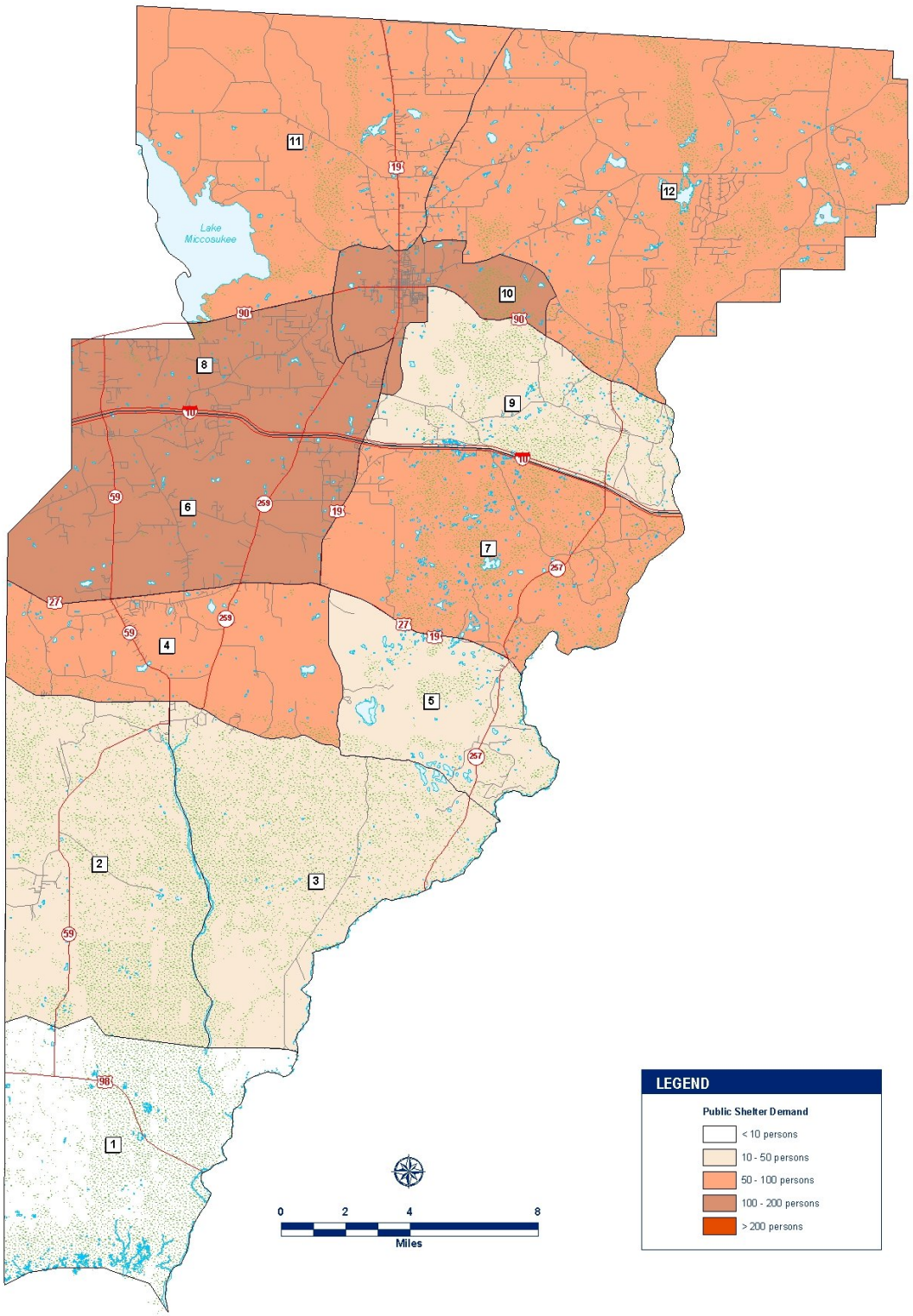
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004


WAKULLA COUNTY
Public Shelter Demand
Category 1
Low Tourist
Occupancy
LEGEND
Public Shelter Demand
< 10 persons
10 - 50 persons
50 - 100 persons
100 - 200 persons
> 200 persons
Goose Creek Bay
Oyster Bay
ApalacheeBay
0 2 4 8
Miles
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

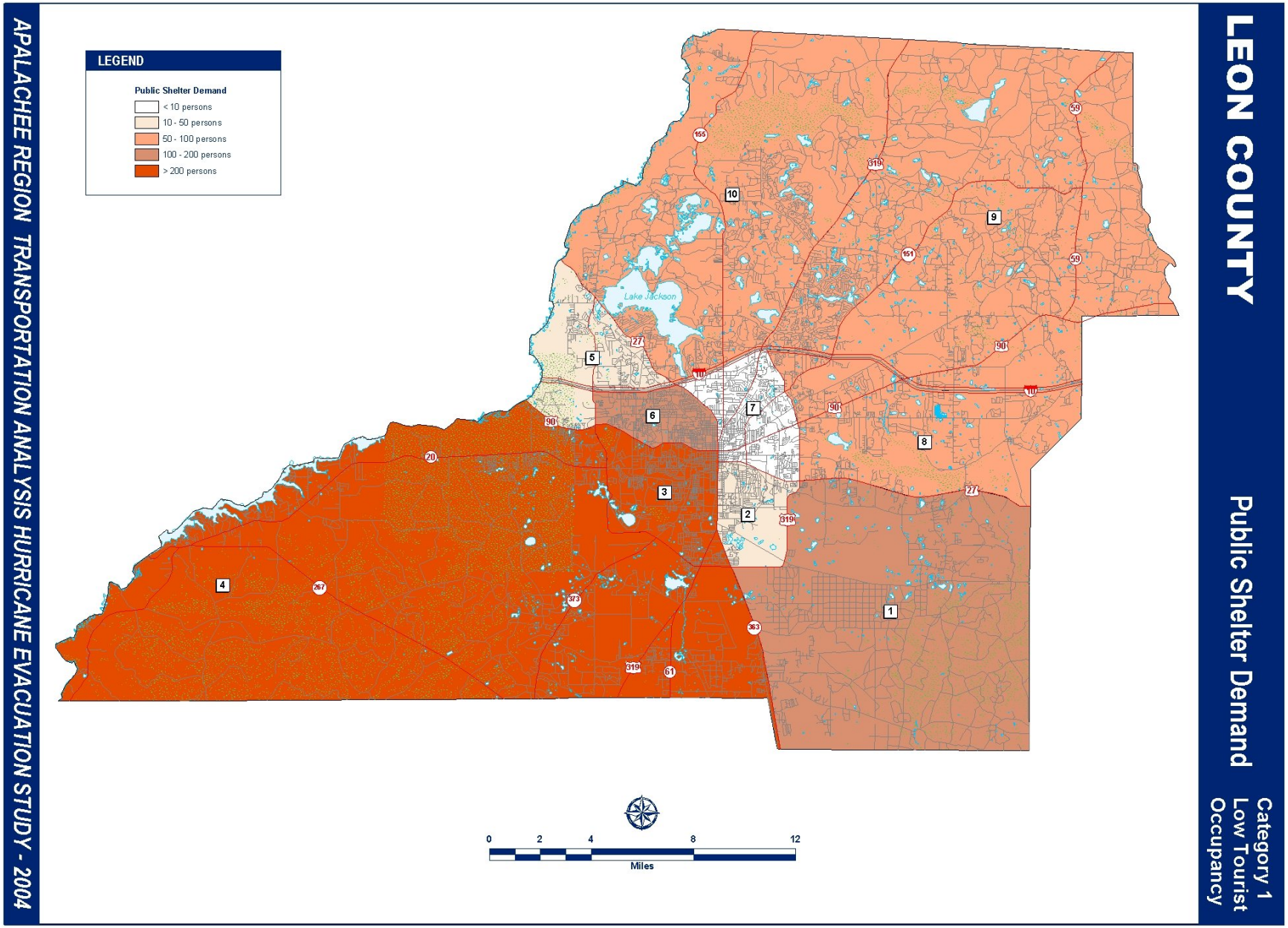
JEFFERSON COUNTY

Public Shelter Demand

Category 1
Low Tourist
Occupancy



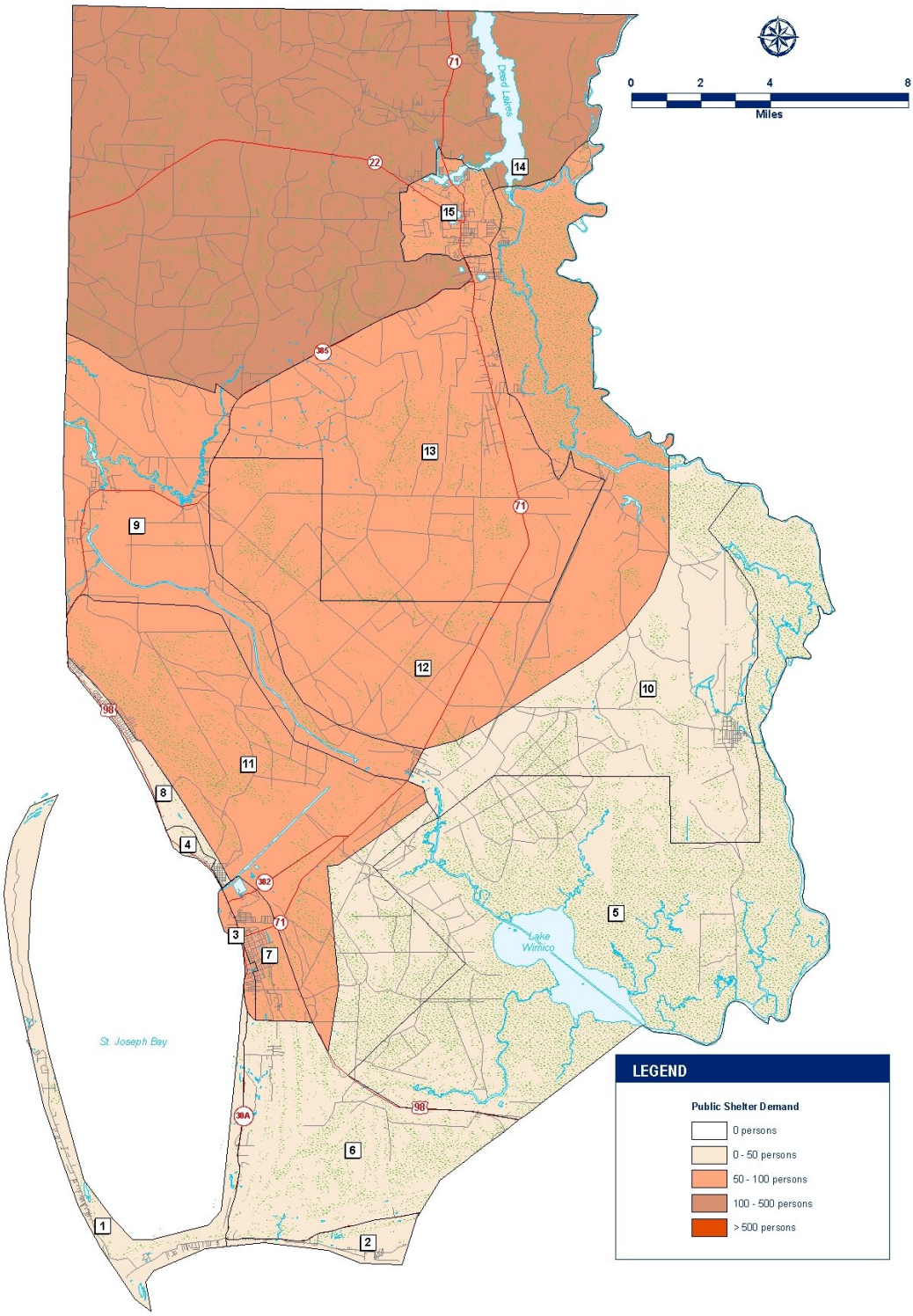
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004


LEON COUNTY
Public Shelter Demand
Category 1
Low Tourist
Occupancy
LEGEND
Public Shelter Demand
< 10 persons
10 - 50 persons
50 - 100 persons
100 - 200 persons
> 200 persons
Lake Jackson
1
2
3
4
5
6
7
8
9
10
0
2
4
8
12
Miles
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

GULF COUNTY

Public Shelter Demand

Category 4-5
High Tourist
Occupancy

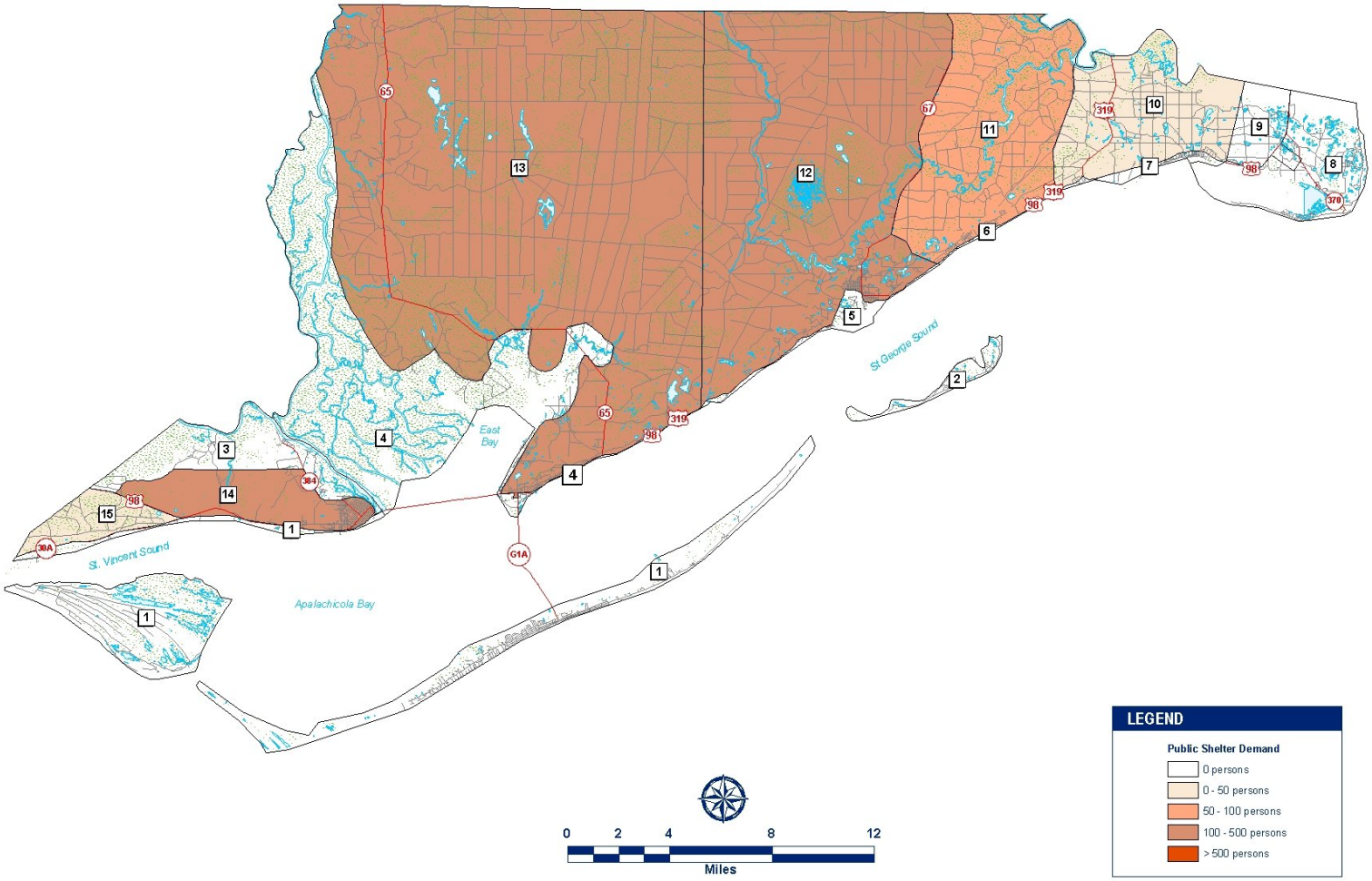


APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

FRANKLIN COUNTY

Public Shelter Demand

Category 2-5
High Tourist
Occupancy

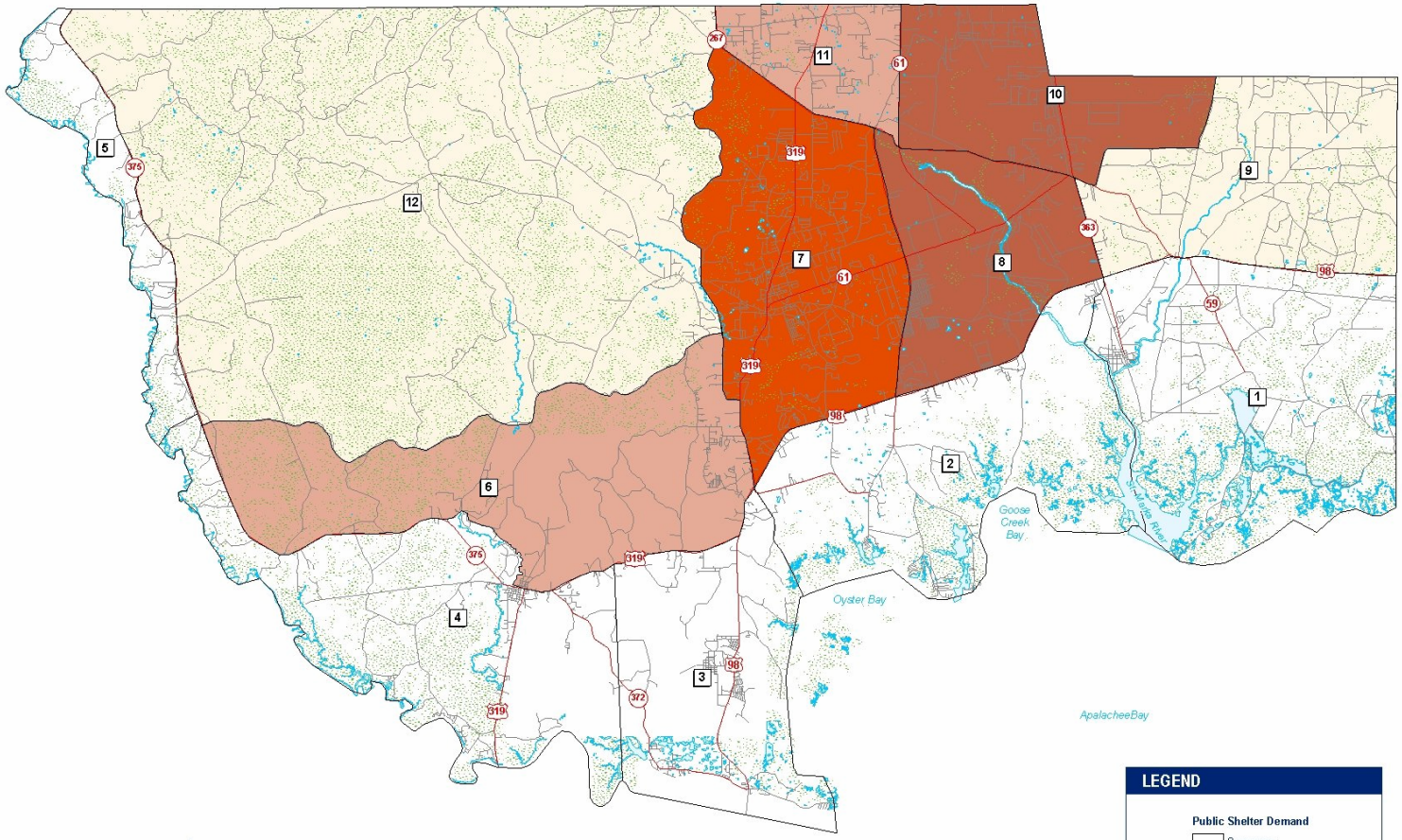


APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

WAKULLA COUNTY

Public Shelter Demand

Category 4-5
High Tourist
Occupancy



LEGEND

Public Shelter Demand

- 0 persons
- 0 - 50 persons
- 50 - 100 persons
- 100 - 500 persons
- > 500 persons

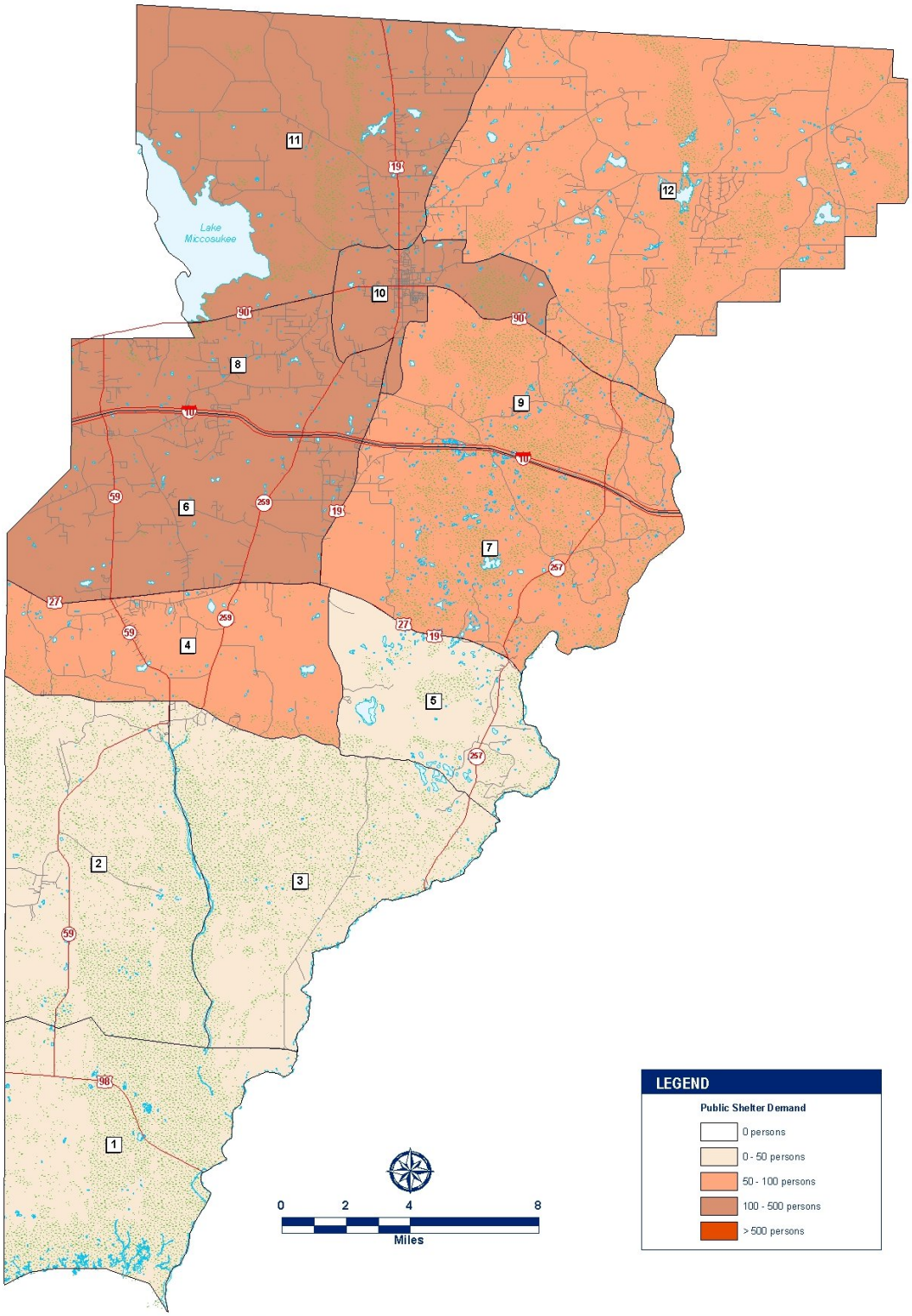
0 2 4 8
Miles

APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

JEFFERSON COUNTY

Public Shelter Demand

Category 2-5
High Tourist
Occupancy

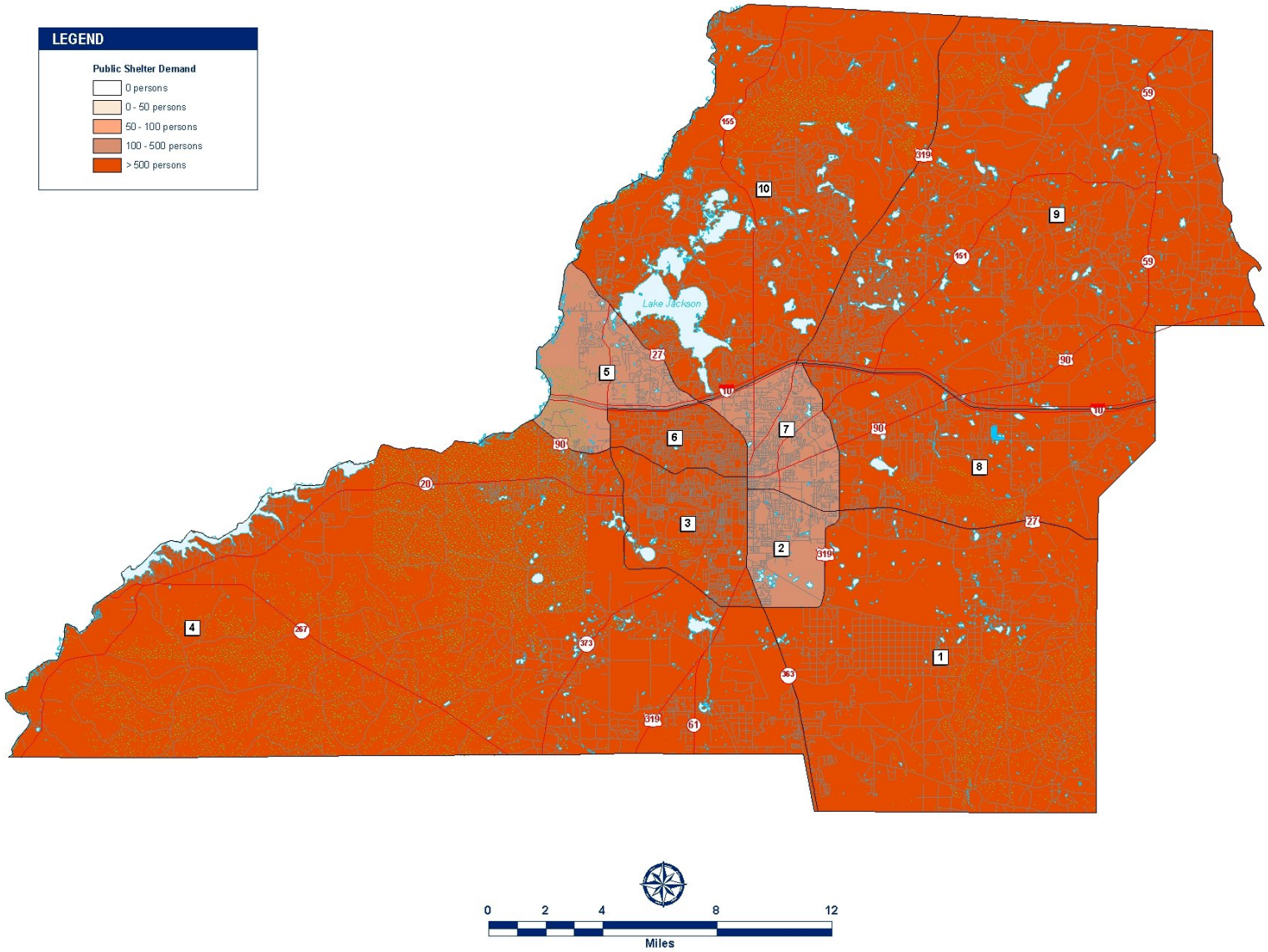


APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

LEON COUNTY

Public Shelter Demand

Category 4-5
High Tourist
Occupancy



APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

3.4 EVACUATION TRAFFIC VOLUMES AND CRITICAL ROADWAY SEGMENTS

The assigned evacuating vehicle figures by roadway segment for Year 2004 for each evacuation scenario can be found in the Transportation Model Support Document Annex F. In addition, the Annex contains the evacuating vehicles to service volume ratio (hereafter referred to as travel demand) calculated for each roadway segment by storm category. Segments with the highest travel demand are considered the "critical links" for a particular evacuation scenario. These congested roadway segments control the flow of evacuation traffic during a hurricane evacuation and are key areas for traffic control and monitoring. Many of these same roadways will be supporting not only the evacuating public, but also the non-evacuating public attempting to gather supplies and fuel for their homes and vehicles. In some cases, depending upon the time of the evacuation, residents may also have to travel from work to home before beginning their evacuation movement.

Table 3-2 lists the most critical roadway segments in the county that will control the flow of evacuation traffic. Figures 3-6 and 3-7 illustrate potential evacuation traffic congestion by roadway segment by storm category.

3.5 EXITING EVACUATION TRAFFIC BY ROUTE AND SCENARIO

Because the evacuation traffic from Gulf, Franklin and Wakulla Counties will contribute greatly to the travel demand and congestion on Leon County's roads during an evacuation, it is important to recognize the levels of potential evacuation traffic that each county is contributing. PBS&J prepared the following table that shows for each storm scenario the levels of traffic that each county will potentially place on specific exiting routes. This becomes particularly significant for roadways that will be relatively heavily impacted such as US 319, US 98, US 27, SR 71, and I-10. This information is presented in Table 3-3.

Table 3-2

CRITICAL ROADWAY LOCATIONS/SEGMENTS

Apalachee Region Transportation Analysis

(The most congested segment is listed first followed by the remaining critical links)

GULF COUNTY

- ► SR71 through Wewahitchka (intersection of SR 22 and SR 71) (Segment Q)
- ► CR 386 at SR 71 intersection south of Wewahitchka (Segment P)
- ► SR 71 from Wewahitchka to the Calhoun County line (Segment R)
- ► SR 71 / SR 20 intersection in Blountstown (in Calhoun County)
- ► SR 73 at US 231 intersection north of Cottondale (in Jackson County)

FRANKLIN COUNTY

- ► US 98 through Lanark Village to US 319 split (Segment L)
- ► US 98 from Carrabelle to Lanark Village (Segment K)
- ► US 319 and Capital Circle intersection south of Tallahassee (in Leon County)
- ► US 319 through Crawfordville (in Wakulla County)
- ► US 319 at US 98 intersection (in Wakulla County)
- ► US 319 and SR 61 intersection south of Tallahassee (in Leon County)

WAKULLA COUNTY

- ► US 319 from Crawfordville to the Leon County Line (Segment G)
- ► US 319 through Crawfordville (Segment E)
- ► US 319 from Crawfordville to SR 267 (Segment F)
- ► US 319 and US 98 intersection in Medart (Segment D)
- ► US 319 and Capital Circle intersection south of Tallahassee (in Leon County)
- ► US 319 and SR 61 intersection south of Tallahassee (in Leon County)
- ► Woodville Highway and Capital Circle intersection south of Tallahassee (in Leon County)

Table 3-2 (Continued)

CRITICAL ROADWAY LOCATIONS/SEGMENTS

Apalachee Region Transportation Analysis

(The most congested segment is listed first followed by the remaining critical links)

JEFFERSON COUNTY

- ► US 19 from CR 259 to US 90 intersection in Monticello (Segment L)
- ► US 27 and US 19 intersection

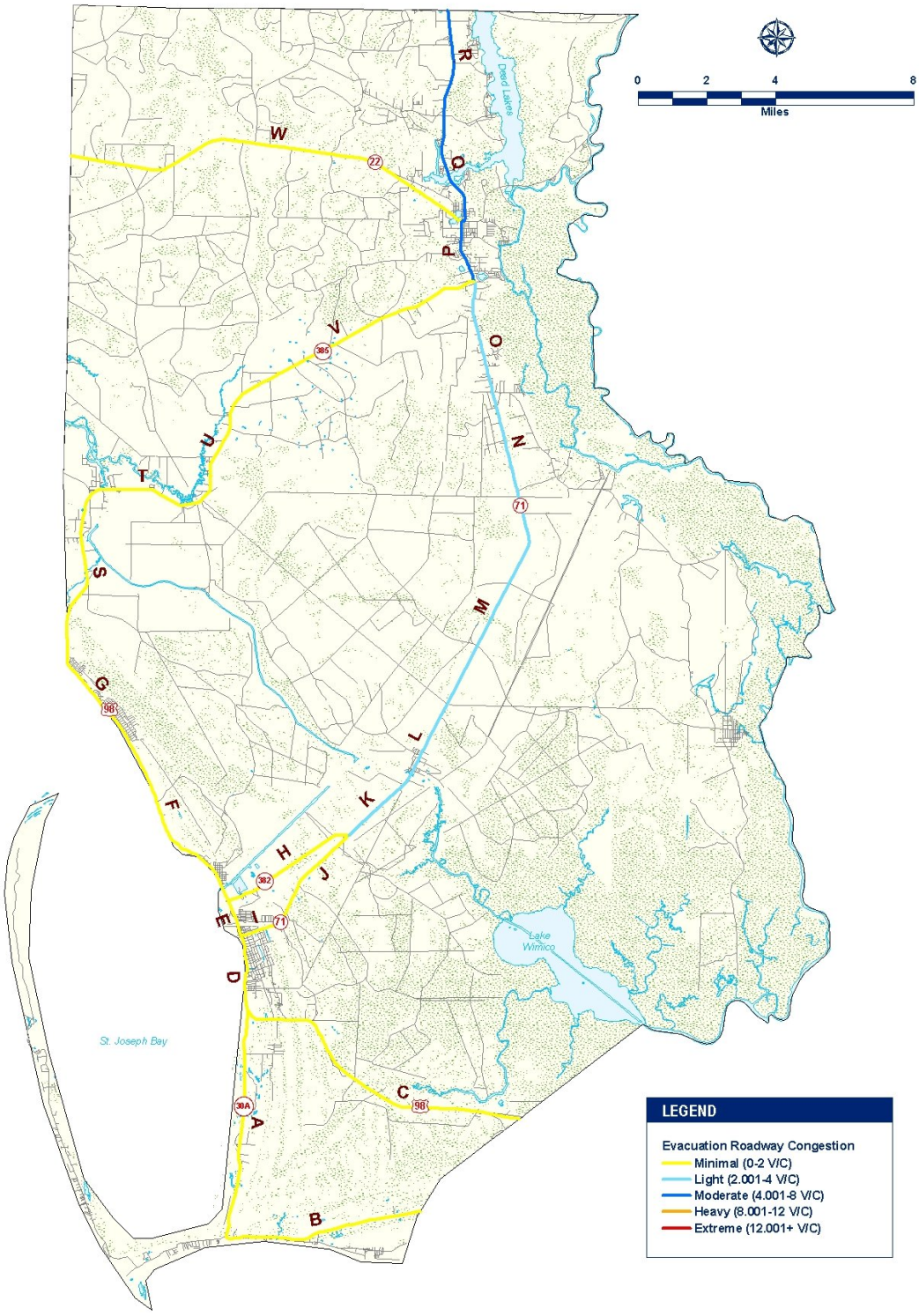
LEON COUNTY

- ► Capital Circle from Crawfordville Highway to Mahan Drive / US 90 (Segments C, D & E)
- ► Crawfordville Highway / US 319 and Capital Circle intersection south of Tallahassee (Segment B)
- ► Crawfordville Highway / US 319 and SR 61 intersection south of Tallahassee (Segment A)
- ► North Monroe Street / US 27 and Thomasville Road intersection (Segment N)
- ► Monroe Street / US 27 and Tennessee Street / US 90 intersection (Segment M)
- ► US 27 / North Monroe Street from Thomasville Road to I-10 interchange (Segment Y)
- ► Capital Circle from Mahan Drive / US 90 to Thomasville Road and I-10 intersection (Segments F & G)
- ► Capital Circle Southwest from SR 20 to US 90 (Segment AP)
- ► Four Points intersection of South Adams Street and South Monroe Street
- ► South Adams Street between Paul Russell Road and FAMU
- ► Connector Streets (Gaile Avenue, Paul Russell Road, Orange Avenue, Magnolia Drive
- ► Intersection of Thomasville Road, US 319 and I-10
- ► US 319 / Thomasville Road from I-10 to the Georgia State line (Segment H & I)

GULF COUNTY

Evacuation Traffic Congestion

Category 1
Low Tourist
Occupancy



APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

FRANKLIN COUNTY

Evacuation Traffic Congestion

Category 1
Low Tourist
Occupancy

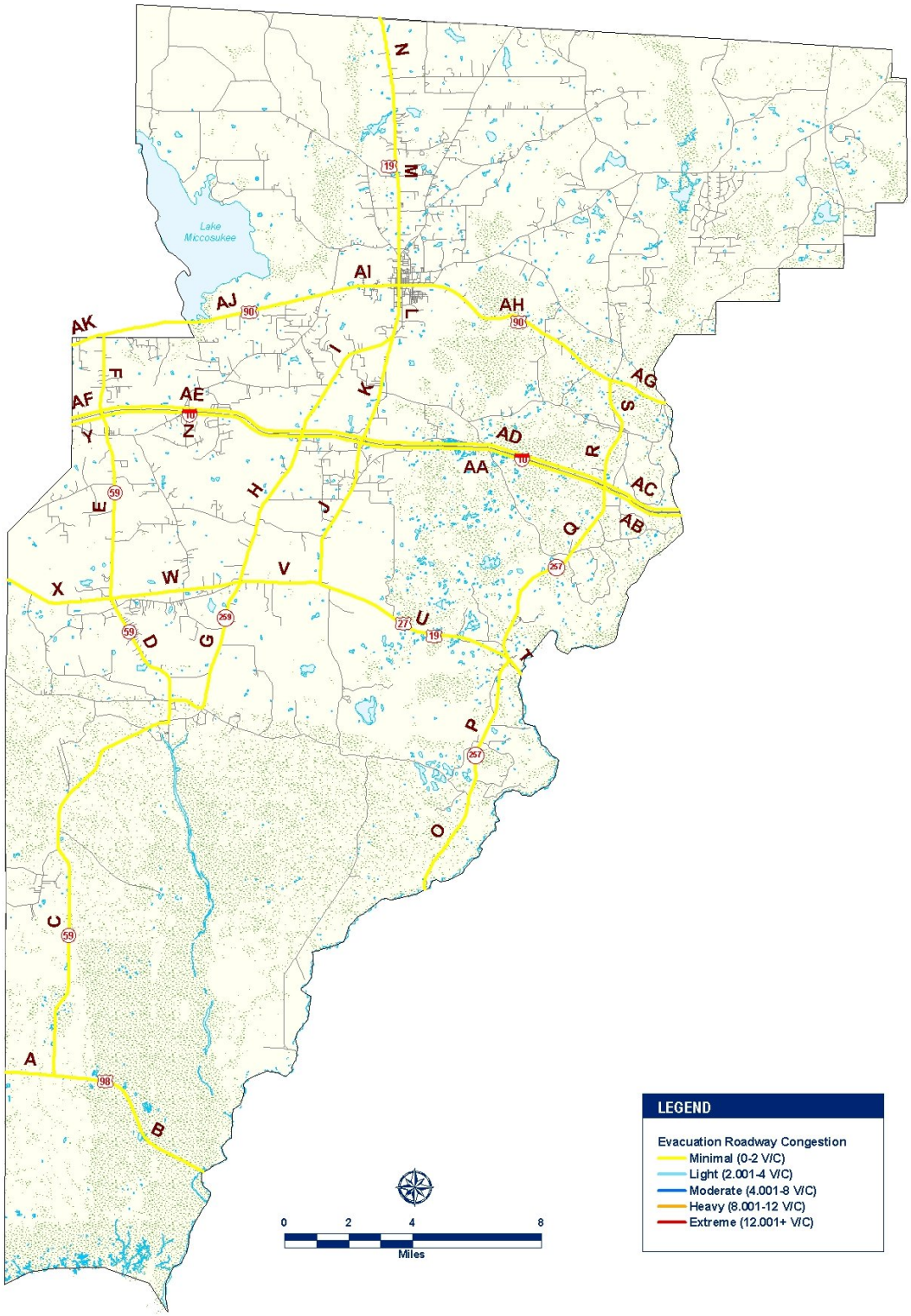
WAKULLA COUNTY Evacuation Traffic Congestion

Category 1
Low Touist
Occupancy

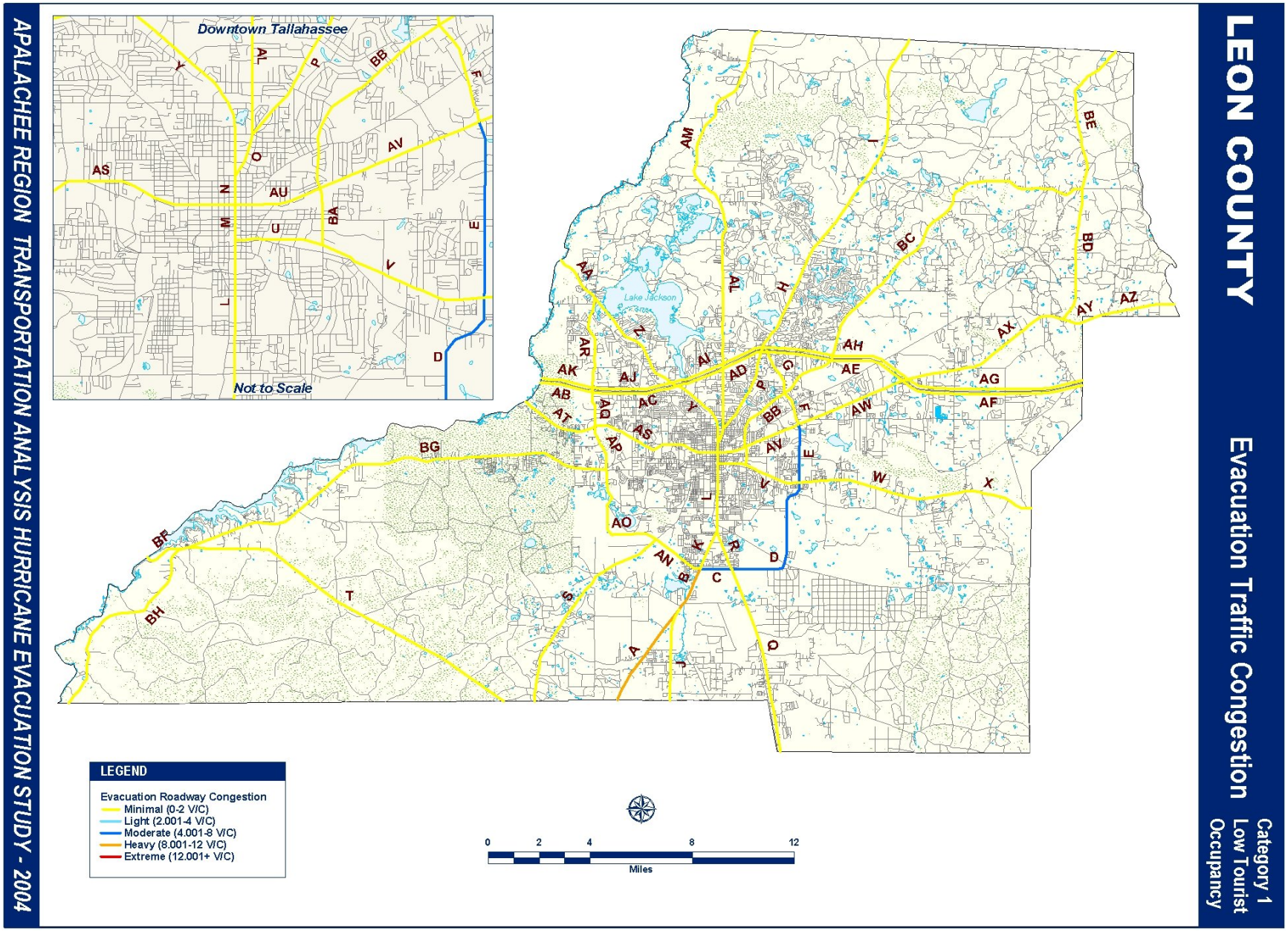
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

JEFFERSON COUNTY Evacuation Traffic Congestion

Category 1
Low Tourist
Occupancy



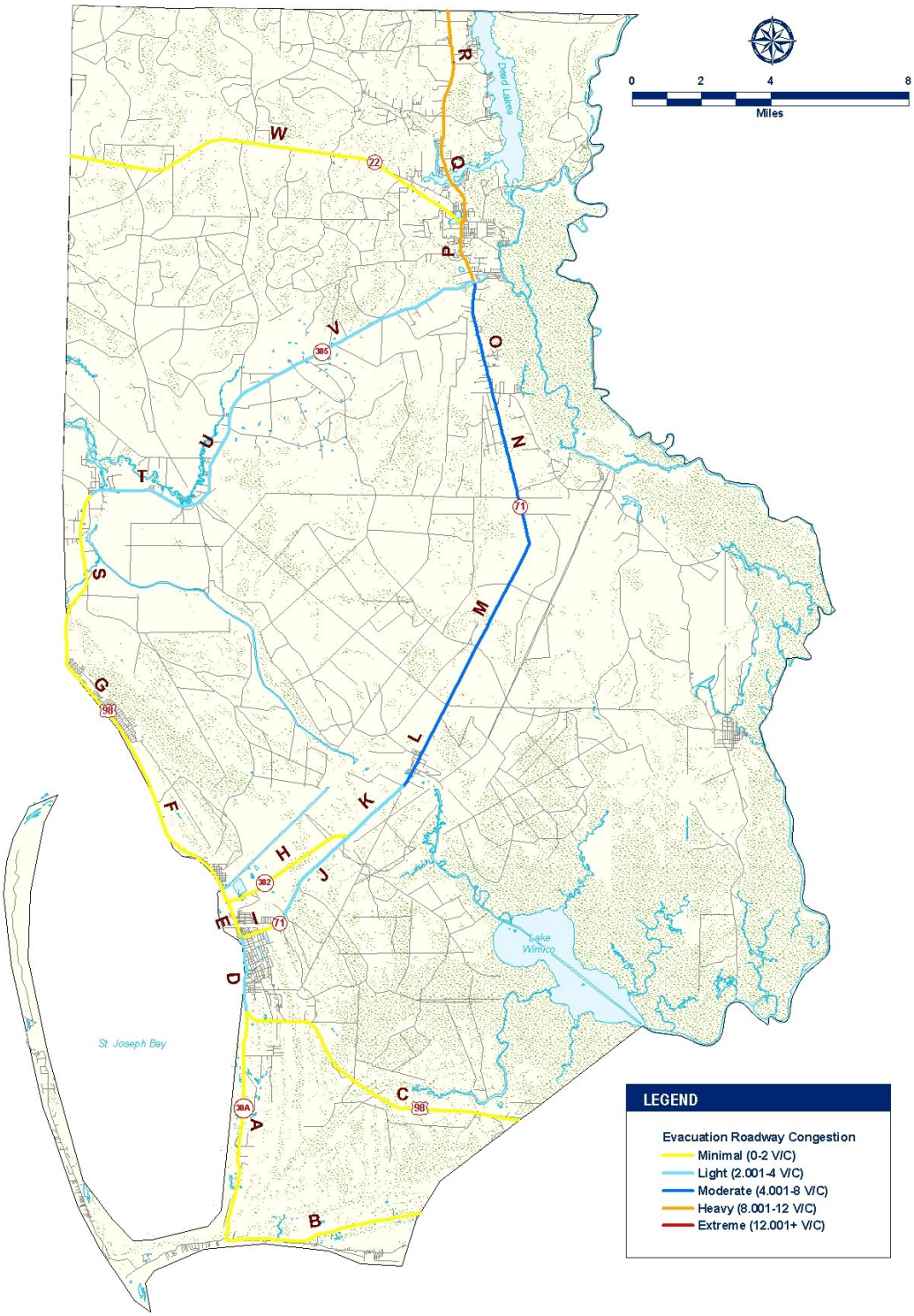
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004


LEON COUNTY
Evacuation Traffic Congestion
Category 1
Low Tourist
Occupancy
Downtown Tallahassee
Not to Scale
Lake Jackson
LEGEND
Evacuation Roadway Congestion
Minimal (0-2 V/C)
Light (2.001-4 V/C)
Moderate (4.001-8 V/C)
Heavy (8.001-12 V/C)
Extreme (12.001+ V/C)
0
2
4
8
12
Miles
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

GULF COUNTY

Evacuation Traffic Congestion

Category 2-5
High Tourist
Occupancy



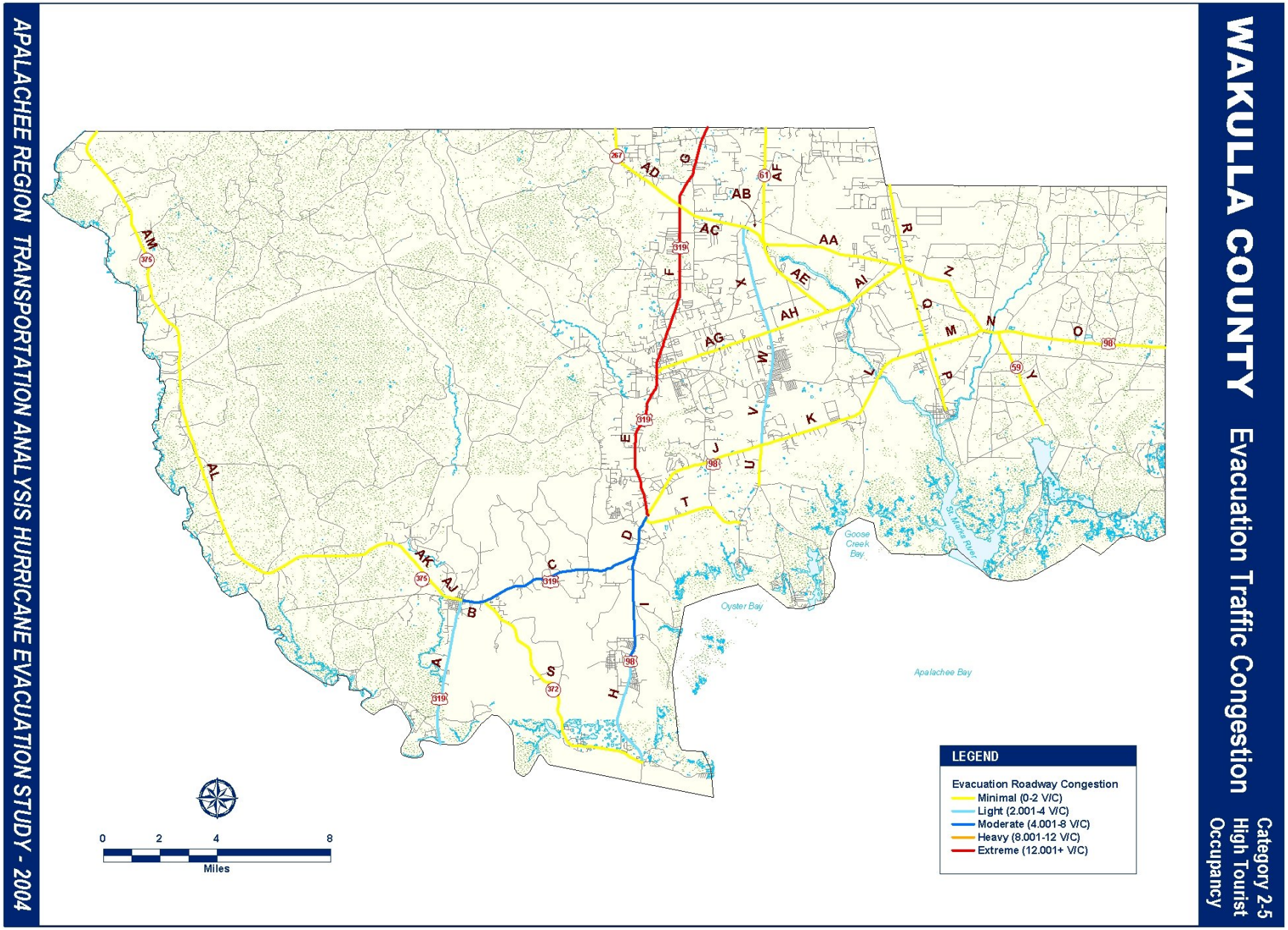
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

FRANKLIN COUNTY Evacuation Traffic Congestion

Category 2-5
High Tourist
Occupancy

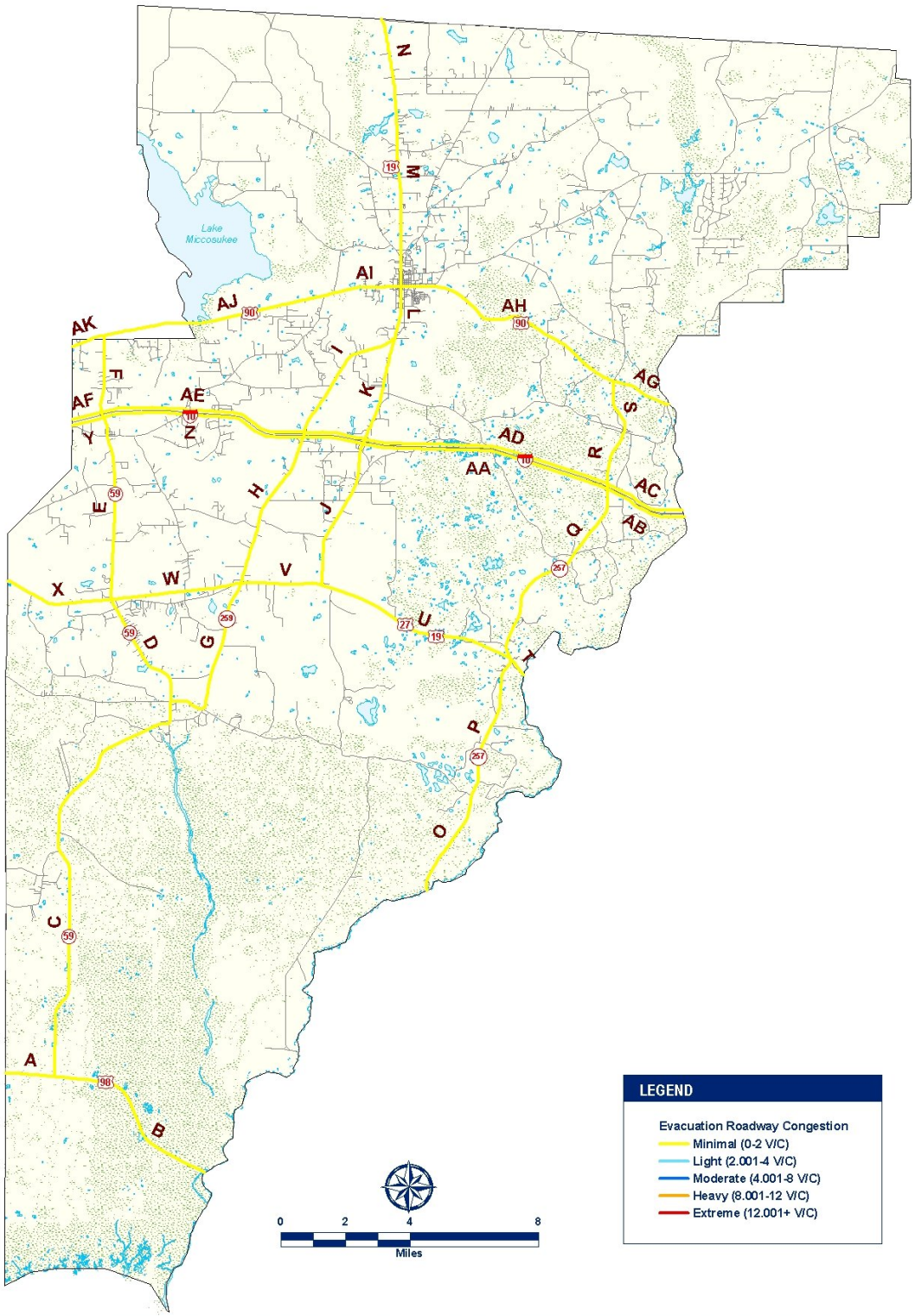
LEGEND

Evacuation Roadway Congestion
- Minimal (0-2 V/C)
- Light (2.001-4 V/C)
- Moderate (4.001-8 V/C)
- Heavy (8.001-12 V/C)
- Extreme (12.001+ V/C)


WAKULLA COUNTY
Evacuation Traffic Congestion
Category 2-5
High Tourist
Occupancy
LEGEND
Evacuation Roadway Congestion
Minimal (0-2 V/C)
Light (2.001-4 V/C)
Moderate (4.001-8 V/C)
Heavy (8.001-12 V/C)
Extreme (12.001+ V/C)
0 2 4 8
Miles
Apalachee Bay
Oyster Bay
Goose Creek Bay
St Marks River
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

JEFFERSON COUNTY Evacuation Traffic Congestion

Category 2-5
High Tourist
Occupancy



APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

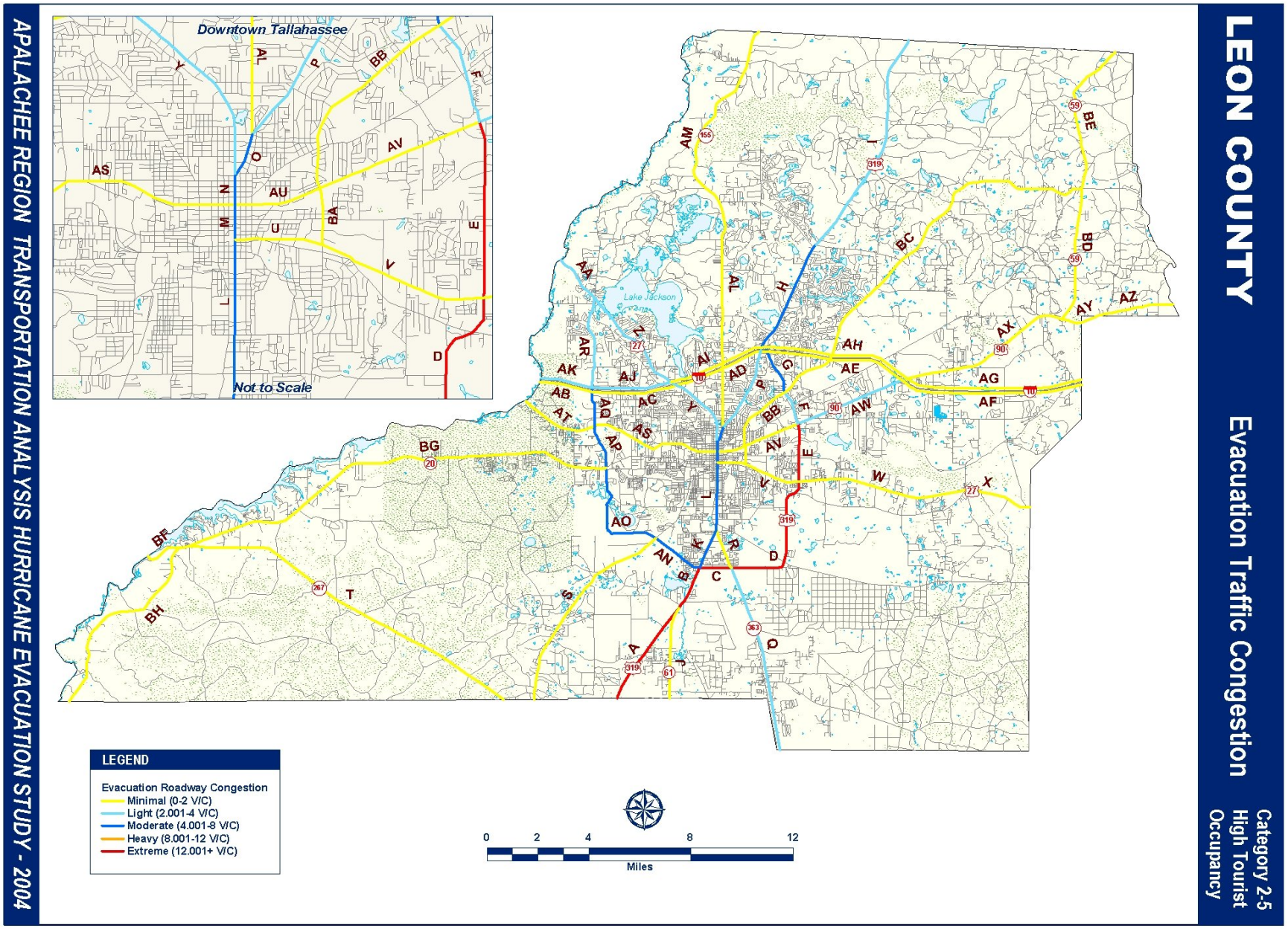

LEON COUNTY
Evacuation Traffic Congestion
Category 2-5
High Tourist
Occupancy
Downtown Tallahassee
Not to Scale
Lake Jackson
LEGEND
Evacuation Roadway Congestion
Minimal (0-2 V/C)
Light (2.001-4 V/C)
Moderate (4.001-8 V/C)
Heavy (8.001-12 V/C)
Extreme (12.001+ V/C)
0
2
4
8
12
Miles
APALACHEE REGION TRANSPORTATION ANALYSIS HURRICANE EVACUATION STUDY - 2004

Table 3-3
EXITING EVACUTION TRAFFIC BY ROUTE BY COUNTY AND BY STORM SCENARIO
Apalachee Region Transportation Analysis

Originating County	Evacuation Scenario	Exiting Vehicles by Evacuation Roadway and Next Receiving County or State									
		SR 73	US 98 EB	US 98 WB	US 319	SR 65	CR 67	SR 363	SR 61	SR 373	SR 375
Gulf County		To Calhoun	To Franklin	To Bay							
	CAT 1, low occ	2,877	127	443							
	CAT 1, high occ	3,644	149	543							
	CAT 2-3, low occ	4,094	197	634							
	CAT 2-3, high occ	4,863	219	735							
	CAT 4-5, low occ	4,600	182	605							
	CAT 4-5, high occ	5,368	204	705							
Franklin County			To Wakulla		To Wakulla	To Liberty	To Liberty				
	CAT 1, low occ		1,630		1,313	246	30				
	CAT 1, high occ		2,133		1,531	256	33				
	CAT 2-5, low occ		2,472		2,189	444	51				
	CAT 2-5, high occ		3,059		2,501	476	58				

Table 3-3
EXITING EVACUTION TRAFFIC BY ROUTE BY COUNTY AND BY STORM SCENARIO
Apalachee Region Transportation Analysis

Originating County	Evacuation Scenario	Exiting Vehicles by Evacuation Roadway and Next Receiving County or State									
		SR 73	US 98 EB	US 98 WB	US 319	SR 65	CR 67	SR 363	SR 61	SR 373	SR 375
Wakulla County			To Jefferson		To Leon *			To Leon	To Leon	To Leon	To Leon
	CAT 1, low occ		16		7,530			668	377	148	160
	CAT 1, high occ		18		8,656			711	397	159	185
	CAT 2-3, low occ		31		13,670			1,286	763	383	250
	CAT 2-3, high occ		32		14,971			1,379	783	394	275
	CAT 4-5, low occ		31		14,170			1,431	905	407	269
	CAT 4-5, high occ		32		15,471			1,474	925	417	294
* Values include vehicles evacuating through Wakulla County from Franklin and Gulf Counties											
		I-10 WB	I-10 EB *	US 27 WB	US 90 WB	US 19 *	US 98 *				
Jefferson County		To Leon	To Madison	To Leon	To Leon	To Georgia	To Taylor				
	CAT 1-2, low occ	137	1,739	20	31	118	5				
	CAT 1-2, high occ	160	2,195	23	37	138	5				
	CAT 3-5, low occ	838	5,265	64	82	330	9				
	CAT 3-5, high occ	405	6,520	67	88	349	10				
* Figures include pass through vehicles from Leon County et. al.											

Table 3-3 (Continued)
EXITING EVACUTION TRAFFIC BY ROUTE BY COUNTY AND BY STORM SCENARIO
Apalachee Region Transportation Analysis

Originating County	Evacuation Scenario	Exiting Vehicles by Evacuation Roadway and Next Receiving County or State									
		I-10 WB *	I-10 EB *	US 319 *	US 27 NB *	US 27 SB *	US 90 WB*	*US 90 EB*	SR 20*	SR 155*	CR 59*
Leon County		To Gadsden	To Jefferson	To Georgia	To Gadsden	To Jefferson	To Gadsden	To Jefferson	To Liberty	To Georgia	To Georgia
	CAT 1, low occ	3,281	1,817	3,553	1,252	111	124	576	71	29	21
	CAT 1, high occ	3,846	2,293	4,321	1,559	150	144	658	75	47	21
	CAT 2-3, low occ	6,495	3,911	4,769	2,820	367	438	1,096	231	97	65
	CAT 2-3, high occ	7,355	4,894	5,225	3,457	476	494	1,196	241	149	66
	CAT 4-5, low occ	7,525	5,294	9,532	3,955	734	809	1,219	400	209	111
	CAT 4-5, high occ	8,552	6,594	11,335	4,799	889	888	1,324	415	283	112

*** Figures include pass through vehicles from all evacuating counties in region**.

3.6 ESTIMATED EVACUATION CLEARANCE TIMES

An important product of the transportation analysis is the clearance times based on storm category, or scenario and behavioral characteristics. Clearance time is one of two major considerations involved in issuing an evacuation order or advisory. The other time aspect, which must be weighed, is the arrival of sustained tropical storm winds. Figure 3-8 illustrates the two timing components of evacuation time and their relationship to one another. Another very important factor in evacuation decision making is the time of day that the order is issued. The time of day will determine the response curve that should be used when selecting the most appropriate clearance time to use in decision making.

Clearance time is the time required to clear the roadway of all vehicles evacuating in response to a hurricane situation. Clearance time begins when the first evacuating vehicle enters the road network (as defined by a hurricane evacuation behavioral response curve) and ends when the last evacuating vehicle reaches an assumed point of safety. Clearance time includes:

- Mobilization Time - the time required by evacuees to prepare for evacuation and enter the road network;
- Travel Time - the time needed to travel along the road network; and
- Queuing Delay Time – the cumulative times for all stops caused by traffic congestion.

Clearance time does not relate to the time any one vehicle spends traveling on the road network and does not include time needed for local officials to assemble and make a decision to evacuate.

Establishing the arrival time of tropical storm force winds within a community determines when an evacuation must be completed. The clearance time added to the tropical storm force arrival time establishes the latest time that local officials must issue an order initiating an evacuation. The general time of day in which the evacuation order must be issued will determine the response curve to be used in choosing a clearance time and whether extra time will be needed in order to complete an evacuation. For instance if the decision time for issuing an evacuation order generally coincides with the middle of the night or the middle of a working day, a clearance time with a slow response curve may be used in order to allow extra mobilization time (to allow people to wake up, or return from work and school), or travel time (to account for the effects of darkness on driving). Conversely, a clearance time with a fast response may be considered if an evacuation

order will occur during a weekend day or before residents have left their households for normal workday activities.

Tables 3-4 and 3-7 present the hurricane evacuation clearance times developed for the Apalachee Region for the years 2004 and the five year projected figures for 2009. These times reflect local in-county movement. Clearance time runs were generated based on differing intensity strengths of hurricanes, levels of background traffic, the rapidity of response by evacuees, and different tourist occupancy levels.

Since Leon County is the most likely destination for a majority of all evacuees from the entire region, that County's times also determine the regional clearance time (Table 3-5). These county/regional clearance times reflect that Leon County in a coordinated effort will almost always evacuate simultaneously with the other coastal counties in the region. In developing these times, it was assumed that consistent evacuation decisions would be made and coordinated between adjacent jurisdictions and the State of Florida Emergency Operations Center.

For the near term, it may be most appropriate for the coastal counties, especially Franklin and Wakulla, to use the clearance times for Leon County rather than using their own specific figures. Virtually all of US 319 south and east of Tallahassee will become extremely congested in a major hurricane event which will cause the traffic queues in Leon County to propagate southward toward the coast. Every modeled road segment on US 319 from the Tully community to US 90 east of Tallahassee can be considered critical in an evacuation. Therefore, even though improvements to segments of US 319 from the Leon County line to Capital Circle (Segment B), as well as Capital Circle from Park Avenue to Connie Drive (portions of Segment D and E) are expected to be completed by the end of 2005, the roadway sections in between those projects (Segment C and most of Segment D) will continue to create severe congestion during evacuations. The clearance time situation in Leon County, and consequently in Wakulla and Franklin Counties, will not improve appreciably until all of the construction projects on Capital Circle southeast and southwest (SR 20 to Connie Drive) are completed around 2011.

Figure 3-8 Components of Evacuation Time versus Clearance Time

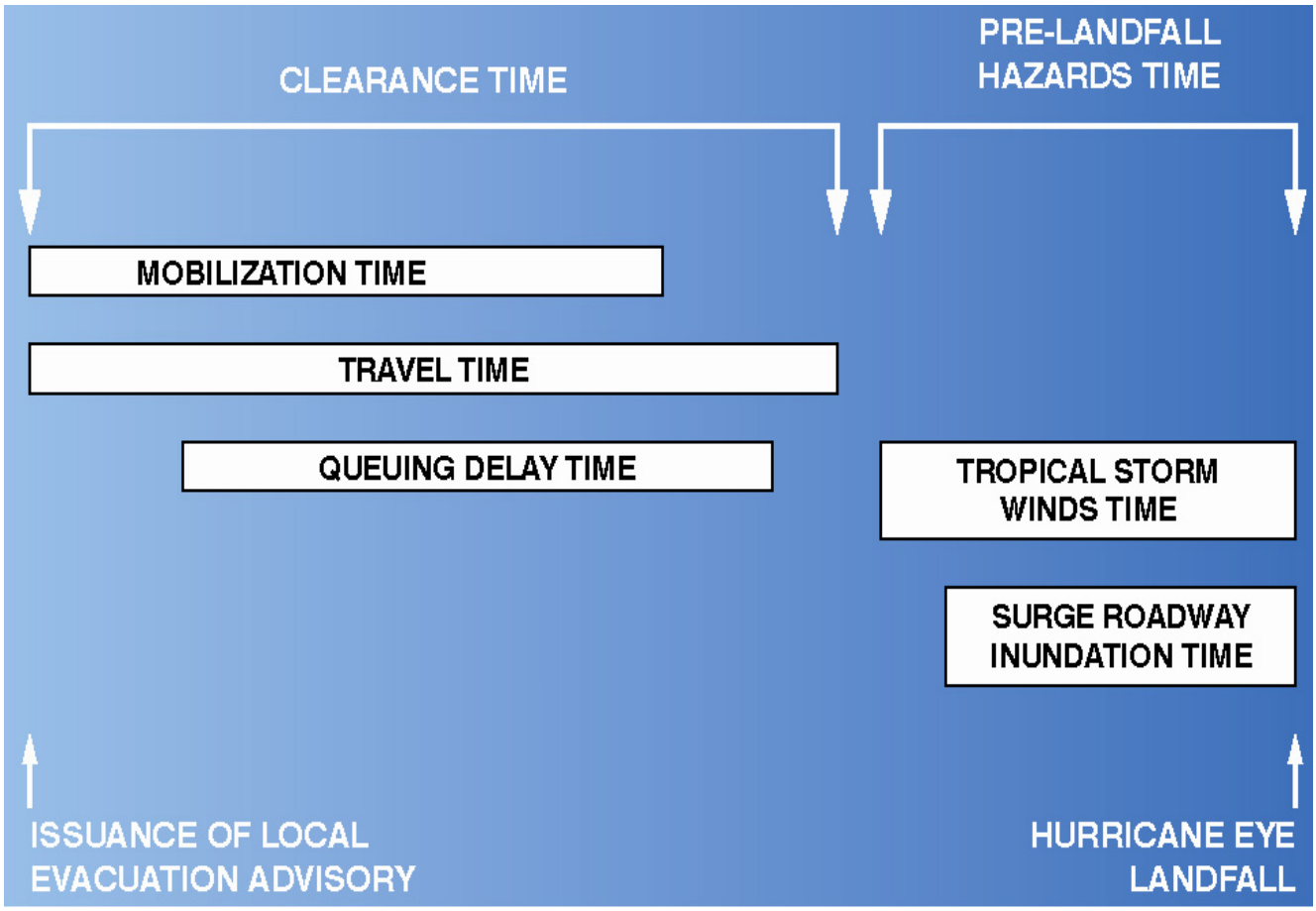


Table 3-4

CURRENT CLEARANCE TIMES (in hours)

Apalachee Region Transportation Analysis

Local In-County Movement

GULF COUNTY (2004)

Category 1 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	5 ½	7
Medium Response	5 ¾	7
Long Response	6	7 ½

Worst individual household commute time – 2 ¼ hours

Category 2-3 Hurricane	Low Seasonal Occupancy	High Seasonal Occupancy
Rapid Response	8	9 ½
Medium Response	8 ¼	9 ¾
Long Response	8 ½	10

Worst individual household commute time – 2 ¾ hours

Category 4-5 Hurricane	Low Seasonal Occupancy	High Seasonal Occupancy
Rapid Response	9	10 ¾
Medium Response	9 ¼	10 ¾
Long Response	9 ½	11 ¼

Worst individual household commute time – 6 ½ hours

Note: Commute time refers to how long one vehicle may be caught in traffic making their evacuation movement

Table 3-4

CURRENT CLEARANCE TIMES (in hours)

Apalachee Region Transportation Analysis

Local In-County Movement

FRANKLIN COUNTY (2004)

Category 1 Hurricane	Low Seasonal Occupancy	High Seasonal Occupancy
Rapid Response	4 ½	5 ½
Medium Response	4 ½	5 ½
Long Response	4 ¾	5 ¾

Worst individual household commute time – 1 hour

Category 2-5 Hurricane	Low Seasonal Occupancy	High Seasonal Occupancy
Rapid Response	7	8
Medium Response	7	8
Long Response	7 ¼	8 ¼

Worst individual household commute time – 3 ½ hours

Note: Commute time refers to how long one vehicle may be caught in traffic making their evacuation movement

Table 3-4

CURRENT CLEARANCE TIMES (in hours)

Apalachee Region Transportation Analysis

Local In-County Movement

WAKULLA COUNTY (2004)

Category 1 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	11 ½	13
Medium Response	11 ¾	13 ¼
Long Response	12 ¾	14

Worst individual household commute time – 8 ½ hours

Category 2-3 Hurricane	Low Seasonal Occupancy	High Seasonal Occupancy
Rapid Response	19 ½	21 ¼
Medium Response	19 ¾	21 ¼
Long Response	20 ½	22 ¼

Worst individual household commute time – 17 hours

Category 4-5 Hurricane	Low Seasonal Occupancy	High Seasonal Occupancy
Rapid Response	20 ¼	22
Medium Response	20 ¼	22
Long Response	21 ¼	22 ¾

Worst individual household commute time – 17 ½ hours

Note: Commute time refers to how long one vehicle may be caught in traffic making their evacuation movement

Table 3-4

CURRENT CLEARANCE TIMES (in hours)

Apalachee Region Transportation Analysis

Local In-County Movement

JEFFERSON COUNTY (2004)

Category 1-2 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	2 ¾	2 ¾
Medium Response	3 ½	3 ½
Long Response	4 ¼	4 ¼

Worst individual household commute time – ¾ hours

Category 3-5 Hurricane	Low Seasonal Occupancy	High Seasonal Occupancy
Rapid Response	4	4 ½
Medium Response	4 ¾	5 ¼
Long Response	5 ½	6

Worst individual household commute time – ¾ hours

Note: Commute time refers to how long one vehicle may be caught in traffic making their evacuation movement

Table 3-5

CURRENT CLEARANCE TIMES (in hours)

Apalachee Region Transportation Analysis

Local In-County & Regional Movement

LEON COUNTY & REGIONAL (2004)

Category 1 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	12 ¾	14
Medium Response	15 ¼	15 ¾
Long Response	17 ¾	18 ¼

Worst individual household commute time – 9 ½ hours

Category 2-3 Hurricane	Low Seasonal Occupancy	High Seasonal Occupancy
Rapid Response	20 ¾	22 ½
Medium Response	21 ½	23
Long Response	24	25 ½

Worst individual household commute time – 17 hours

Category 4-5 Hurricane	Low Seasonal Occupancy	High Seasonal Occupancy
Rapid Response	21 ¾	23 ¼
Medium Response	23	24 ½
Long Response	25 ½	27

Worst individual household commute time – 18 ½ hours

Note: Commute time refers to how long one vehicle may be caught in traffic making their evacuation movement

Table 3-5

ESTIMATED CLEARANCE TIMES (in hours)

Apalachee Region Transportation Analysis

Local In-County & Regional Movement WITH Year 2005 Improvements

to US 319 on Crawfordville Highway (Segment B) and Capital Circle (Segment E) Only

LEON COUNTY & REGIONAL (With Improvements to Segments B & E)

Category 1 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	10 ¾	11 ½
Medium Response	12 ¼	12 ¾
Long Response	13 ½	14

Worst individual household commute time – 7 ½ hours

Category 2-3 Hurricane	Low Seasonal Occupancy	High Seasonal Occupancy
Rapid Response	17 ¼	18 ¾
Medium Response	18 ¼	19 ½
Long Response	19 ½	21

Worst individual household commute time – 14 ½ hours

Category 4-5 Hurricane	Low Seasonal Occupancy	High Seasonal Occupancy
Rapid Response	18 ¾	20
Medium Response	19 ½	20 ¾
Long Response	21	22 ¼

Worst individual household commute time – 16 hours

Note: Commute time refers to how long one vehicle may be caught in traffic making their evacuation movement

Table 3-5

ESTIMATED CLEARANCE TIMES (in hours)

Apalachee Region Transportation Analysis

Local In-County & Regional Movement WITH Year 2011 Planned Improvements to US 319 on Crawfordville Highway and Capital Circle (Segments B, C, D and E)

LEON COUNTY & REGIONAL (With US 319 Improvements)

Category 1 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	6 ½	7
Medium Response	6 ½	7 ¼
Long Response	7	7 ¾

Worst individual household commute time – 2 ¼ hours

Category 2-3 Hurricane	Low Seasonal Occupancy	High Seasonal Occupancy
Rapid Response	10 ¼	11
Medium Response	10 ¼	11
Long Response	10 ¾	11 ½

Worst individual household commute time – 6 hours

Category 4-5 Hurricane	Low Seasonal Occupancy	High Seasonal Occupancy
Rapid Response	10 ¾	11 ½
Medium Response	10 ¾	11 ½
Long Response	11 ¼	12

Worst individual household commute time – 6 ½ hours

Note: Commute time refers to how long one vehicle may be caught in traffic making their evacuation movement

Table 3-6

ESTIMATED CLEARANCE TIMES (in hours)

Apalachee Region Transportation Analysis

Local In-County & Regional Movement

WITH Simultaneous Northwest Florida Evacuations

JACKSON COUNTY / SOUTHEAST ALABAMA BOTTLENECKS

Category 1 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	3 ¾	5 ¼
Medium Response	4 ¼	5 ½
Long Response	4 ¾	6

Worst individual household commute time – Normal commute time

Category 2-3 Hurricane	Low Seasonal Occupancy	High Seasonal Occupancy
Rapid Response	5 ¾	8
Medium Response	6	8 ¼
Long Response	6 ½	8 ¾

Worst individual household commute time – 3 ¼ hours

Category 4-5 Hurricane	Low Seasonal Occupancy	High Seasonal Occupancy
Rapid Response	8	10 ¾
Medium Response	8 ¼	11
Long Response	8 ¾	11 ½

Worst individual household commute time – 6 hours

Note: Commute time refers to how long one vehicle may be caught in traffic making their evacuation movement

Table 3-7

2009 CLEARANCE TIMES (in hours)

Apalachee Region Transportation Analysis

Local In-County Movement

GULF COUNTY (2009)		
Category 1 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	6 ¼	7 ¾
Medium Response	6 ½	8
Long Response	7	8 ½
Category 2-3 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	9	11
Medium Response	9 ¼	11
Long Response	9 ¾	11½
Category 4-5 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	10 ¼	12 ¼
Medium Response	10 ½	12 ¼
Long Response	12	12 ¾

FRANKLIN COUNTY (2009)		
Category 1 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	5 ¼	6 ½
Medium Response	5 ½	6 ½
Long Response	5 ¾	6 ¾
Category 2-5 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	8 ½	9 ½
Medium Response	8 ½	9 ½
Long Response	8 ½	9 ¾

Table 3-7

2009 CLEARANCE TIMES (in hours)

Apalachee Region Transportation Analysis

Local In-County Movement

WAKULLA COUNTY (2009)		
Category 1 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	13 ¾	15 ½
Medium Response	14 ¼	16
Long Response	15 ¼	17
Category 2-3 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	23 ¾	25 ¾
Medium Response	23 ¾	25 ¾
Long Response	25	27
Category 4-5 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	24 ½	26 ½
Medium Response	24 ½	26 ½
Long Response	25 ¾	27 ¾

JEFFERSON COUNTY (2009)		
Category 1-2 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	2 ¾	3
Medium Response	3 ¾	3 ¾
Long Response	4 ½	4 ½
Category 3-5 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	4 ½	4 ¾
Medium Response	5 ¼	5 ½
Long Response	6	6 ¼

Table 3-7

2009 CLEARANCE TIMES (in hours)

Apalachee Region Transportation Analysis

In-County & Regional Movement

LEON COUNTY & REGIONAL (2009) [1]		
Category 1 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	12	13
Medium Response	13 ¼	14
Long Response	14 ¾	15 ½
Category 2-3 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	19 ½	21 ¼
Medium Response	20 ½	22
Long Response	22	23 ½
Category 4-5 Hurricane	**Low Seasonal Occupancy**	**High Seasonal Occupancy**
Rapid Response	21	22 ½
Medium Response	21 ¾	23 ¼
Long Response	23 ½	24 ¾

1 Assumes that Roadway improvements to Crawfordville Highway, as well as to some to Capital Circle Northeast are completed

3.7 EVACUEE NOTIFICATION/EVACUATION SHUT-DOWN TIME FRAMES

As Tallahassee is a potential destination for significant numbers of evacuees from the entire region, it will be important to implement evacuation shut down procedures so that evacuees are not stranded on US 319 and Capital Circle Southeast as a storm arrives. For Franklin County the principal evacuation route, US 98, is an exposed roadway directly on the coast. This could be a particularly dangerous situation if sustained tropical storm winds or hurricane winds begin to affect the roadway while evacuees are still on it attempting to reach their final destination. Once a hurricane makes landfall, the winds will not diminish appreciably between the coast and most of the likely host areas in the region. Evacuees stranded on roadways in Tallahassee, could easily be subject to life threatening winds, even though the city is considered to be in an "inland" county.

Unfortunately, this region enjoys few alternative sheltering or roadway options and is therefore very limited in the actions that it can undertake to guarantee the safety of evacuees in the final hours before the arrival of tropical and more dangerous winds. Many of the roadways in the region that are perpendicular to the coast are very isolated with long stretches completely devoid of any substantial structures that could be used as refuges of last resort. Additionally two coastal counties in the region are evacuated in their entirety in category 4 and 5 events with no in-county sheltering options. In those cases, evacuees must leave their county and have no options regarding alternative roadways to use in reaching their final destination.

There are FDOT permanent traffic count stations located along the facilities that should be used for travel speed monitoring (sites 590296 on US 319 in Wakulla County, 550349 on US 319 in northern Leon County, 500220 on I-10 in Gadsden County, and 470328 on SR 71 in Calhoun County). Traffic conditions can be further monitored through Civil Air Patrol support and/or highway patrolmen stationed on the ground at strategic locations. Traffic can also be monitored using CCTV cameras throughout the Tallahassee area. Hourly snapshots of traffic volumes and average travel speeds at these locations, coupled with storm information regarding the radius of tropical storm winds and forward speed, will be critical to making prudent shutdown decisions. As average travel speeds are monitored hour-to-hour and the information fed back to the state and county Emergency Operations Centers (EOCs), data must be interpreted and the public notified of evacuation shut down timeframes and actions.

The best indicator of evacuation traffic congestion and progress is average travel speed. By identifying the most congested sites in the appropriate direction, it is appropriate that the State and counties direct the public to stop entering US 319, US 27, I-10 and SR 71 in the hourly time frames shown below in Table 3-8 and seek refuge in shelters of last resort. This should help significantly in avoiding the possibility that evacuees will be trapped on the on the roadway system as hazardous conditions arrive.

Table 3-8

EVACUATION CLOSURE/EVACUEE NOTIFICATION TIMEFRAMES

(Number of hours needed before the arrival of sustained tropical storm winds to discourage new evacuees from entering identified roadways and seek refuges of last resort)

Average Travel of Evacuation Traffic at Most Congested Sites	Most Congested Sites			
	Wakulla	Leon	Gadsden	Calhoun
	Site 590296 [1] On US 319	Site 550349 [2] On US 319	Site 500220 [3] On I-10	Site 470328 [4] On SR 71
5 mph	5 hours	4 hours	9 hours	14 hours
15 mph	1 ¾ hours	1 ½ hours	3 hours	4 ½ hours
25 mph	1 hour	1 hour	2 hours	3 hours
35 mph	¾ hour	¾ hour	1 ¼ hours	2 hours
45 mph	¾ hour	½ hour	1 hour	1 ½ hours
55 mph	½ hour	½ hour	¾ hour	1 ¼ hours
65 mph	½ hour	½ hour	¾ hour	1 hour

1 Assumed safety destination is any location in Tallahassee

2 Assumed safety destination is Thomasville, Georgia

3 Assumed safety destination is Marianna

4 Assumed safety destination is any location in Tallahassee

3.9 TIME CONSTRAINED EVACUATIONS

Until the roadway improvement projects are completed on the Crawfordville Highway and Capital Circle, the evacuation clearance times calculated for Franklin, Wakulla and Leon Counties can exceed one full day of heavy evacuation traffic movement for a worst-case storm if all those who wish to leave the area are to be accommodated. This timeframe easily extends beyond the maximum amount of warning and preparation time provided by the National Hurricane Center under a Hurricane Warning. The meteorological characteristics of hurricanes will rarely allow that amount of time for evacuation movements to take place. In that regard, PBSJ was asked by the State of Florida to look at the number of evacuees who would be unable to leave the Apalachee region, if only 12, 24, or 36 hour timeframes were available for evacuation. These additional people could ultimately place more strain on public shelters or other in-area sheltering options. The table 3-9 shows the number of people who can evacuate in those prescribed timeframes for all of the Apalachee counties.

Table 3-9
Time Constrained Evacuations
Apalachee Region Transportation Analysis

County	WAKULLA COUNTY SEGMENT E ON US 319						
	Unconstrained Number of Evacuees	12-hour Constrained Category 4-5 Evacuating Population	Evacuees Unable To Leave Area	18-hour Constrained Category 4-5 Evacuating Population	Evacuees Unable To Leave Area	24-hour Constrained Category 4-5 Evacuating Population	Evacuees Unable To Leave Area
Wakulla	14,222	10,110	4,112	0	0	0	0
Franklin	14,618	10,392	4,226	0	0	0	0
Total	**28,840**	**20,502**	**8,338**				
Longest Queue Length = 6,052 vehicles or approximately 22.9 miles							
Queue Length at 12 hours = 12.1 miles							
County	**WAKULLA COUNTY SEGMENT G ON US 319**						
	Unconstrained Number of Evacuees	12-hour Constrained Category 4-5 Evacuating Population	Evacuees Unable To Leave Area	18-hour Constrained Category 4-5 Evacuating Population	Evacuees Unable To Leave Area	24-hour Constrained Category 4-5 Evacuating Population	Evacuees Unable To Leave Area
Wakulla	22,399	13,357	9,042	20,212	2,187	0	0
Franklin	14,618	7,538	7,080	12,013	2,605	0	0
Total	**37,017**	**20,895**	**16,122**	**32,225**	**4,792**		
Longest Queue Length = 9,450 vehicles or approximately 35.0 miles							
Queue Length at 12 hours = 29.6 miles							
Queue Length at 18 hours = 8.9 miles							

Table 3-9
Time Constrained Evacuations
Apalachee Region Transportation Analysis

County	LEON COUNTY SEGMENT B ON US 319 (BEFORE 2005 IMPROVEMENTS) *						
	Unconstrained Number of Evacuees	12-hour Constrained Category 4-5 Evacuating Population	Evacuees Unable To Leave Area	18-hour Constrained Category 4-5 Evacuating Population	Evacuees Unable To Leave Area	24-hour Constrained Category 4-5 Evacuating Population	Evacuees Unable To Leave Area
Leon Co.	387	211	176	325	62		
Region	39,874	21,735	18,139	33,490	6,384		
	40,261	**21,946**	**18,315**	**33,815**	**6,446**		
Longest Queue Length = 10,611 vehicles or approximately 35.6 miles							
Queue Length at 12 hours = 33.8 miles							
Queue Length at 18 hours = 11.9 miles							
* Once improvements are completed by October 2005 (projected date), then clearance time for this link drops below 12 hours.							

County	LEON COUNTY SEGMENT E ON US 319 WITH 2004 IMPROVEMENTS **						
	Unconstrained Number of Evacuees	12-hour Constrained Category 4-5 Evacuating Population	Evacuees Unable To Leave Area	18-hour Constrained Category 4-5 Evacuating Population	Evacuees Unable To Leave Area	24-hour Constrained Category 4-5 Evacuating Population	Evacuees Unable To Leave Area
Leon Co.	3,898	1,753	2,145	2,752	1,146	3,750	148
Region	30,732	13,237	17,495	21,105	9,627	28,974	1,758
Total	**34,630**	**14,990**	**19,640**	**23,857**	**10,773**	**32,724**	**1,906**
Longest Queue Length = 13,609 vehicles or approximately 51.1 miles							
Queue Length at 12 hours = 44.6 miles							
Queue Length at 18 hours = 22.8 miles							
Queue Length at 24 hours = 1.0 mile							
** Once improvements are completed by December 2004 (projected date), then clearance time for this link drops below 12 hours.							

Table 3-9
Time Constrained Evacuations
Apalachee Region Transportation Analysis

County	LEON COUNTY SEGMENT D ON US 319 (BEFORE 2007 IMPROVEMENTS) *						
	Unconstrained Number of Evacuees	12-hour Constrained Category 4-5 Evacuating Population	Evacuees Unable To Leave Area	18-hour Constrained Category 4-5 Evacuating Population	Evacuees Unable To Leave Area	24-hour Constrained Category 4-5 Evacuating Population	Evacuees Unable To Leave Area
Leon Co.	2,943	1,608	1,335	2,533	410		
Region	30,588	16,525	14,063	26,143	4,445		
	33,531	**18,133**	**15,398**	**28,676**	**4,855**		
Longest Queue Length = 8,484 vehicles or approximately 29.9 miles							
Queue Length at 12 hours = 24.6 miles							
Queue Length at 18 hours = 2.8 miles							

***** Once improvements are completed by 2007 (projected date), then clearance time for this link drops below 12 hours.

All values in this table are for a cat 4/5, high tourist occupancy scenario

Constrained Timeframe Evacuation Tables were not prepared for Gulf, Franklin or Jefferson Counties because none of those jurisdictions had clearance times that exceeded 12 hours. Nonetheless, evacuees from these counties will be using the same routes as Wakulla and Leon County residents, and therefore competing for the same space on the regional evacuation road network. Therefore, those counties may need to consider the likelihood of their residents being trapped on roadways in Wakulla and Leon County in their evacuation decision making process.

3.10 GENERAL TRAFFIC CONTROL MEASURES

Some general recommendations concerning traffic control are as follows:

- Where the state and county have sufficient personnel resources, officers should be stationed at critical intersections to facilitate traffic flow. The primary locations for the positioning of these law enforcement personnel should coincide with locations specified in Table 3-2.

- Increase the use of strategically placed variable message signs (VMS) and other programmable methods of communicating with evacuees in their vehicles on roadways. This measure will greatly assist the law enforcement staff stationed at the critical intersections. These forms of communications will be critical for evacuees, especially in major hurricanes with large scale regional evacuations. Prime locations for the placement of these dynamic communications capabilities are along US 319 in Wakulla County from the community of Tully to the intersection of Crawfordville Highway with Capital Circle in southern Leon County.

- Petition state and local agencies to revisit the Capital Improvements Plan (CIP) for the region to step up the roadway improvements along US 319 and Capital Circle, particularly in Wakulla County and southern Leon County. Improvements to Capital Circle and US 319 would significantly improve evacuation clearance times for the entire region and greatly reduce the likelihood of vehicles being stranded on evacuation roadways as tropical storm and hurricane force winds approach.

- Where intersections will continue to have signalized control, synchronize traffic signal patterns to provide the most "green time" for the predominant evacuation routes. Consult Figures 3-6 and 3-7 for further guidance on which roads should have the highest priority with respect to traffic flow and have the most

precedence for synchronized signalization.

- Traffic flow and traffic signal synchronization will be extremely critical along the entire length of US 319 from community of Tully in Wakulla County to the Georgia state line. This is especially true in southern Leon County along Crawfordville Highway, Capital Circle Southeast and South Monroe Street (US 27) through downtown Tallahassee to Mahan Drive (US 90).

- Develop a methodology to use the traffic camera system throughout the Tallahassee roadway network (see http://smsdmz12.state.fl.us/) to monitor and manage evacuation traffic. These cameras could provide the county emergency management center and law enforcement officials with the information necessary to implement better traffic management strategies, such as diverting traffic flow to lesser congested routes and other measures to temporarily enhance capacity.

- The traffic cameras in Tallahassee should also be used in a "know before you go" public information campaign, especially for residents in Wakulla and Franklin Counties. In the latter periods of an evacuation as roadways in Tallahassee and northern Wakulla County become saturated with evacuation traffic, the information from these cameras could be used in bulletins and other communications methods to divert traffic from problem areas, as well as recommend alternate roadways and destinations.

- Consider strategies to divert more traffic to US 98 rather than simply allowing most traffic to proceed up the most obvious and thereby most potentially congested regional evacuation route. The traffic diverted onto US 98 could then be allowed to proceed on to Tallahassee via Woodville Highway or continue on to other locations within the region or beyond, especially earlier on in the evacuation.

- If possible, pre-position tow truck operators and other incident management teams

along key travel corridors and critical roadway facilities such as bridges. Any accidents or other incidents that even temporarily impede traffic along these vital roadway segments could result in significantly higher clearance times. Figures 3-6 and 3-7 provide specifics regarding which roadways will benefit most by having incident management teams on them.

► Increase efforts to develop refuge of last resort plans in Northern Wakulla and Leon Counties. Until all of the scheduled roadway improvement projects are completed on Crawfordville Highway (October 2005); Capital Circle from Apalachee Parkway to Park Ave (December 2004) and; and the rest of Capital Circle Southeast (around 2011) traffic queues during major evacuations will reduce traffic on US 319 to a crawl. The Apalachee region hurricane transportation model estimates that in a category 4/5, high tourist occupancy evacuation, the bottlenecks below will create the following traffic backups:

- *Capital Circle Apalachee Pkwy to Mahan Drive* *51 Miles*
- *Capital Circle Southeast* *30 Miles*
- *Crawfordville Hwy south of Capital Circle* *36 Miles*
- *Crawfordville Hwy from Crawfordville to Leon Co. line* *35 Miles*
- *US 319 from US 98 split in Tully to Crawfordville* *23 Miles*
- *South Monroe Street in downtown Tallahassee* *21 Miles*

All these traffic queues could extend to the next bottleneck as the evacuation progresses until US 319 becomes a very long parking lot thereby increasing the likelihood that evacuees will be stranded on the roadway as tropical storm winds approach.

► Investigate the use of parking garages in downtown Tallahassee as possible refuges of last resort. Given that southern Leon County could slow to a standstill in a major evacuation and the availability of parking garages in downtown Tallahassee, these facilities could be a viable refuge option whereby evacuating vehicles are diverted into them and evacuees directed to wait out the hurricane in their vehicles.

- Increase the inventory of ARC 4496 public shelter facilities in Wakulla County and develop strategies to encourage local residents to use them rather than evacuating out of county. Sole reliance on the latter as a protective action, given the expected congestion on most of the regional evacuation routes inland, will increase the likelihood that evacuees will be stranded on the roadway during a hurricane.

- The long causeways over water bodies, such as the Gorrie Bridge, the St. George Island Causeway, and the Ocklochonee Bay Bridge, as well as long portions of US 98 in eastern Franklin County must be monitored for early wind vulnerability. These exposed roadways may experience unobstructed straight line sustained winds and gusts well before other roadway segments. These precursor winds may render the aforementioned roadways unsuitable for vehicles in advance of tropical storm force winds. These winds may prove to be especially treacherous for trucks, RVs and other high profile vehicles.