Forsyth County, Georgia

Hazard Mitigation Plan 2016

Including the City of Cumming

Chapter 1
Introduction

1.1 Purpose

The Disaster Mitigation Act of 2000 has helped to bring attention to the need for successful hazard mitigation planning throughout the United States. Section 322 of the Act emphasizes the importance of comprehensive multi-hazard planning at the local level, both natural and technological, and the necessity of effective coordination between State and local entities to promote an integrated, comprehensive approach to mitigation planning. The Hazard Mitigation Planning and Hazard Mitigation Grant Program (HMGP) interim final rule published on February 26, 2002, identifies these new local mitigation planning requirements. According to this rule, state and local governments are required to develop, submit, and obtain FEMA approval of a hazard mitigation plan (HMP). Completion of an HMP that meets the new Federal requirements will increase access to funds for local governments and allow them to remain eligible for Stafford Act assistance.

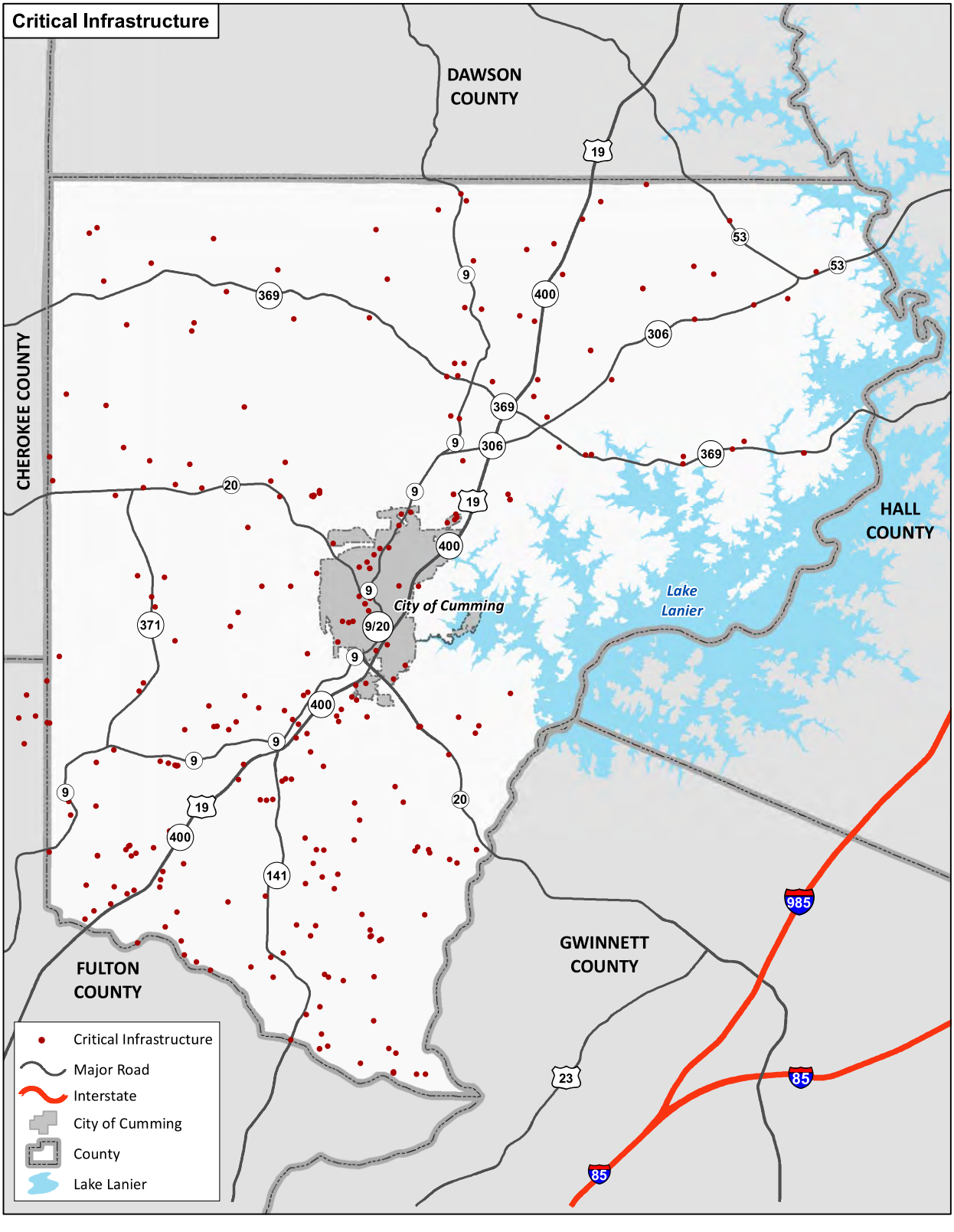
The HMP becomes part of the foundation for emergency management planning, exercises, training, preparedness and mitigation within the County. Such a plan sets the stage for long-term disaster resistance through identification of actions that will, over time, reduce the exposure of people and property to identifiable hazards. This plan provides an overview of the hazards that threaten the County, and what safeguards have been implemented, or may need to considered for implementation in the future.

Hazards, for purposes of this plan, have been divided into two basic categories: natural and technological. Natural hazards include all hazards that are not caused either directly or indirectly by man and are frequently related to weather events, such as tornados and winter storms. Technological hazards include hazards that are directly or indirectly caused by man, including hazardous materials spills and weapons of mass destruction (WMD) events, although terrorism is not the particular focus of this Plan. This Plan also makes some recommendations that transcend this classification of natural and technological hazards. In other words, some of the recommendations contained within this Plan apply to many or all hazards. This is commonly referred to as an "all-hazards approach". Most hazards throughout the United States could happen anytime and anywhere. However, the main focus of this plan is on those hazards that are most likely to affect Forsyth County and the City of Cumming in the future.

1.2 Organization of the Plan

The Hazard Mitigation Plan (HMP) consists of four main components: 1) the narrative plan, 2) the Hazard History Database, 3) the Hazard Frequency Table, and 4) a Critical Facilities Database. The narrative plan itself is the main component of the HMP. This part of the Plan includes an overview of the planning process, a summary of the County's hazard history, hazard frequency projections, a detailed discussion of proposed mitigation measures, and a description of how future reviews and updates to the Plan will be handled. The Hazard History Database is attached as a Microsoft Excel spreadsheet and includes relevant information on past hazards within the County. The Hazard Frequency Table is derived from the hazard history and provides frequency-related statistics for each discussed hazard. This table is also attached as a Microsoft Excel spreadsheet. Finally, the Critical Facilities Database is an online tool developed in part by UGA for GEMA that contains detailed information on critical facilities within the County. Critical facilities for the purposes of this plan are those facilities that are among the most important within a specific jurisdiction with regard to the security and welfare of the persons and property within that jurisdiction. Typical critical facilities include hospitals, fire stations, police stations, critical records storage locations, etc. These facilities should be given special consideration during mitigation planning. For instance, a critical facility should not be located in a floodplain if at all possible. Using the critical facilities information, including GPS coordinates and replacement values, along with different hazard maps from GEMA, this database becomes a valuable planning tool that can be used by Counties to help estimate losses and assess vulnerabilities. This interactive Critical Facilities Database will also help to integrate mitigation planning into their other planning processes.

The map on the following page displays the location of critical facilities within Forsyth County and the City of Cumming. These facilities may be viewed in much greater detail within the Critical Facilities Database. Access to this database is limited and can only be viewed with the permission of the EMA Director due to the sensitive nature of some of the information.


Critical Infrastructure
DAWSON COUNTY
CHEROKEE COUNTY
HALL COUNTY
FULTON COUNTY
GWINNETT COUNTY
City of Cumming
Lake Lanier
19
53
9
400
369
306
20
371
9/20
141
985
85
23
Critical Infrastructure
Major Road
Interstate
City of Cumming
County
Lake Lanier

A risk assessment, which is composed of elements from each of the four main HMP components, provides the factual basis for all mitigation activities proposed within this Plan.

Inventory of Critical Facilities: Critical facilities are defined as facilities that provide essential products and services to the public. Many of these facilities are government buildings that provide a multitude of services to the public, including most public safety disciplines such as emergency management, fire, police, and EMS. Other government buildings/facilities commonly classified as critical facilities are water distribution systems, wastewater treatment facilities, public works, public schools, administrative services, and post offices. For the purposes of this Plan, critical facilities have been identified by the HMPC and important information gathered for each one. This information is located in the Critical Facilities Database (Appendix A).

Hazard Identification: During the planning process, a hazard history was created based on available records from the past fifty years. This hazard history includes the natural and technological hazards that are most likely to affect the County. Unfortunately, record keeping was not as accurate or detailed decades ago as it is now. Therefore, the most useful information relating to these hazard events is found within the last ten to fifteen years. This fact is obvious upon review of the Hazard History Database (Appendix B), and the Hazard Frequency Table (Appendix C).

Profile of Hazard Events: Each hazard identified was analyzed to determine likely causes and characteristics, and what portions of the County's population and infrastructure were most affected. However, each of the hazards discussed in this Plan has the potential to negatively impact any given point within the County. A profile of each hazard discussed in this plan is provided in Chapter 2.

Vulnerability Assessment: This step is accomplished with the Critical Facilities Database by comparing GEMA hazard maps with the inventory of affected critical facilities, other buildings, and population exposed to each hazard (see Worksheets 3a).

Estimating Losses: Using the best available data, this step involved estimating structural and other financial losses resulting from a specific hazard. This is also accomplished to some degree using the Critical Facilities Database. Describing vulnerability in terms of dollar amounts provides the County with a rough framework in which to estimate the potential effects of hazards on the built environment.

Based on information gathered, the Plan identifies some specific mitigation goals, objectives, and actions to reduce exposure or impact from hazards that have the most impact on each community. A framework for Plan implementation and maintenance is also presented within this document.

Planning grant funds from the Federal Emergency Management Agency, administered by GEMA, funded the HMP. The HMP was developed by the HMPC, with technical assistance from GEMA and North Georgia Consulting Group.

1.3 Participants in Planning Process

This Hazard Mitigation Plan (HMP) is designed to protect both the unincorporated areas of the County as well as the City of Cumming. Though the County facilitated this planning process, the City of Cumming provided critical input into the process. Without this mutual cooperation, the Plan would not exist in its present comprehensive form. Note: Please keep in mind that throughout this Plan, the term "county" refers to all of Forsyth County, including the City of Cumming.

The process for updating Forsyth County's Hazard Mitigation Plan can be found in the Federal Emergency Management Association's (FEMA) Hazard Mitigation Planning's "How To" Guides. According to "Getting Started: Building Support for Mitigation Planning;" the suggested process for preparing a Hazard Mitigation Plan is to 1) Organize resources and identify stakeholders and those holding technical expertise; 2) Access risks to the community; 3) Develop a Mitigation Plan and lastly; 4) Implement and Monitor that plan once it is adopted. (FEMA 386-1)

The Forsyth County Hazard Mitigation Planning Committee (HMPC) is made up of a variety of members. The Chairman of the HMPC is Fire Chief and EMA Director Danny Bowman. The Chairman's responsibilities include all decisions relating to the overall direction of the Plan, retrieval of data from various departments, and serving as a central point of contact for all matters relating to the Plan. These responsibilities are shared with the Vice-Chairman of the HMPC, Deputy EMA Director Chris Grimes. The consultant, NGCG, is responsible for facilitation of HMPC meetings, integration of updated data into the Plan, grant administration, and other administrative functions. Local government officials including County and City employees, representatives from Georgia Forestry and Georgia Dept of Public Health represented the HMPC. Representatives for utilities and local businesses were also extended an invitation to participate. Potential participants were invited either verbally or by email, depending upon the participant. Some representatives provided important data requested by the HMPC without attending HMPC meetings. This diverse group provided valuable input into the planning process including identifying hazards and developing important mitigation measures to be considered in the future. The entire HMPC met several times over the course of this planning process. These meetings occurred on April 23, 2015, June 11, 2015, July 13, 2015, and September 14, 2015. Other meetings were held throughout this planning process at various times between two or more HMPC members in order to accomplish smaller tasks. Two public meetings relating to this Plan are required by FEMA: one during the drafting stages of the Plan, and one after the final version of the Plan is completed. The first of these two meetings occurred on December 8, 2015 during the drafting stages of the Plan. Once necessary revisions were made to the Plan, a second public meeting was held on *** where it was adopted by Forsyth County. A copy of the adoption resolution is included in the Appendices. Prior to adoption at the final public meeting, the public was provided with an additional opportunity to review and comment on the Plan. This final version was then submitted to GEMA and FEMA for review and approval. All public meetings were advertised in the local newspaper and on the Forsyth County website.

The Plan is the result of a community-wide effort put forth over the past several months utilizing FEMA's Hazard Mitigation Plan "How To" Guides to aid in laying out the planning process described above. Stakeholders and persons with technical expertise were identified early in the process. Full participation was provided by Forsyth County and the City of Cumming. Each jurisdiction had representatives on the Hazard Mitigation Planning Committee and provided critical data to the HMPC for consideration.

The public involvement elements of this Plan were reviewed by the HMPC. They were determined to have remained effective and were approved for use in the current Plan update process.

HMPC members are listed alphabetically in the following table:

Name	Jurisdiction/Dept
Danny Bowman	Forsyth County Fire Chief and EMA Director
Kris Butler	Georgia Forestry Commission
Mike Butler	Forsyth County Roads & Bridges
Daniel Chan	Georgia Forestry Commission
John Cunard	Forsyth County Engineering Department Director
Jodi Gardner	Forsyth County Communications Director
Pat Giordano	Forsyth County 911 Director
Chris Grimes	Forsyth County EMA Deputy Director
Jon Heard	City of Cumming Utilities Director
Michael Hoff	Forsyth County GIS Department
Renee Hoge	Forsyth County Engineering Department
Steve Honn	Forsyth County Schools, School Safety Manager
John Kilgore	Forsyth County GIS Department Director
Steve Martin	Forsyth County Sheriff's Office
Barbara Meincke	Forsyth County Roads & Bridges, Admin Assistant
Mark Palen	Georgia Department of Public Health, District 2
Tim Perkins	Forsyth County Water and Sewer Department Director
Patrick Tittle	Forsyth County Roads & Bridges Superintendent

Various County and City departments, schools, and others participated in conversations with the EMA Director that directly contributed to the development of this Plan. Due to limited resources within the

County and City, attendance at HMPC meetings for many was not an option. Nevertheless, their direct input was utilized by the HMPC to develop this Plan.

The Plan was posted on the county's website during the planning process. This was done to allow the general public, including other nearby communities, as well as other agencies to review and comment on the Plan utilizing the contact information provided on the website.

1.4 HRV summary/Mitigation goals

Forsyth County has experienced a number of hazard events throughout its history, most resulting in fairly localized damage. Flooding, tornados, winter storms, wildfire, severe thunderstorms (including hail and lightning), earthquakes, dam failure and hazardous materials to varying degrees represent known threats to Forsyth County. The Forsyth County HMPC used information gathered throughout this planning process to identify mitigation goals and objectives as well as some recommended mitigation actions. Each potential mitigation measure identifies an organization or agency responsible for initiating the necessary action, as well as potential resources, which may include grant programs and human resources. An estimated timeline is also provided for each mitigation action.

1.5 Multi-Jurisdictional Special Considerations

The City of Cumming was an active participants and equal partner in the current planning process, as well as the previous planning process. As an active part of the HMPC, the City contributed significantly to the identification of mitigation goals and objectives and potential mitigation measures contained within the HMP.

Participation in Mitigation Plan

Jurisdiction	***2015 Plan***	***2011 Plan***
Forsyth County		
City of Cumming		

1.6 Adoption, Implementation, Monitoring, Evaluation

Upon completion of the Plan, it will be forwarded to GEMA for initial review. GEMA will then forward the Plan to FEMA for final review and approval. Once final FEMA approval has been received, Forsyth County and the City of Cumming will be responsible for initiating the appropriate courses of action related to this Plan. Actions taken may be in coordination with one another or may be pursued separately. The Plan maintenance section of this document details the formal process that will ensure that the Forsyth County HMP remains an active and relevant document. The HMP maintenance process includes monitoring and evaluating the Plan annually, and producing a complete Plan revision every five years. Additionally, procedures will ensure public participation throughout the plan maintenance process. This Plan will be considered for integration into various existing plans and programs, including the Forsyth County Comprehensive Plan at its next scheduled update. Mitigation actions within the HMP may be used by the County and City as one of many tools to better protect the people and property of Forsyth County and the City of Cumming. Forsyth County and the City of Cumming are each individually responsible for the processes necessary to formally adopt this Plan.

Adoption Status

Jurisdiction	***Date of Adoption***
Forsyth County	**Upon GEMA & FEMA Approval**
City of Cumming	**Upon GEMA & FEMA Approval**

1.7 Review and Incorporation

The HMPC recognized the need to integrate other plans, codes, regulations, procedures and programs into this Hazard Mitigation Plan (HMP). Forsyth County did not have the opportunity to incorporate the original HMP's strategy into other planning mechanisms, but will now ensure that during the planning process for new and updated local planning documents such as a comprehensive plan or Local Emergency Operations Plan, the EMA Director will provide a copy of the HMP to the appropriate parties, so incorporation will be considered in future updates. All goals and strategies of new and updated local planning documents should be consistent with, and support the goals of, the HMP and not contribute to increased hazards in the affected jurisdiction(s).

Record of Review

Existing planning mechanisms	Reviewed? (Yes/No)	Method of use in Hazard Mitigation Plan
Comprehensive Plan (multi-jurisdictional)	Yes	Development trends
Local Emergency Operations Plan	Yes	Identifying hazards; Assessing vulnerabilities
Storm Water Management / Flood Damage Protection Ordinance	Yes	Mitigation strategies
Building and Zoning Codes and Ordinances	Yes	Development trends; Future growth
Mutual Aid Agreements	Yes	Assessing vulnerabilities
State Hazard Mitigation Plan	Yes	Risk assessment
Land Use Maps	Yes	Assessing vulnerabilities; Development trends; Future growth
Critical Facilities Maps	Yes	Locations
Community Wildfire Protection Plan	Yes	Mitigation strategies

As set forth in the plan maintenance section of this plan (Section 6.4), the Hazard Mitigation Planning Committee will meet during the plan approval anniversary date of every year to complete a review of the Hazard Mitigation Plan. It is during this review process that the mitigation strategy and other information

contained within the Hazard Mitigation Plan are considered for incorporation into other planning mechanisms as appropriate. Opportunities to integrate the requirements of this HMP into other local planning mechanisms will continue to be identified through future meetings of the HMPC on an annual basis. The primary means for integrating mitigation strategies into other local planning mechanisms will be through the revision, update and implementation of each jurisdiction's individual action plans that require specific planning and administrative tasks (e.g., plan amendments and ordinance revisions).

During the planning process for new and updated local planning documents such as a comprehensive plan or Local Emergency Operations Plan, the EMA Director will provide a copy of the HMP to the appropriate parties. It will be recommended that all goals and strategies of new and updated local planning documents be consistent with, and support the goals of, the HMP and will not contribute to increased hazards in the affected jurisdiction(s).

Although it is recognized that there are many benefits to integrating components of this plan into other local planning mechanisms, and that components are actively integrated into other planning mechanisms when appropriate, the development and maintenance of this stand-alone HMP is deemed by the committee to be the most effective method to ensure implementation of local hazard mitigation actions at this time. Therefore, the review and incorporation efforts made in this update and the last, which consisted of a simple review of the documents listed in the chart above by various members of the HMPC, are considered successful by the HMPC and will likely be utilized in future updates.

The County's EMA is committed to incorporating hazard mitigation planning into its Local Emergency Operations Plan and other public emergency management activities. As the EMA Director becomes aware of updates to other County or City plans, codes, regulations, procedures and programs, the Director will continue to look for opportunities to include hazard mitigation into these mechanisms.

1.8 Scope of Updates

Many changes have been made to the HMP in this updated version. These changes are summarized in the following table.

Chapter or Section	Chapter or Section Description	Changes this Update
1.2	Organization of the Plan	Descriptions
1.3	Participants in Planning Process	Data
1.5	Multi-Jurisdictional Special Considerations	Data
1.6	Adoption, Implementation, Monitoring, Evaluation	Descriptions, Data
1.7	Review and Incorporation	Descriptions, Data
1.8	Scope of Updates	Descriptions, Data
1.9	Brief County Overview	Descriptions, Data
2	Introduction	Descriptions, Data
2.1	Severe Thunderstorm	Descriptions, Data, Visual Aids
2.2	Winter Storm	Descriptions, Data, Visual Aids
2.3	Flooding	Descriptions, Data, Visual Aids
2.4	Tornado	Descriptions, Data, Visual Aids
2.5	Wildfire	Descriptions, Data, Visual Aids
2.6	Drought	Descriptions, Data, Visual Aids
2.7	Earthquake	Descriptions, Data, Visual Aids
3.1	Hazardous Materials Rel.	Descriptions, Data, Visual Aids
3.2	Dam Failure	Descriptions, Data, Visual Aids
4	Land Use & Dev. Trends	Descriptions, Data, Visual Aids
5	Hazard Mitigation Goals Objectives & Actions	Descriptions, Data
6.1	Action Plan Implementation	Descriptions
6.2	Evaluation	Descriptions
6.3	Multi-Jurisdictional Strategy & Considerations	Descriptions
6.4	Plan Update & Maintenance	Descriptions, Data
7.2	References	Data
App. A	Critical Facilities Database	Data, Visual Aids
App. B	Hazard History Database	Data
App. C	Hazard Frequency Table	Data
App. D	Other Planning Documents	Descriptions, Data, Visual Aids

1.9 Brief County Overview

County Formed: December 3, 1832

County Seat: City of Cumming

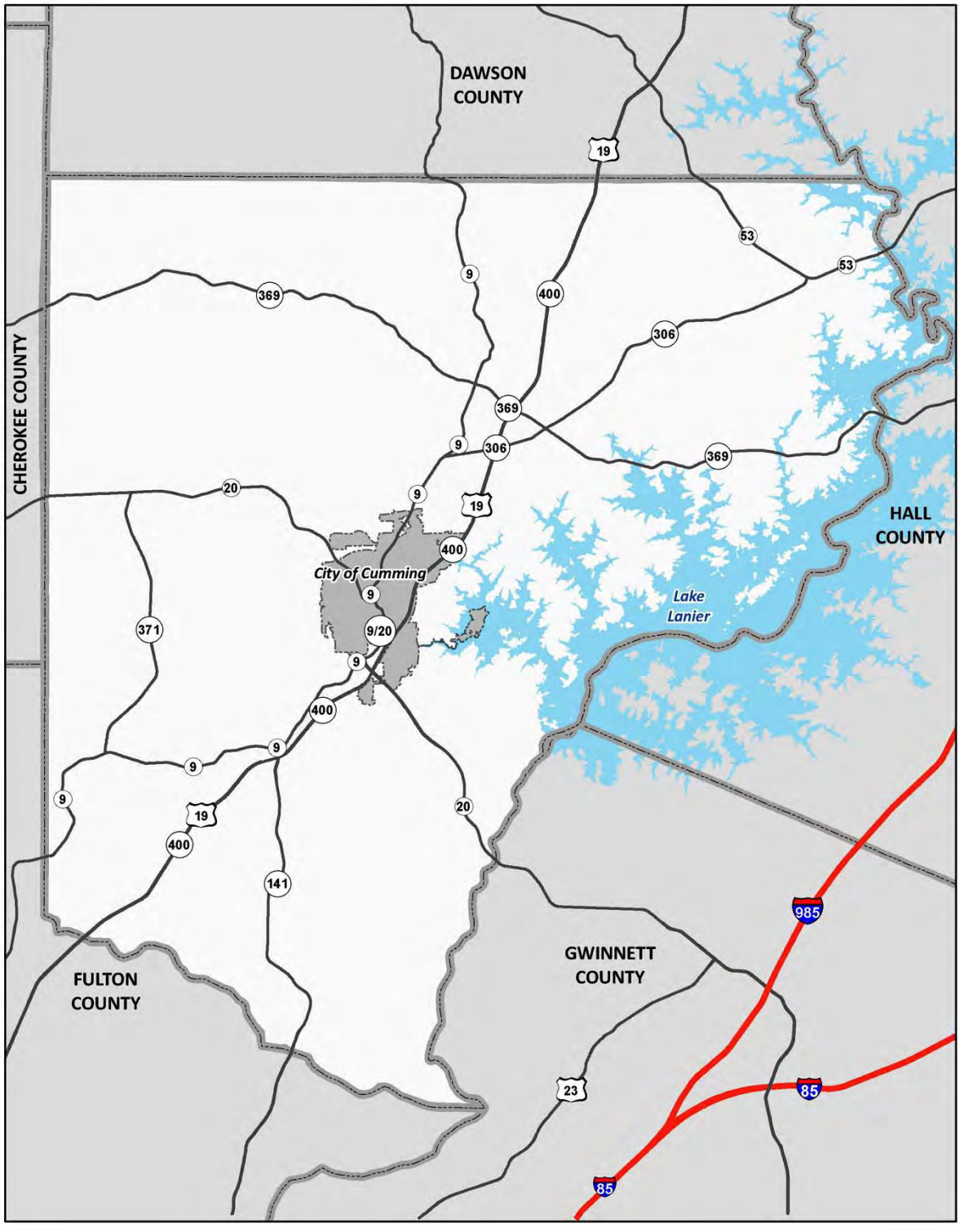
Incorporated Municipalities: City of Cumming

Total Area: 225.8 square miles

Population: Forsyth County: 204,202 (2014 Est.)

City of Cumming: 5,615 (2014 Est.)

Forsyth County and City of Cumming Map:


DAWSON
COUNTY
CHEROKEE COUNTY
HALL
COUNTY
City of Cumming
Lake
Lanier
FULTON
COUNTY
GWINNETT
COUNTY
19
53
9
400
369
306
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141
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23

Brief History:

Forsyth County was named for John Forsyth, the governor of Georgia from 1827 to 1829, who had a long and distinguished political career at the state and national levels. The County is located approximately forty miles north of Atlanta and has become one of the most vibrant and successful metro-Atlanta counties. Although the region was populated by Cherokee Indians for hundreds of years, white settlers began moving in after gold was discovered in 1829. In 1832 Georgia leaders divided the former Cherokee lands into ten counties, including Forsyth. The Cherokees were removed forcibly from their Georgia lands in 1838 and relocated to Oklahoma. One of the forts at which the Cherokees were assembled before removal, Fort Campbell, was located in Forsyth County.

Forsyth County prospered during the 1830s and 1840s because of gold mining and the Federal Road, which ran through the county and led settlers to open numerous roadside inns and taverns. The City of Cumming, the county seat, was incorporated in 1834, and by 1840 Forsyth County possessed several schools, including the Cumming Academy. By the early 1840s the heyday of the Georgia gold rush had ended, and the building of new roads and railroads in north Georgia diverted a large amount of traffic from the Federal Road, forcing many local businesses to close by the end of the decade.

The Civil War (1861-65) bypassed Forsyth County, but Reconstruction hit the region hard, and for the remainder of the nineteenth century the county remained rural and poor, with an economy based largely on cotton. During this period, Forsyth native Hiram Parks Bell served two terms in the U.S. House of Representatives, from 1873 to 1874 and from 1877 to 1878. He later served in both houses of the state legislature.

Today, outdoor recreation draws many visitors to Forsyth County. Thirty percent of the shoreline of Lake Lanier, a popular destination for boating, camping, and fishing enthusiasts, lies in Forsyth. The completion of Georgia Highway 400 has also helped turn Forsyth County into a suburb of Atlanta, further encouraging population growth. In 2008, Forbes Magazine named Forsyth County as the 2nd "Best Place in America to Get Ahead" and the 13th wealthiest county in the nation. Forsyth is now home to over 40 international companies, 15 of which have located their North American corporate headquarters in Forsyth County. These companies include Scientific Games, the producer of lottery tickets for the Georgia Lottery; Tyson Foods, which has maintained a poultry processing plant in downtown Cumming since the 1950s, Automation Direct, and New York Life Insurance Company.

Local Natural Hazard, Risk and Vulnerability (HRV) Summary

The Forsyth County Hazard Mitigation Planning Committee (HMPC) identified seven natural hazards the County is vulnerable to based upon available data including scientific evidence, known past events, and future probability estimates. As a result of this planning process, which included an analysis of the risks associated with probable frequency and impact of each hazard, the HMPC determined that each of these natural hazards pose a threat significant enough to address within this Plan. These include tornado, severe thunderstorm (including hail & lightning), flooding, winter storms, wildfire, drought, and earthquakes. For this plan update, the HMPC reviewed the natural hazards listed in the 2011 Georgia Hazard Mitigation Strategy Standard Plan Update to assess the applicability of these hazards to Forsyth County and the City of Cumming (See Table 2.1). Each of these natural hazards is addressed in this chapter of the Plan. An explanation and results of the vulnerability assessment are found in Tables 2-1 and 2-2.

Table 2.1 – Hazards Terminology Differences

Hazards Identified in 2011 Georgia State Plan	Equivalent/Associated Hazards Identified in the 2015 Forsyth County Plan	Difference
Tornadoes	Tornados	Grammatical only.
Wind	Severe Thunderstorms	HMPC views as an associated hazard.
Severe Weather	Severe Thunderstorms	Difference in terminology.
Hailstorm	Severe Thunderstorms	HMPC views as an associated hazard.
Lightning	Severe Thunderstorms	HMPC views as an associated hazard.
Tropical Cyclonic Events	Severe Thunderstorms Flooding	Due to the County's inland location, not directly viewed as a threat. Tropical weather has limited effects within the County and is generally considered in terms of Severe Thunderstorms and Flooding, associated hazards.
Inland Flooding	Flooding	Difference in terminology.
Earthquake	Earthquake	None
Severe Winter Storms	Winter Storms	Difference in terminology.
Wildfire	Wildfire	None
Drought	Drought	None

Table 2.2 – Vulnerability Assessment *(see Keys below)*

HAZARD	FORSYTH	CUMMING
Severe Thunderstorms (includes lightning & hail)		
Frequency	H	H
Severity	EX	EX
Probability	H	H
Tornados		
Frequency	M	M
Severity	H	H
Probability	H	H
Flooding		
Frequency	M	L
Severity	H	L
Probability	M	L
Winter Storms		
Frequency	M	M
Severity	EX	H
Probability	M	M
Drought		
Frequency	H	H
Severity	EX	EX
Probability	H	H
Wildfire		
Frequency	M	L
Severity	H	L
Probability	M	L
Earthquake		
Frequency	VL	VL
Severity	L	L
Probability	L	L

Key for Table 2.2 – Vulnerability Assessment Frequency and Probability Definitions

NA = Not applicable; not a hazard to the jurisdiction
VL = Very low risk/occurrence
L = Low risk; little damage potential (for example, minor damage to less than 5% of the jurisdiction)
M = Medium risk; moderate damage potential (for example, causing partial damage to 5-15% of the jurisdiction, infrequent occurrence)
H = High risk; significant risk/major damage potential (for example, destructive, damage to more than 15% of the jurisdiction, regular occurrence)
EX = Extensive risk/probability/impact

Key for Table 2.2 – Vulnerability Assessment Severity Definitions

	Low	Medium	High	Extensive
Tropical Cyclonic Events		*(See Wind & Inland Flooding)*		
Wind – Wind Speed	38 MPH	39–50 MPH	50-73 MPH	73–91 MPH
Severe Thunderstorm		*(See Wind & Inland Flooding)*		
Tornado - Magnitude	< EF3	EF3	EF4	EF5
Inland Flooding - Water depth	3" or less	3 – 8"	8-12"	12"+
Severe Winter Storms – Ice/ Sleet	½" or less	½ – 4"	4-7"	7"+
Severe Winter Storms - Snow	1" or less	1-6"	6-12"	12"+
Drought – Duration	1 year	1 – 2 years	2-5 years	5+ years
Wildfire - # of Acres	<50	50-110	110-200	200+
Earthquake - Magnitude	1-2	3	4	5+

2.1 Severe Thunderstorms (including Hail & Lightning)

A. Hazard Identification – A Severe Thunderstorm is defined as a thunderstorm producing wind at or above 58 mph and/or hail ¾ of an inch in diameter or larger. This threshold is met by approximately 10% of all thunderstorms. These storms can strike any time of year, but similar to tornados, are most frequent in the spring and summer months. They are nature's way of providing badly needed rainfall, dispersing excessive atmospheric heat buildup and cleansing the air of harmful pollutants. Not only can severe thunderstorms produce injury and damage from violent straight-line winds, hail, and lightning, but these storms can produce tornados very rapidly and without warning. Note: For the purposes of this Plan, severe thunderstorms that result from tropical storms and hurricanes are also included in this section.

The most damaging phenomena associated with thunderstorms, excluding tornado activity, are thunderstorm winds. These winds are generally short in duration involving straight-line winds and/or gusts in excess of 50 mph. However, these winds can gust to more than 100 miles an hour, overturning trailers, un-roofing homes, and toppling trees and power lines. Such winds tend to affect areas of the County with significant tree stands, as well as areas with exposed property, infrastructure, and above-ground utilities. Resulting damage often includes power outages, transportation and economic disruptions, and significant property damage. Severe thunderstorms can ultimately leave a population with injuries and loss of life. Thunderstorms produce two types of wind. Tornados are characterized by rotational winds. The other more predominant winds from a thunderstorm, downbursts, are small areas of rapidly descending air beneath a thunderstorm that strike the ground

producing isolated areas of significant damage. Every thunderstorm produces a downburst. The typical downburst consists of only a 25 mph gusty breeze, accompanied by a temperature drop of as much as 20 degrees within a few minutes. However, severe downburst winds can reach from 58 to 100 mph, or more, significantly increasing the potential for damage to structures. Downbursts develop quickly with little or no advance warning and come from thunderstorms whose radar signatures appear non-severe. There is no sure method of detecting these events, but atmospheric conditions have been identified which favor the development of downbursts. Severe downburst winds have been measured in excess of 120 miles per hour, or the equivalent of an F2 tornado, on the Fujita Scale. Such winds have the potential to produce both a loud "roaring" sound and the widespread damage typical of a tornado. This is why downbursts are often mistaken for tornados.

Hail can also be a destructive aspect of severe thunderstorms. Hail causes more monetary loss than any other type of thunderstorm-spawned severe weather. Annually, the United States suffers about one billion dollars in crop damage from hail. Storms that produce hailstones only the size of a dime can produce dents in the tops of vehicles, damage roofs, break windows and cause significant injury or even death. Unfortunately hail is often much larger than a dime and can fall at speeds in excess of 100 mph. Hailstones are created when strong rising currents of air called updrafts carry water droplets high into the upper reaches of thunderstorms where they freeze. These frozen water droplets fall back toward the earth in downdrafts. In their descent, these frozen droplets bump into and coalesce with unfrozen water droplets and are then carried back up high within the storm where they refreeze into larger frozen drops. This cycle may repeat itself several times until the frozen water droplets become so large and heavy that the updraft can no longer support their weight. Eventually, the frozen water droplets fall back to earth as hailstones.

Finally, one of the most frightening aspects of thunderstorms is lightning. Lightning kills nearly one hundred people every year in the United States and injures hundreds of others. A possible contributing reason for this is that lightning victims frequently are struck before or just after the occurrence of precipitation at their location. Many people apparently feel safe from lightning when they are not experiencing rain. Lightning tends to travel the path of least resistance and often seeks out tall or metal objects. With lightning however, it's all relative. A 'tall' object can be an office tower, a home, or a child standing on a soccer field. Lightning can and does strike just about any object in its path. Some of the most dangerous and intense lightning may occur with severe thunderstorms during the summer months, when outdoor activities are at their peak.

B. Hazard Profile – Severe thunderstorms, hail, and lightning are serious threats to the residents of Forsyth County. Over the course of a year, the County experiences dozens of

thunderstorms, with about one in ten being severe. Severe thunderstorms occur more frequently than any other natural hazard event within Forsyth County. Most of these storms include lightning and/or hail. There have been dozens of severe thunderstorm events within Forsyth County over the past fifty years according to available documentation. It is very likely this is a low estimate due to poor record keeping in decades past. It is clear from information collected that more accurate record keeping related to severe thunderstorms developed over the past two decades, with even more detailed information available for the past ten years.

Most of the available information relating to severe thunderstorms, hail, and lightning occurrences within Forsyth County fails to describe damage estimates in great detail. However, with each thunderstorm event it is likely there are unreported costs related to infrastructure and utilities repair and public safety costs, at a minimum. Severe thunderstorms have occurred in all parts of the day and night within Forsyth County. They have also taken place in every single month of the year.

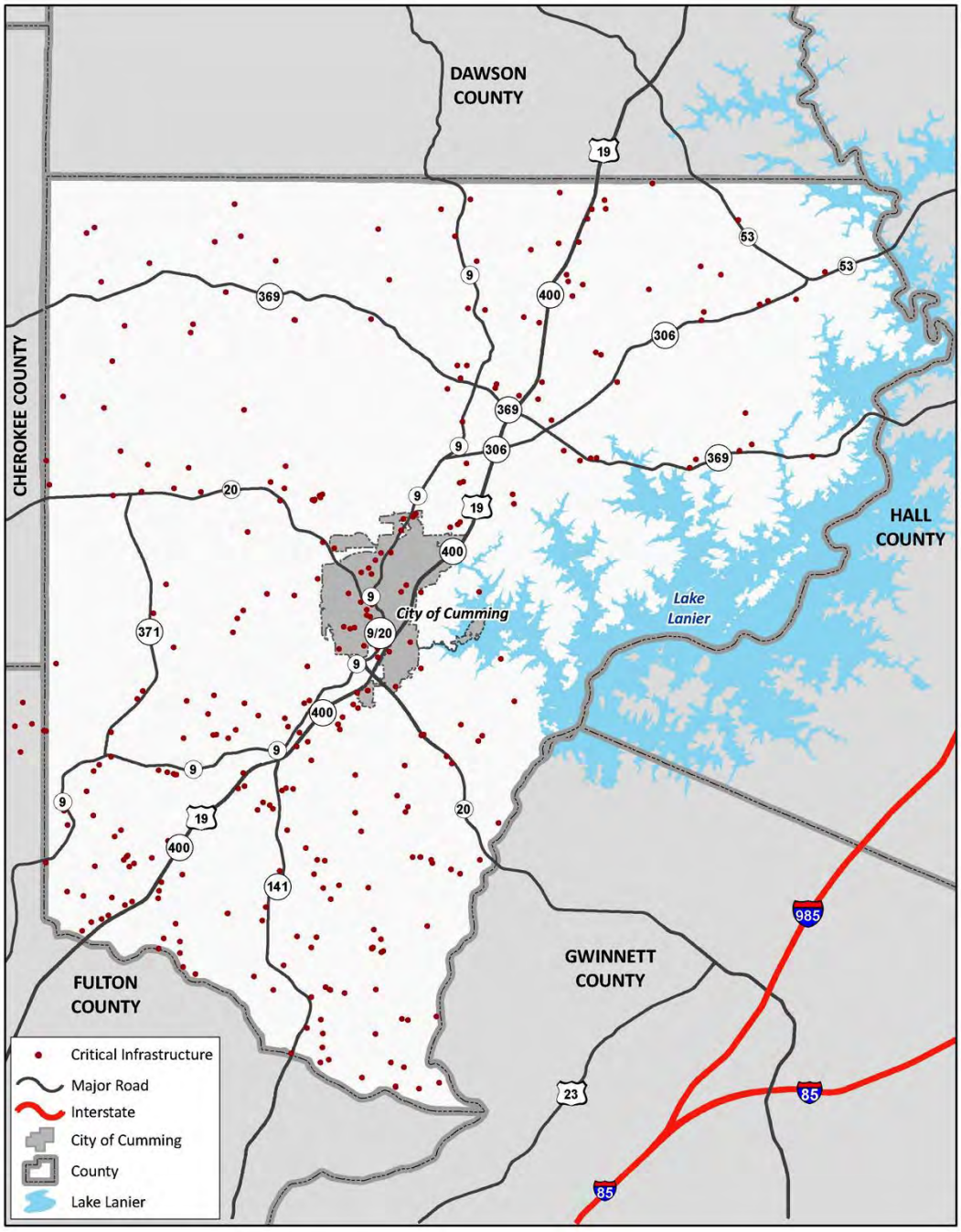
The Forsyth County HMPC utilized data from the National Climatic Data Center, the National Weather Service, numerous weather-related news articles and various online resources in researching severe thunderstorms and their impact on the County. With most of the County's recorded severe thunderstorm events, only basic information was available. It is also likely that some severe thunderstorm events have gone unrecorded. Therefore, any conclusions reached based upon available information on severe thunderstorms within Forsyth County should be treated as the minimal possible threat.

NCDC records show that 225 severe thunderstorms occurred within the County over the past fifty years, which equates to a 450% annual frequency based upon reported events. Over the past twenty years that frequency has more than doubled. It would appear that severe thunderstorm activity has increased over time within the County. This may be the case or it may simply be that record keeping and technology have improved significantly over the course of time, reflecting the higher numbers. It may also be a combination of these two factors. The following chart provides annual frequency of reported events over the past five, ten, twenty, and fifty-year periods. The most recent five-year period, covering the span of time since the last update to this Plan, is highlighted in gold.

Forsyth County – Severe Thunderstorm Frequency including Hail & Lightning (based on Reported Events)				
Time Period	**5yrs (2010-2015)**	**10yrs (2005-2015)**	**20yrs (1995-2015)**	**50yrs (1965-2015)**
Number of Reported Events	**38**	**84**	**189**	**225**
Frequency Average per Year	**7.6**	**8.4**	**9.45**	**4.5**
Frequency Percent per Year	**760%**	**840%**	**945%**	**450%**

C. Assets Exposed to Hazard – In evaluating assets that are susceptible to severe thunderstorms, hail, and lightning, the committee determined that, since this hazard is not

spatially defined, all public and private property is susceptible to severe thunderstorms, including all critical facilities. The following map identifies critical facilities located within the hazard area, which in the case of severe thunderstorms, includes the entire County.



D. Estimate of Potential Losses – For loss estimate information, please refer to Appendix A, the Critical Facilities Database, and Appendix D, Worksheet 3a (Non-Spatially Defined Hazards), for each jurisdiction.

E. Multi-Jurisdictional Concerns – Any portion of Forsyth County can be negatively impacted by severe thunderstorms, hail, and lightning. Therefore, any mitigation steps taken related to these weather events will be pursued on a countywide basis and include the City of Cumming.

F. Hazard Summary – Overall, severe thunderstorm, hail, and lightning events pose one of the greatest threats to Forsyth County in terms of property damage, injuries and loss of life. These weather events represent the most frequently occurring natural hazard within Forsyth County and have a great potential to negatively impact the County each year. Based on the frequency of this hazard, as well as its ability to negatively impact any part of the County, the HMPC recommends that the mitigation measures identified in this plan for severe thunderstorm, hail, and lightning be aggressively pursued. Specific mitigation actions related to these weather events are identified in Chapter 5.

2.2 Winter Storms

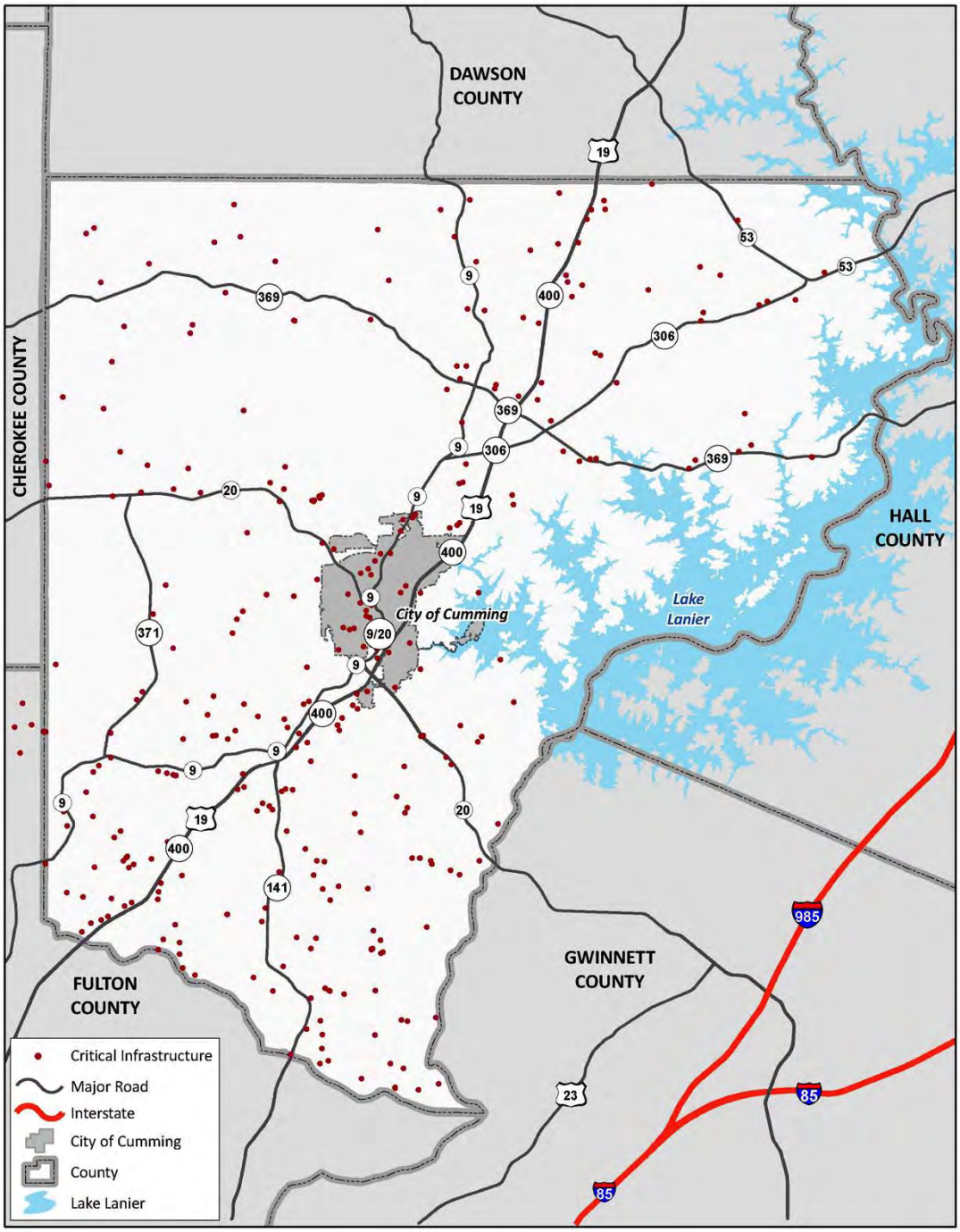
A. Hazard Identification – The Forsyth County HMPC researched historical data from the National Climatic Data Center, The National Weather Service, as well as information from past newspaper articles and various online resources relating to winter storms in Forsyth County. Winter storms bring the threat of freezing rain, ice, sleet, snow and the associated dangers. A heavy accumulation of ice, especially when accompanied by high winds, devastates trees and power lines. Such storms make highway travel or any outdoor activity extremely hazardous due to falling trees, ice, and other debris.

B. Hazard Profile – Although winter storms occur relatively infrequently, they have the potential to wreak havoc on the community when they do strike. Winter storms within Forsyth County typically cause damage to power lines, trees, buildings, structures, and bridges, to varying degrees. In addition, trees, power lines, and structures weighed down by snow and ice become very dangerous to person and property.

NCDC records show that 36 winter storms occurred within the County over the past fifty years, which equates to a 72% annual frequency based upon reported events. However, winter storm events were obviously underreported during the first few decades of the fifty-year history since reported events for the twenty-year history also equal 36, equating to a 180% annual frequency. It may be best to place higher consideration on the more consistent 5, 10 and 20-year histories when considering the threat that winter storm events present to the County. The following chart provides annual frequency of reported events over the past five, ten, twenty, and fifty-year periods. The most recent five-year period, covering the span of time since the last update to this Plan, is highlighted in gold.

Forsyth County – Winter Storm Frequency (based on Reported Events)				
Time Period	**5yrs (2010-2015)**	**10yrs (2005-2015)**	**20yrs (1995-2015)**	**50yrs (1965-2015)**
Number of Reported Events	**11**	**21**	**36**	**36**
Frequency Average per Year	**2.2**	**2.1**	**1.8**	**0.72**
Frequency Percent per Year	**220%**	**210%**	**180%**	**72%**

C. Assets Exposed to Hazard - In evaluating assets that may potentially be impacted by the effects of winter storms, the HMPC determined that all critical facilities, public and private property, are susceptible. The map on the following page identifies critical facilities located within the hazard area which, in the case of winter storms, includes the entire County.



D. Estimate of Potential Losses – For loss estimate information, please refer to Appendix A, the Critical Facilities Database, and Appendix D, Worksheet 3a (Non-Spatially Defined Hazards), for each jurisdiction.

E. Multi-Jurisdictional Concerns – Any portion of Forsyth County can be negatively impacted by winter storms. Therefore, any mitigation steps taken related to winter storms will be pursued on a countywide basis and include the City of Cumming.

F. Hazard Summary – Winter storms, unlike other natural hazards, typically afford communities some advance warning. The National Weather Service issues winter storm warnings and advisories as these storms approach. Unfortunately, even with advance warning, some of the most destructive winter storms have occurred in the Southern United States, where buildings, infrastructure, crops, and livestock are not well-equipped for severe winter conditions. Motorists, not accustomed to driving in snow and icy conditions, pose an additional danger on roads and highways. The Forsyth County HMPC recognized the potential threats of winter storms and identified specific mitigation actions. These actions are detailed in Chapter 5.

2.3 Flooding

A. Hazard Identification: The vulnerability of a river or stream to flooding depends upon several variables. Among these are topography, ground saturation, rainfall intensity and duration, soil types, drainage, drainage patterns of streams, and vegetative cover. A large amount of rainfall over a short time span can result in flash flood conditions. Nationally, the total number of flash flood deaths has exceeded tornado fatalities during the last several decades. Two factors seem to be responsible for this: public apathy regarding the flash flood threat and increased urbanization. A small amount of rain can also result in floods in locations where the soil is saturated from a previous wet period or if the rain is concentrated in an area of impermeable surfaces such as large parking lots, paved roadways, etc. Topography and ground cover are also contributing factors for floods in that water runoff is greater in areas with steep slopes and little or no vegetation.

B. Hazard Profile: Over the past fifty years, relatively little information on flooding damage estimates, in terms of dollars, was available. However, with each of these events there were certainly significant costs related to road repair, infrastructure repair, and public safety, at a minimum. Most of the flood damage that has occurred historically within the County appears to be "public" flood damage. More specifically, roads and culverts washing out have been the most common flooding problem on record.

NCDC records show that 31 flood events occurred within the County over the past fifty years, which equates to a 62% annual frequency based upon reported events. However, flooding events were obviously underreported during the first few decades of the fifty-year history since reported events for the twenty-year history also equal 31, equating to a 155% annual frequency. Therefore it may be best to focus more on the more consistent 5, 10, and 20-year histories when considering the threat that flooding presents to the County.

The following chart provides annual frequency of reported events over the past five, ten, twenty, and fifty-year periods. The most recent five-year period, covering the span of time since the last update to this Plan, is highlighted in gold.

Forsyth County – Flooding Frequency
(based on Reported Events)

Time Period	5yrs (2010-2015)	10yrs (2005-2015)	20yrs (1995-2015)	50yrs (1965-2015)
Number of Reported Events	8	18	31	31
Frequency Average per Year	1.6	1.8	1.55	0.62
Frequency Percent per Year	160%	180%	155%	62%

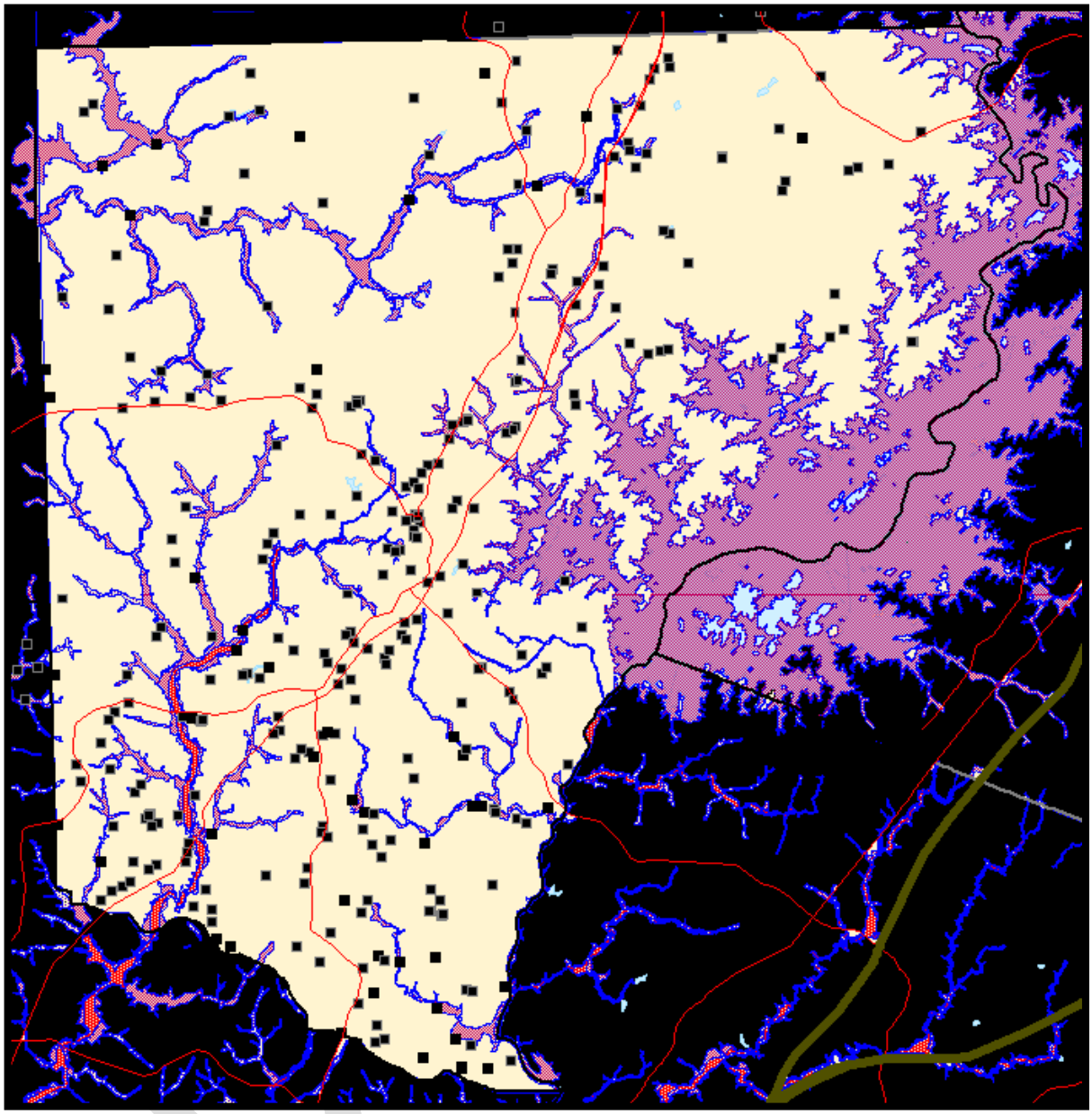
Forsyth County (CID No. 130312) and the City of Cumming (CID No. 130236) each participates in the National Flood Insurance Program (NFIP) and follows the Program guidelines to ensure future development is carried out in the best interests of the public. According to NFIP guidelines, each jurisdiction has executed a Flood Damage Prevention Ordinance. The purpose of this ordinance is to minimize the loss of human life and health as well as to minimize public and private property losses due to flood conditions. The ordinance requires that potential flood damage be evaluated at the time of initial construction of structures, facilities and utilities, and that certain uses be restricted or prohibited based on this County evaluation. The ordinance also requires that potential homebuyers be notified that property is located in a flood area. In addition, all construction must adhere to the Georgia State Minimum Standard Codes (Uniform Codes Act) and the International Building Code (2000 edition). The minimum standards established by these codes provide reasonable protection to persons and property within structures that comply with the regulations for most natural hazards.

According to the National Flood Insurance Reform Act, a repetitive loss structure is defined as "…a building covered by a contract for flood insurance that has incurred flood-related damages on two occasions during a 10-year period ending on the date of the event for which a second claim is made, in which the cost of repairing the flood damage, on the average, equaled or exceeded 25 percent of the market value of the building at the time of each such flood event." **As of September 2015, there is only one "repetitive loss structure" on file for Forsyth County.** *Specific addresses for repetitive loss structures cannot be included in this Plan, but a current list of these structures may be viewed in GMIS by authorized individuals, as determined by the EMA Director.*

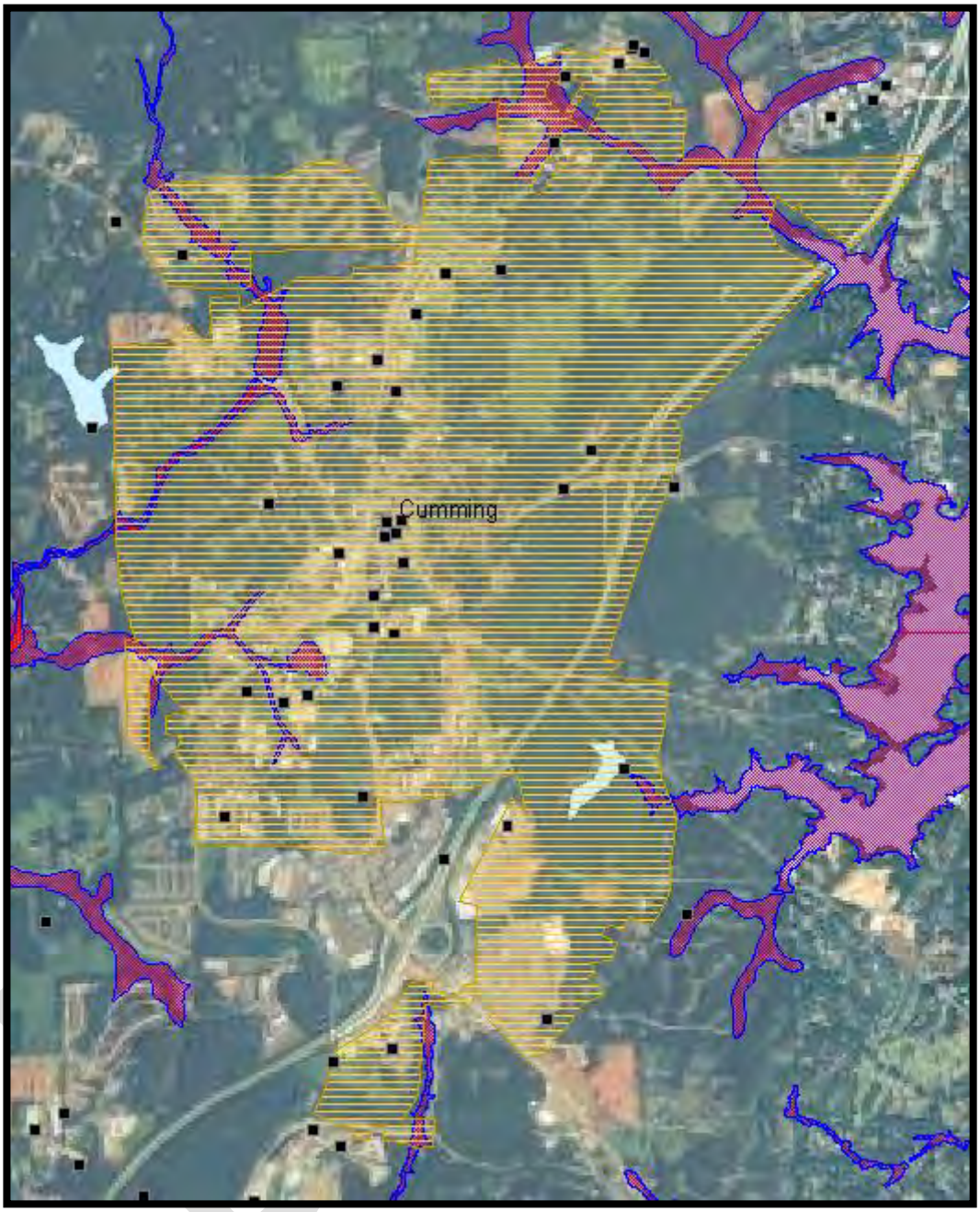
C. Assets Exposed to Hazard – In evaluating assets that may potentially be impacted by the effects of flooding, the HMPC attempted to identify all known structures located within or close to the identified 100-year floodplain.

Flood hazard scores are derived from the FEMA Q3 "Zone" values. The Q3 layer is derived from the FEMA paper flood insurance rate maps. The table below describes the different flood zones and applies to the flood maps that follow. These particular maps identify the locations of critical facilities in relationship to the known flooding hazard areas within Forsyth County and the City of Cumming.

Score	Original Value	Description
4 (red)	Floodway	Floodway (within zone AE)
	V	1% with Velocity no Base Flood Elevation (BFE)
	VE	1% with Velocity BFE
3 (amaranth, a deep pink color)	A	1% Annual Chance no BFE
	A99	1% Federal flood protection system
	AE	1% has BFE
	AH	1% Ponding has BFE
	AO	1% Sheet Flow has depths
	AR	1% Federal flood protection system
2 (purple)	X500	0.2% Annual Chance
1 (blue)	ANI	Area not included in survey
	D	Undetermined but possible
0 (gray)	UNDES	Undesignated
	X	Outside Flood Zones



City of Cumming



The main flooding threat within Forsyth County is the Etowah River. The Etowah River enters northwest Forsyth County from neighboring Dawson County. Flooding of the Etowah River within Dawson County has been successfully mitigated to a large degree thanks to past federal and state mitigation projects. A Dawson County flooding mitigation project during the 1970's involved the raising of a flood control dam, Etowah River Reach Sub Watershed Structure No. 12 – State I.D. No. 042-007-00625, to a height of approximately 57.6 feet in order to increase the control of Etowah River floodwaters. Another important mitigation project within Dawson County was completed in the early 1990's that reduced Etowah River flooding at SR 53 and the present location of the Georgia

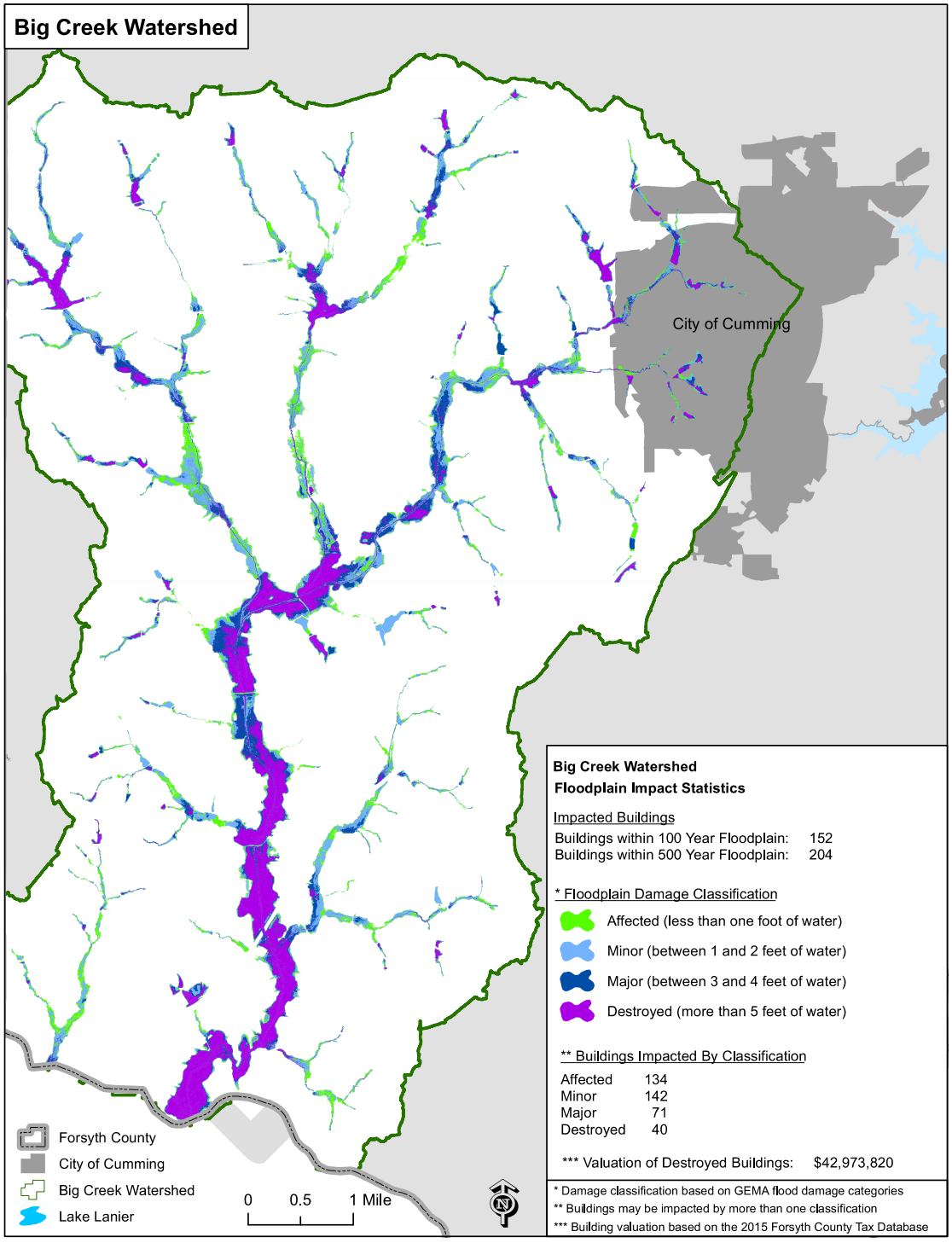
Forestry Commission Dawsonville offices and near the Etowah Water & Sewer Authority water intake. This project involved the addition of numerous erosion control measures and materials including the altering of the Etowah River banks in that area. Unfortunately, Forsyth County still experiences significant flooding of the Etowah River at a point where the Etowah makes a sharp turn near Old Federal Rd and Nicholson Rd. Such flooding has occurred on many occasions throughout Forsyth County history.

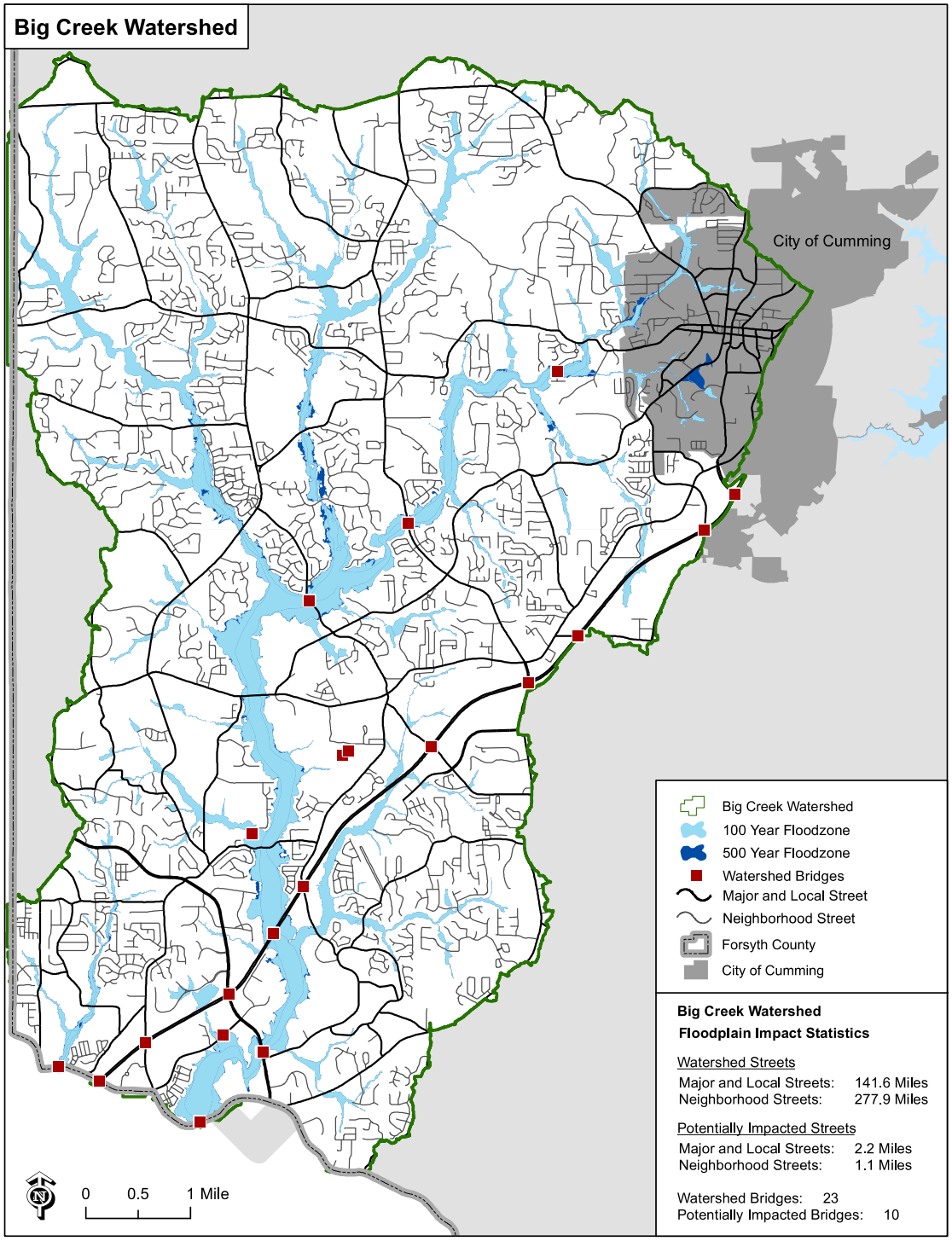
A second significant flood threat is found near the intersection of State Route 9 and Big Creek. This includes the areas located near Fowler Rd. Flooding of Big Creek has also occurred on many occasions in the past.

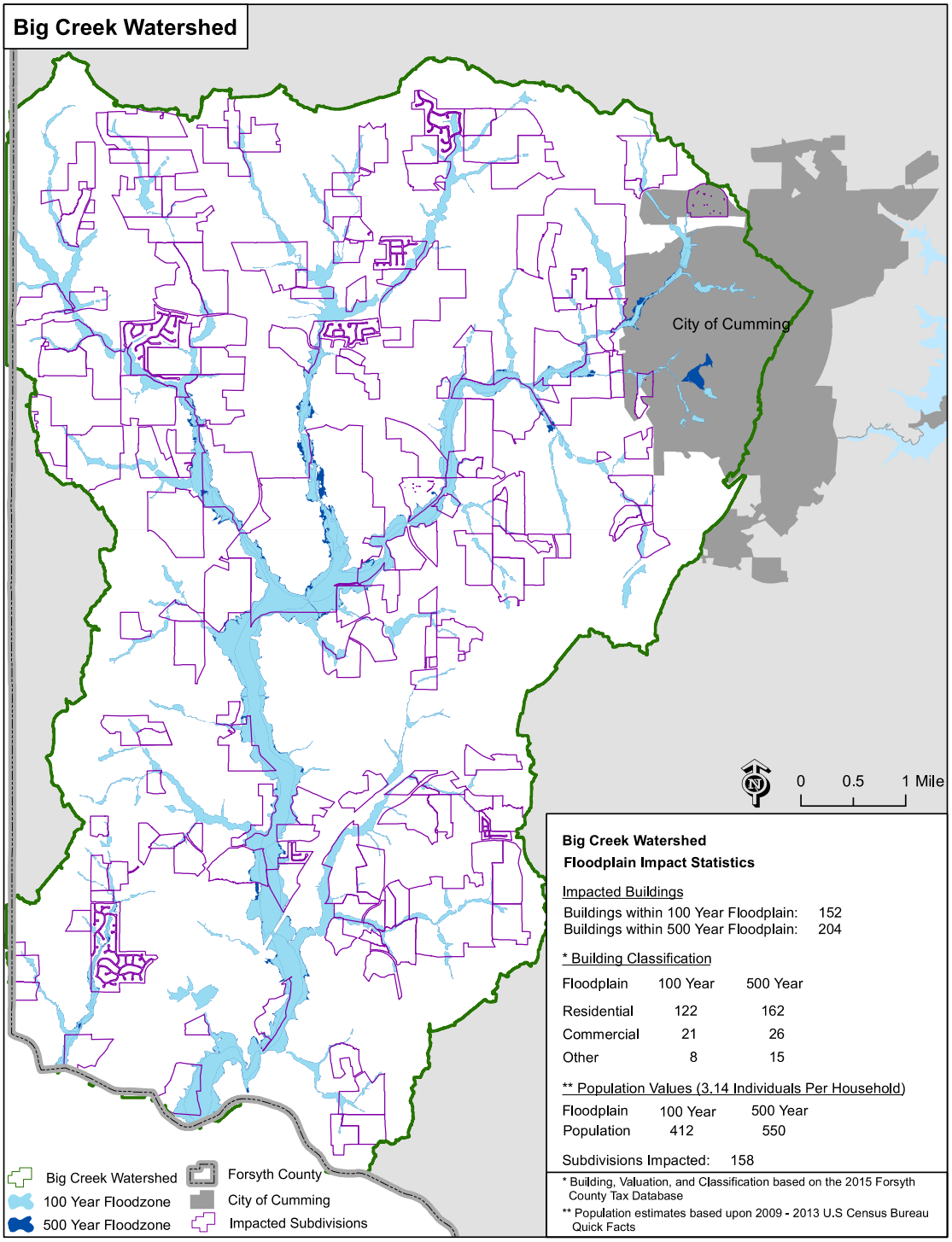
Within the City of Cumming, a flood threat exists on State Route 9 at the City of Cumming Water Treatment Facility. Sawnee Creek, located near the Water Treatment Facility, occasionally overflows its banks and, combined with a large volume of stormwater from adjoining parking lots and baseball fields, can flood the property. One consequence of this has been a six to seven foot hole washed out around a power pole that provides power to the Water Treatment Facility. Another fear is that, under the worst of circumstances, flooding could contaminate the City's water supply. Sawnee Creek also causes flooding problems along the residential streets of Pirklewood Circle, Franklin Way, and surrounding areas. Within this area, homes and streets have been flooded in the past.

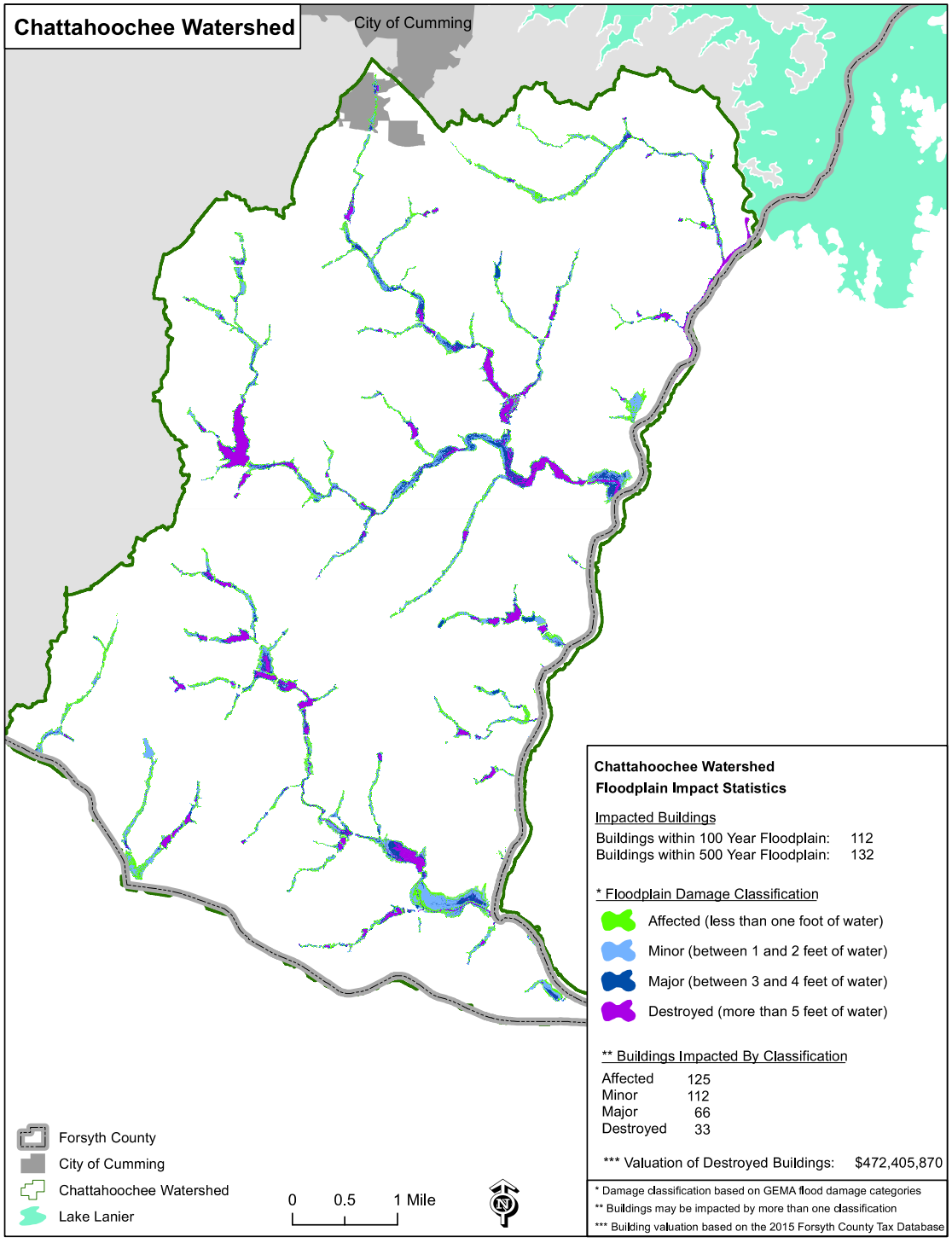
Flooding within the City of Cumming also occurs along Pine Lake Drive and Hickory Knoll in the Hickory Ridge Subdivision. The source of flooding is Mill Branch. This flooding threatens to wash out these roads and has even flooded homes in the past. A main culvert in this area is undersized and will need to be replaced to correct this problem.

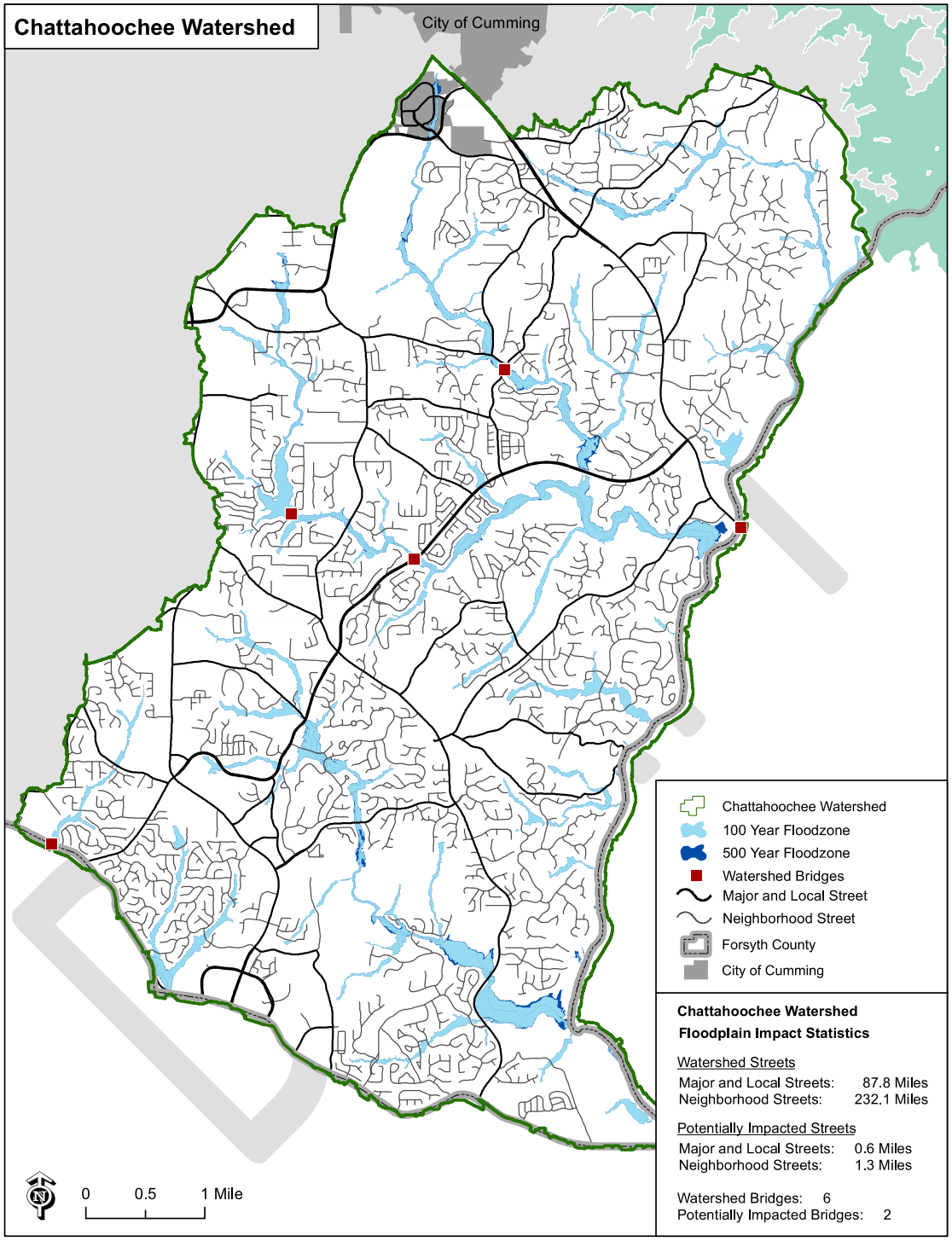
The following 12 maps display the flood hazard areas broken down by each individual watershed (four watersheds; three maps each).

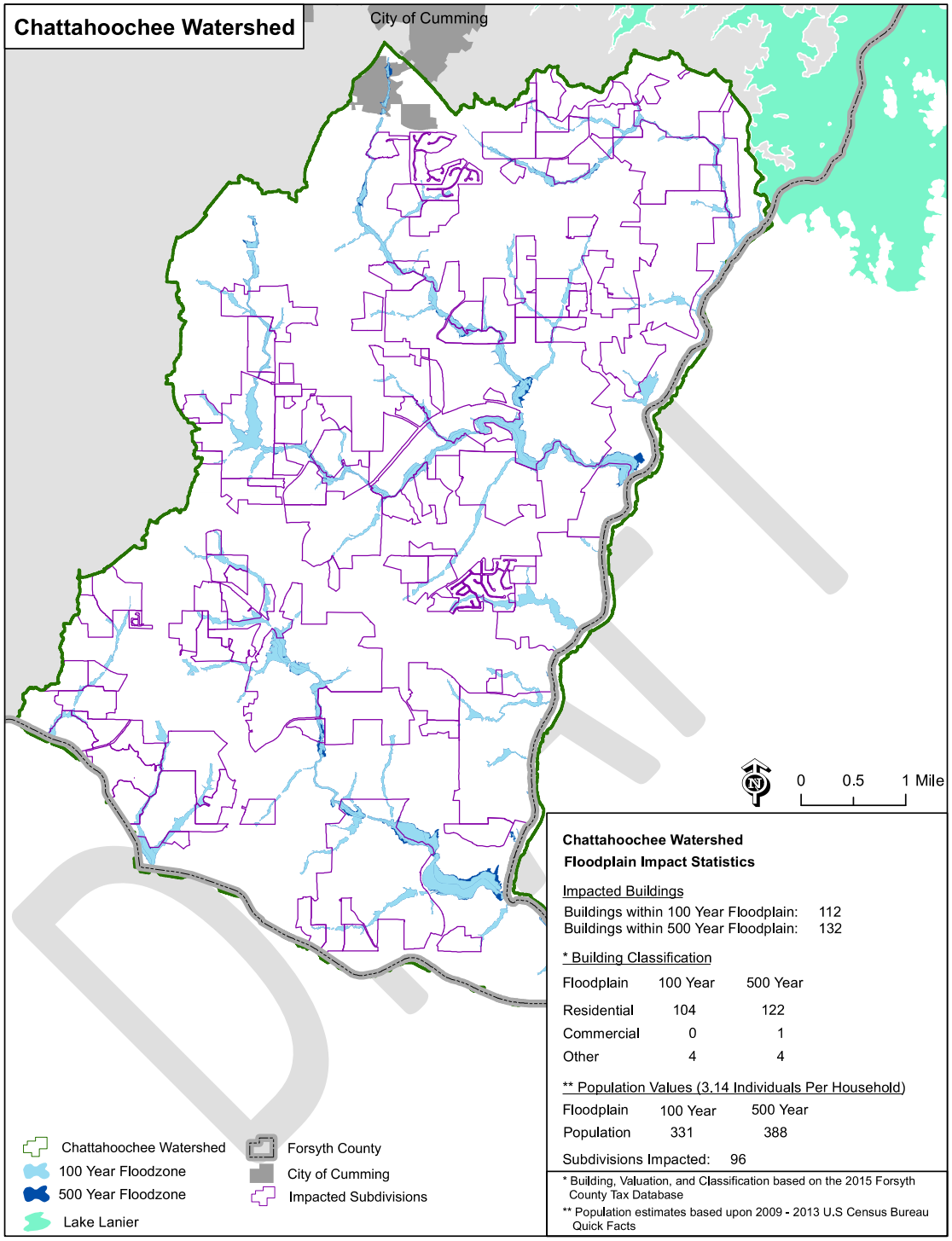

Big Creek Watershed
City of Cumming
Big Creek Watershed
Floodplain Impact Statistics
Impacted Buildings
Buildings within 100 Year Floodplain: 152
Buildings within 500 Year Floodplain: 204
* Floodplain Damage Classification
Affected (less than one foot of water)
Minor (between 1 and 2 feet of water)
Major (between 3 and 4 feet of water)
Destroyed (more than 5 feet of water)
** Buildings Impacted By Classification
Affected 134
Minor 142
Major 71
Destroyed 40
*** Valuation of Destroyed Buildings: $42,973,820
* Damage classification based on GEMA flood damage categories
** Buildings may be impacted by more than one classification
*** Building valuation based on the 2015 Forsyth County Tax Database
Forsyth County
City of Cumming
Big Creek Watershed
Lake Lanier
0 0.5 1 Mile

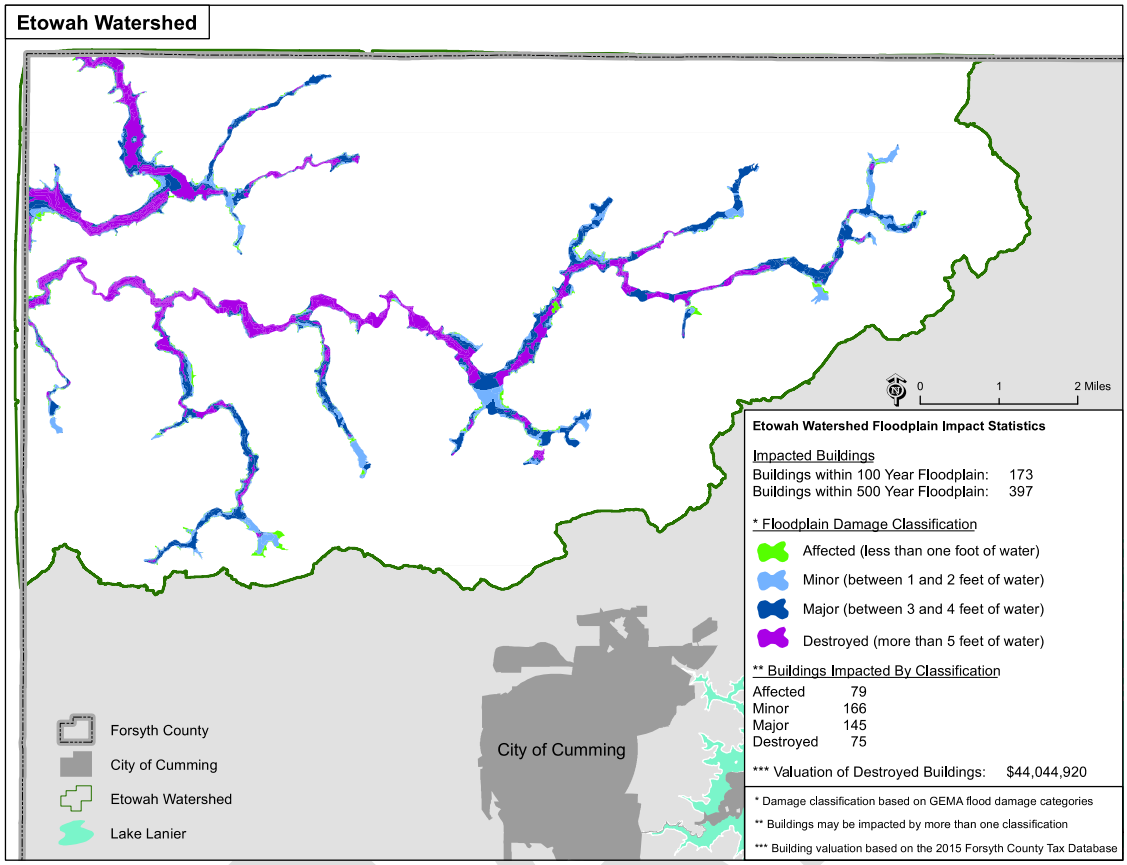

Big Creek Watershed
City of Cumming
Big Creek Watershed
100 Year Floodzone
500 Year Floodzone
Watershed Bridges
Major and Local Street
Neighborhood Street
Forsyth County
City of Cumming
Big Creek Watershed
Floodplain Impact Statistics
Watershed Streets
Major and Local Streets: 141.6 Miles
Neighborhood Streets: 277.9 Miles
Potentially Impacted Streets
Major and Local Streets: 2.2 Miles
Neighborhood Streets: 1.1 Miles
Watershed Bridges: 23
Potentially Impacted Bridges: 10
0 0.5 1 Mile

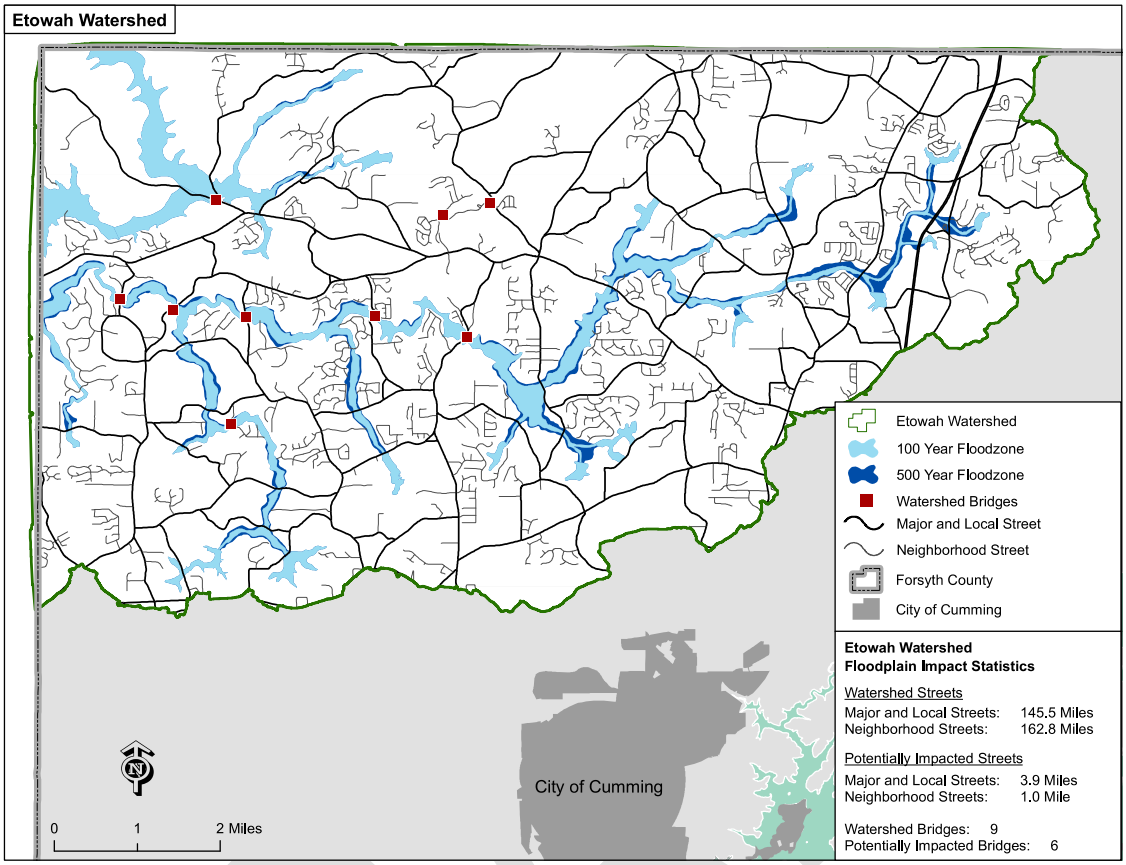

Big Creek Watershed
City of Cumming
0
0.5
1 Mile
Big Creek Watershed
Floodplain Impact Statistics
Impacted Buildings
Buildings within 100 Year Floodplain: 152
Buildings within 500 Year Floodplain: 204
* Building Classification
Floodplain 100 Year 500 Year
Residential 122 162
Commercial 21 26
Other 8 15
** Population Values (3.14 Individuals Per Household)
Floodplain 100 Year 500 Year
Population 412 550
Subdivisions Impacted: 158
* Building, Valuation, and Classification based on the 2015 Forsyth County Tax Database
** Population estimates based upon 2009 - 2013 U.S Census Bureau Quick Facts
Big Creek Watershed
100 Year Floodzone
500 Year Floodzone
Forsyth County
City of Cumming
Impacted Subdivisions

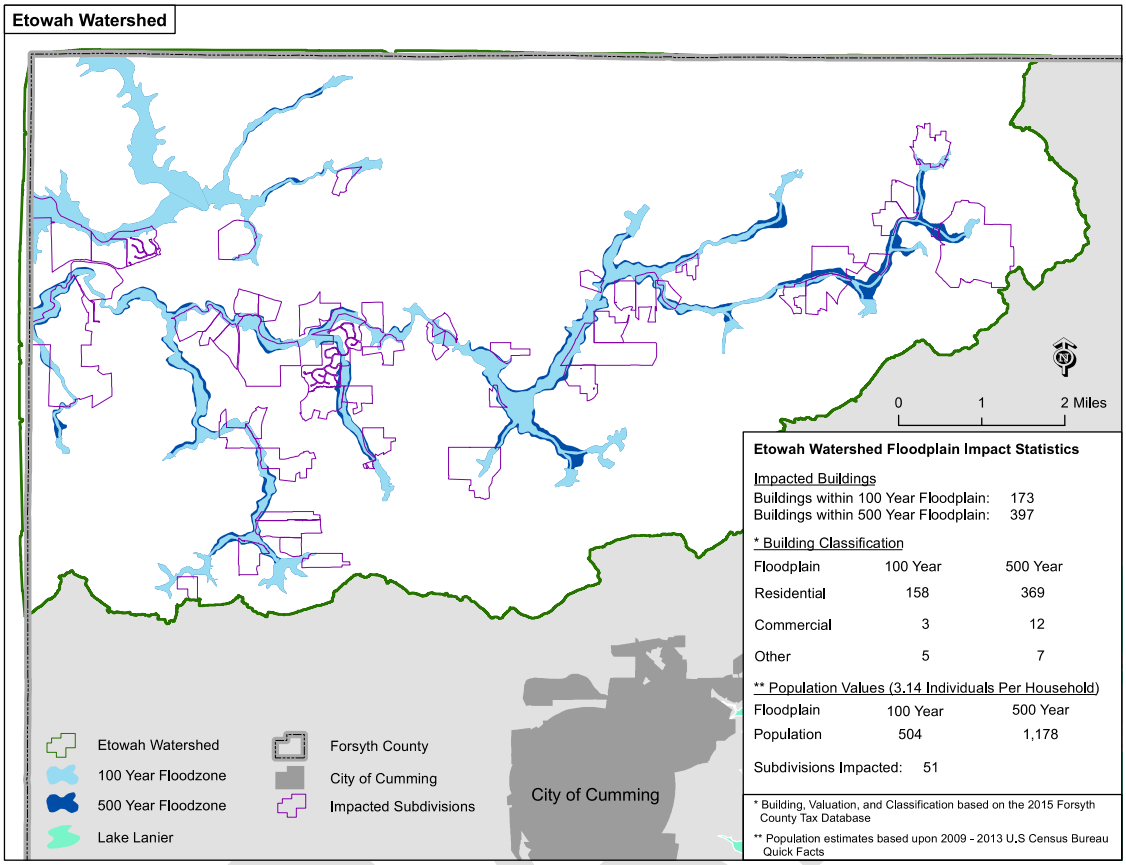

Chattahoochee Watershed
City of Cumming
Chattahoochee Watershed
Floodplain Impact Statistics
Impacted Buildings
Buildings within 100 Year Floodplain: 112
Buildings within 500 Year Floodplain: 132
* Floodplain Damage Classification
Affected (less than one foot of water)
Minor (between 1 and 2 feet of water)
Major (between 3 and 4 feet of water)
Destroyed (more than 5 feet of water)
** Buildings Impacted By Classification
Affected 125
Minor 112
Major 66
Destroyed 33
*** Valuation of Destroyed Buildings: $472,405,870
* Damage classification based on GEMA flood damage categories
** Buildings may be impacted by more than one classification
*** Building valuation based on the 2015 Forsyth County Tax Database
Forsyth County
City of Cumming
Chattahoochee Watershed
Lake Lanier
0 0.5 1 Mile
N

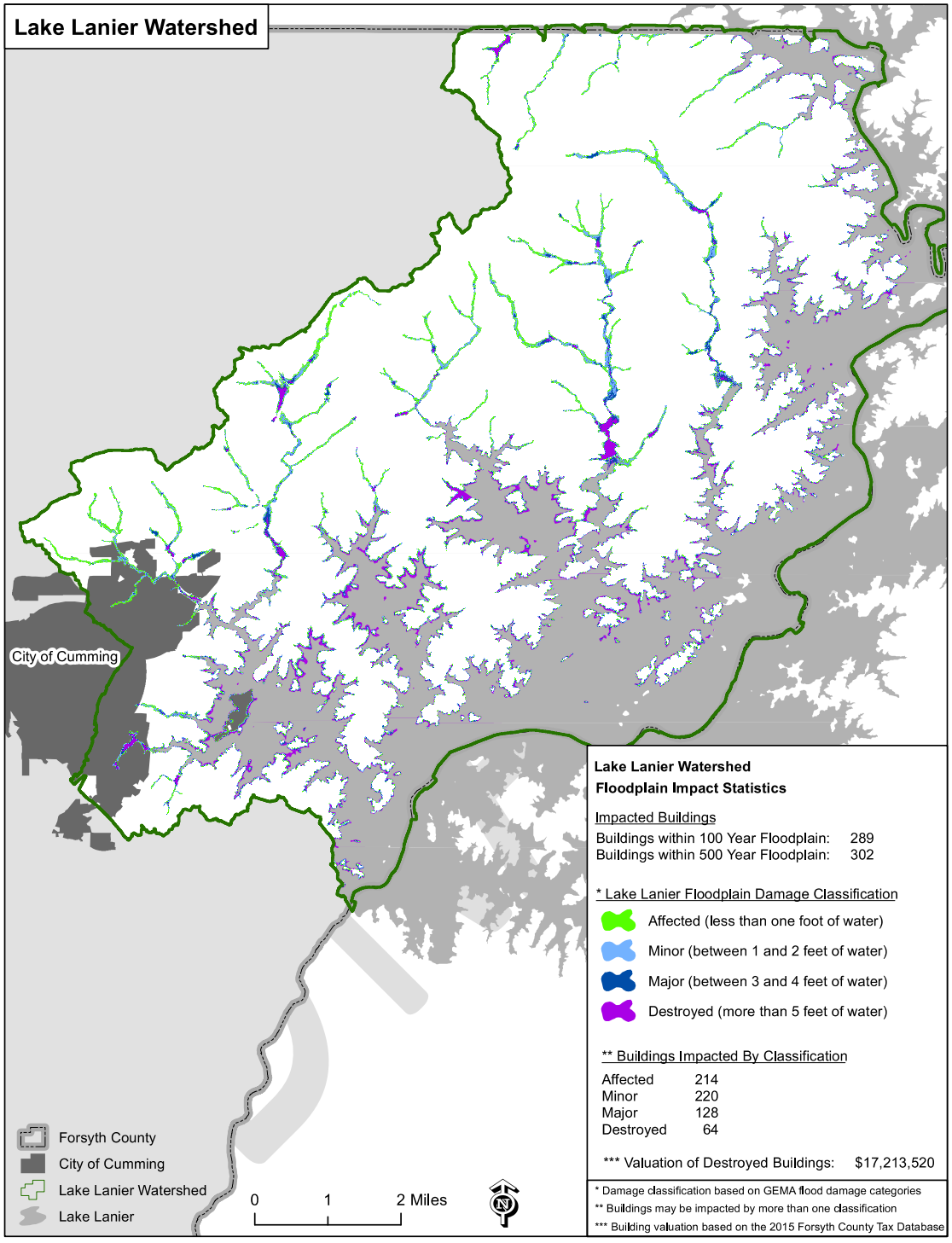

Chattahoochee Watershed
City of Cumming
Chattahoochee Watershed
100 Year Floodzone
500 Year Floodzone
Watershed Bridges
Major and Local Street
Neighborhood Street
Forsyth County
City of Cumming
Chattahoochee Watershed
Floodplain Impact Statistics
Watershed Streets
Major and Local Streets: 87.8 Miles
Neighborhood Streets: 232.1 Miles
Potentially Impacted Streets
Major and Local Streets: 0.6 Miles
Neighborhood Streets: 1.3 Miles
Watershed Bridges: 6
Potentially Impacted Bridges: 2
0
0.5
1 Mile

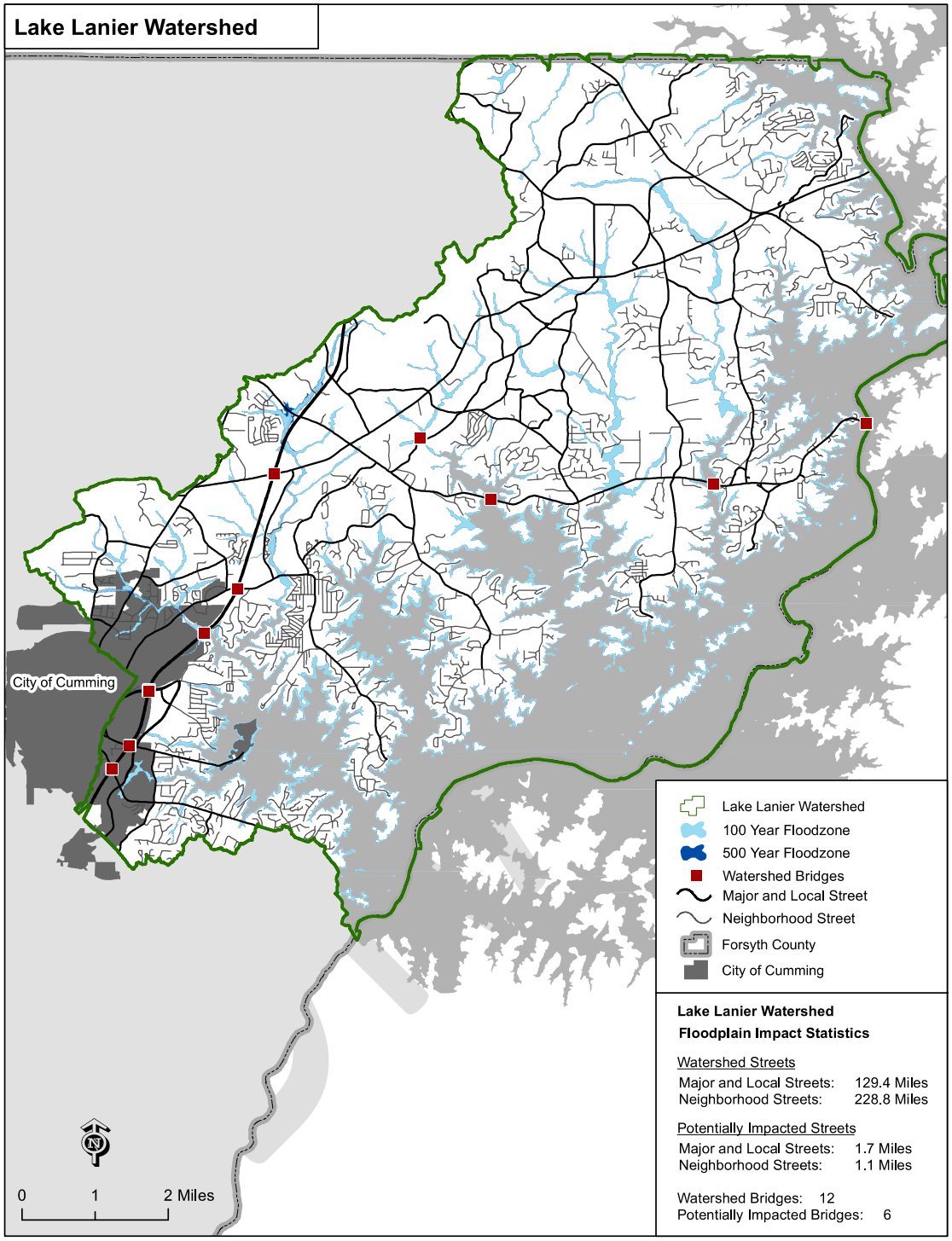

Chattahoochee Watershed
City of Cumming
0 0.5 1 Mile
Chattahoochee Watershed
Floodplain Impact Statistics
Impacted Buildings
Buildings within 100 Year Floodplain: 112
Buildings within 500 Year Floodplain: 132
* Building Classification
Floodplain 100 Year 500 Year
Residential 104 122
Commercial 0 1
Other 4 4
** Population Values (3.14 Individuals Per Household)
Floodplain 100 Year 500 Year
Population 331 388
Subdivisions Impacted: 96
* Building, Valuation, and Classification based on the 2015 Forsyth County Tax Database
** Population estimates based upon 2009 - 2013 U.S Census Bureau Quick Facts
Chattahoochee Watershed
100 Year Floodzone
500 Year Floodzone
Lake Lanier
Forsyth County
City of Cumming
Impacted Subdivisions

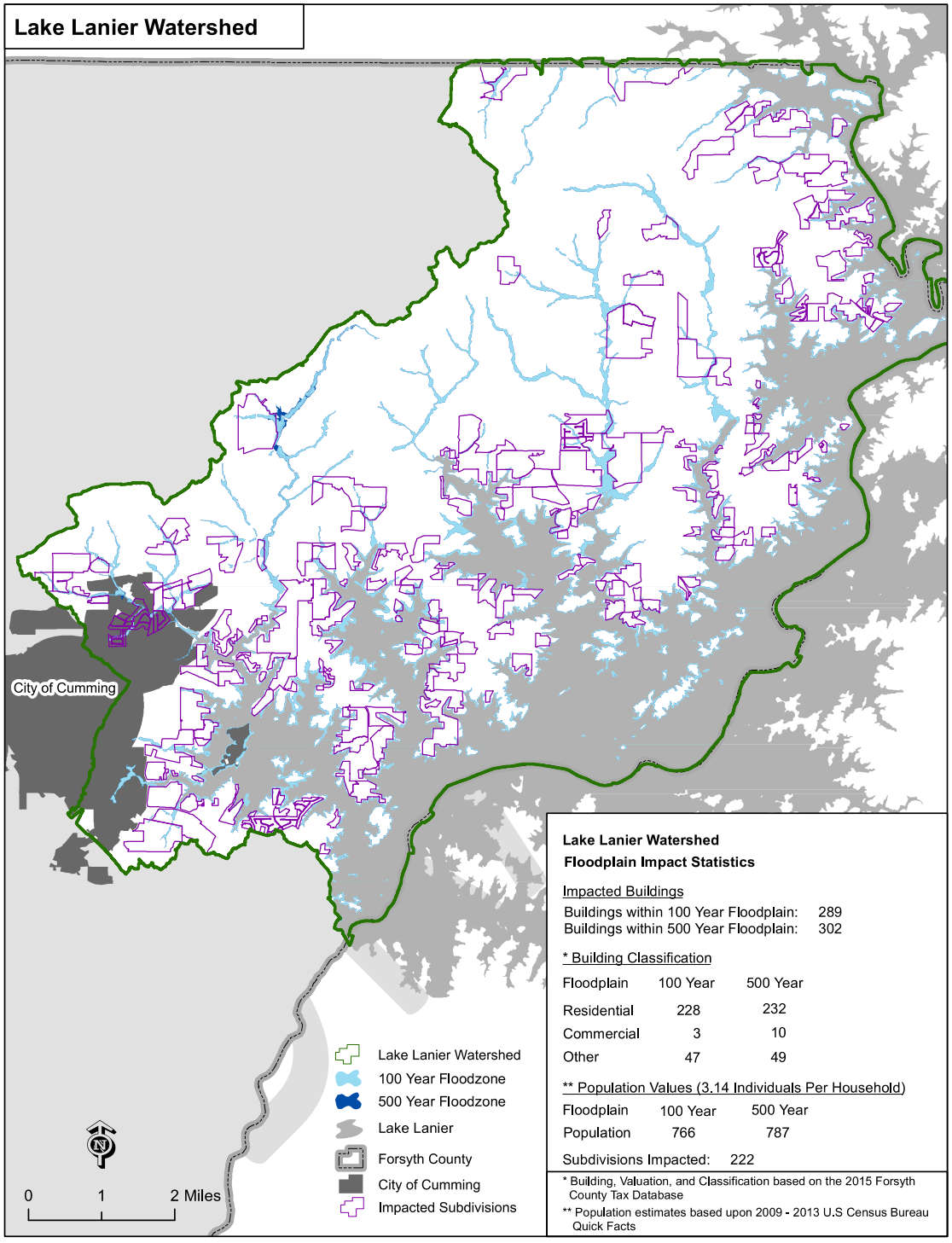

Etowah Watershed
0
1
2 Miles
Etowah Watershed Floodplain Impact Statistics
Impacted Buildings
Buildings within 100 Year Floodplain: 173
Buildings within 500 Year Floodplain: 397
* Floodplain Damage Classification
Affected (less than one foot of water)
Minor (between 1 and 2 feet of water)
Major (between 3 and 4 feet of water)
Destroyed (more than 5 feet of water)
** Buildings Impacted By Classification
Affected 79
Minor 166
Major 145
Destroyed 75
*** Valuation of Destroyed Buildings: $44,044,920
* Damage classification based on GEMA flood damage categories
** Buildings may be impacted by more than one classification
*** Building valuation based on the 2015 Forsyth County Tax Database
Forsyth County
City of Cumming
Etowah Watershed
Lake Lanier
City of Cumming


Etowah Watershed
Etowah Watershed
100 Year Floodzone
500 Year Floodzone
Watershed Bridges
Major and Local Street
Neighborhood Street
Forsyth County
City of Cumming
Etowah Watershed
Floodplain Impact Statistics
Watershed Streets
Major and Local Streets: 145.5 Miles
Neighborhood Streets: 162.8 Miles
Potentially Impacted Streets
Major and Local Streets: 3.9 Miles
Neighborhood Streets: 1.0 Mile
Watershed Bridges: 9
Potentially Impacted Bridges: 6
City of Cumming
0
1
2 Miles

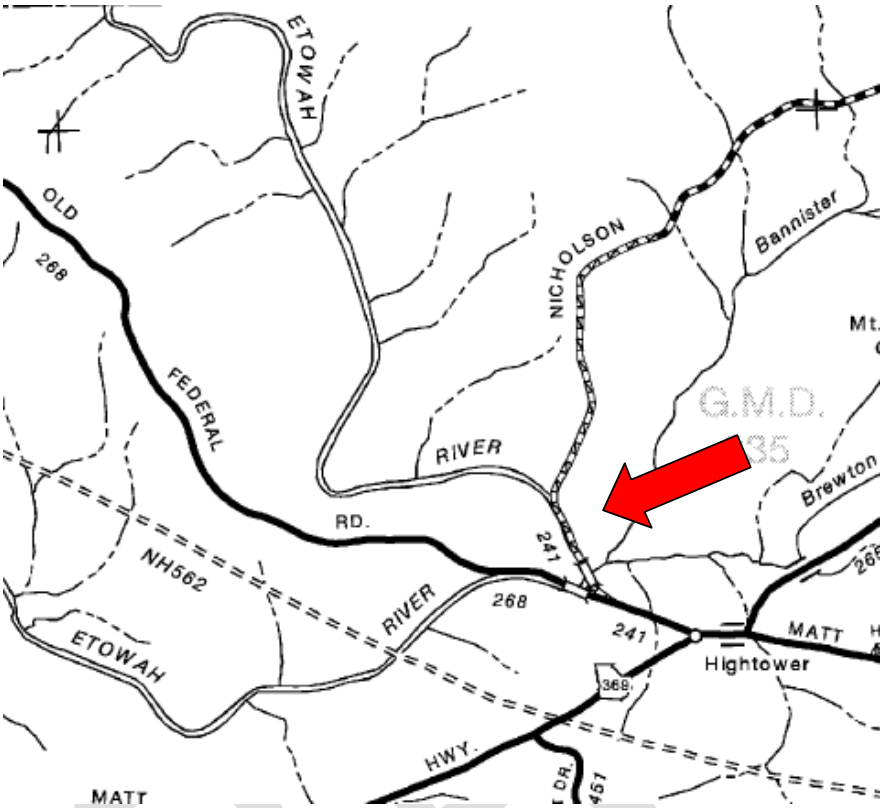

Etowah Watershed
0
1
2 Miles
Etowah Watershed Floodplain Impact Statistics
Impacted Buildings
Buildings within 100 Year Floodplain: 173
Buildings within 500 Year Floodplain: 397
* Building Classification
Floodplain 100 Year 500 Year
Residential 158 369
Commercial 3 12
Other 5 7
** Population Values (3.14 Individuals Per Household)
Floodplain 100 Year 500 Year
Population 504 1,178
Subdivisions Impacted: 51
* Building, Valuation, and Classification based on the 2015 Forsyth County Tax Database
** Population estimates based upon 2009 - 2013 U.S Census Bureau Quick Facts
Etowah Watershed
100 Year Floodzone
500 Year Floodzone
Lake Lanier
Forsyth County
City of Cumming
Impacted Subdivisions
City of Cumming


Lake Lanier Watershed
City of Cumming
Lake Lanier Watershed
Floodplain Impact Statistics
Impacted Buildings
Buildings within 100 Year Floodplain: 289
Buildings within 500 Year Floodplain: 302
* Lake Lanier Floodplain Damage Classification
Affected (less than one foot of water)
Minor (between 1 and 2 feet of water)
Major (between 3 and 4 feet of water)
Destroyed (more than 5 feet of water)
** Buildings Impacted By Classification
Affected 214
Minor 220
Major 128
Destroyed 64
*** Valuation of Destroyed Buildings: $17,213,520
* Damage classification based on GEMA flood damage categories
** Buildings may be impacted by more than one classification
*** Building valuation based on the 2015 Forsyth County Tax Database
Forsyth County
City of Cumming
Lake Lanier Watershed
Lake Lanier
0
1
2 Miles

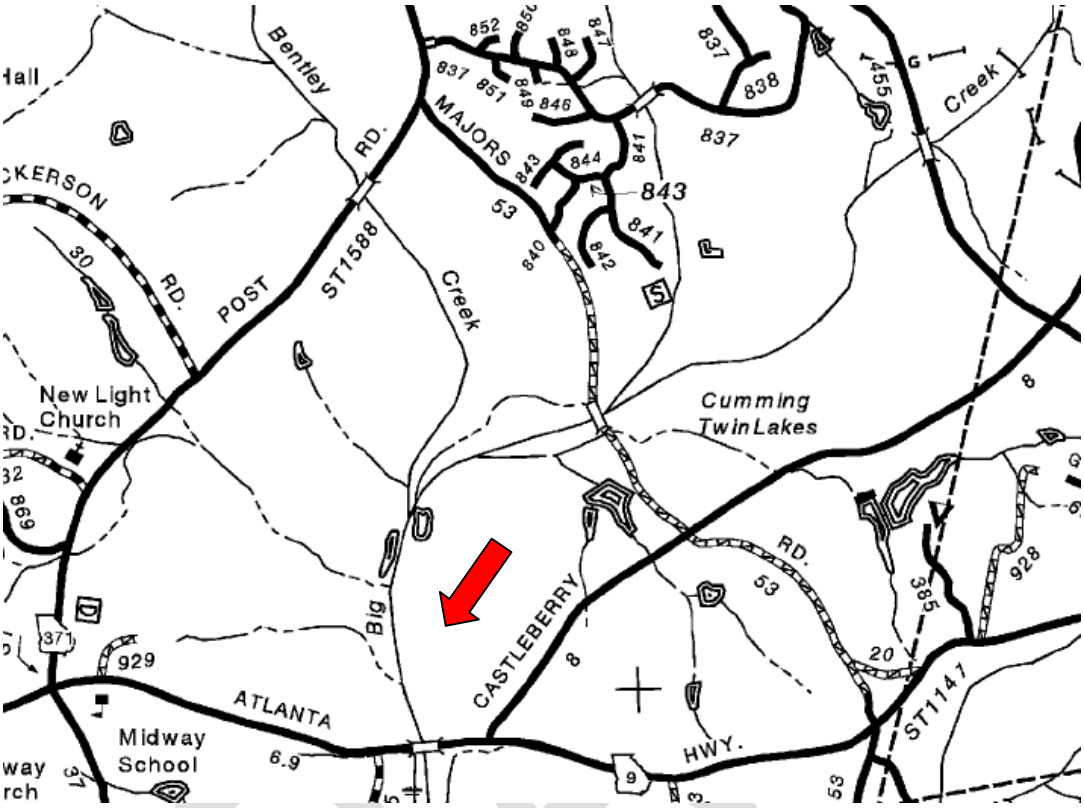

Lake Lanier Watershed
City of Cumming
0
1
2 Miles
Lake Lanier Watershed
100 Year Floodzone
500 Year Floodzone
Watershed Bridges
Major and Local Street
Neighborhood Street
Forsyth County
City of Cumming
Lake Lanier Watershed
Floodplain Impact Statistics
Watershed Streets
Major and Local Streets: 129.4 Miles
Neighborhood Streets: 228.8 Miles
Potentially Impacted Streets
Major and Local Streets: 1.7 Miles
Neighborhood Streets: 1.1 Miles
Watershed Bridges: 12
Potentially Impacted Bridges: 6

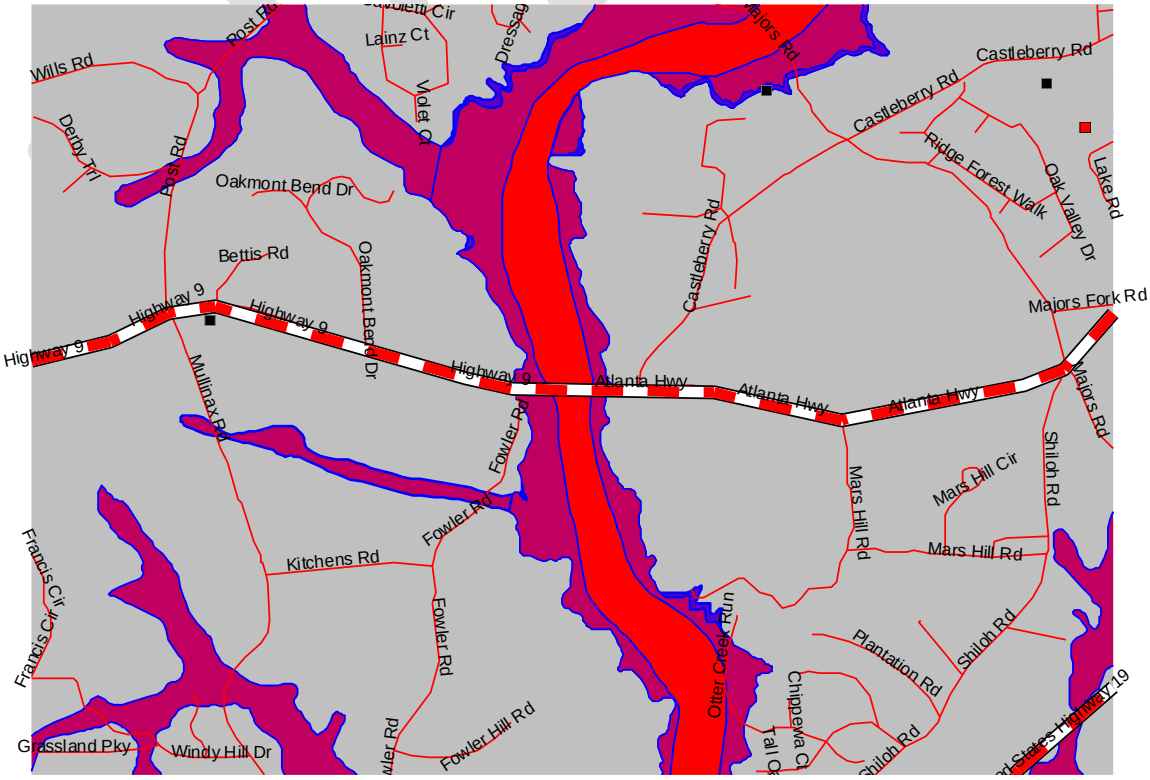

Lake Lanier Watershed
City of Cumming
0
1
2 Miles
Lake Lanier Watershed
100 Year Floodzone
500 Year Floodzone
Lake Lanier
Forsyth County
City of Cumming
Impacted Subdivisions
Lake Lanier Watershed
Floodplain Impact Statistics
Impacted Buildings
Buildings within 100 Year Floodplain: 289
Buildings within 500 Year Floodplain: 302
* Building Classification
Floodplain 100 Year 500 Year
Residential 228 232
Commercial 3 10
Other 47 49
** Population Values (3.14 Individuals Per Household)
Floodplain 100 Year 500 Year
Population 766 787
Subdivisions Impacted: 222
* Building, Valuation, and Classification based on the 2015 Forsyth County Tax Database
** Population estimates based upon 2009 - 2013 U.S Census Bureau Quick Facts

One of the main flooding threats to Forsyth County is located in the vicinity of Old Federal Rd and Nicholson Rd in the Northwest corner of Forsyth County. See the following two maps.

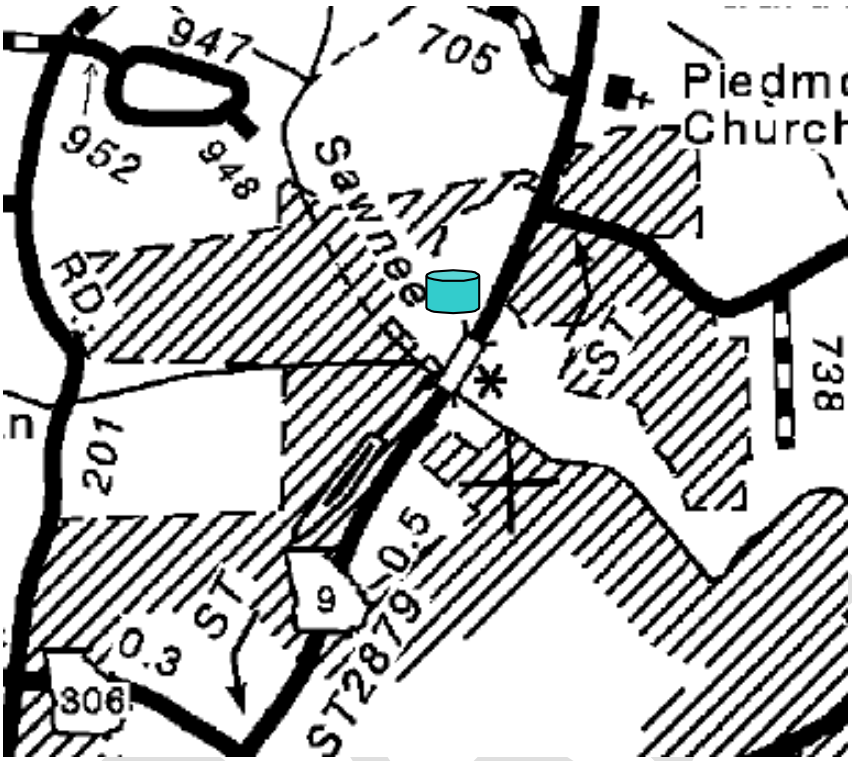


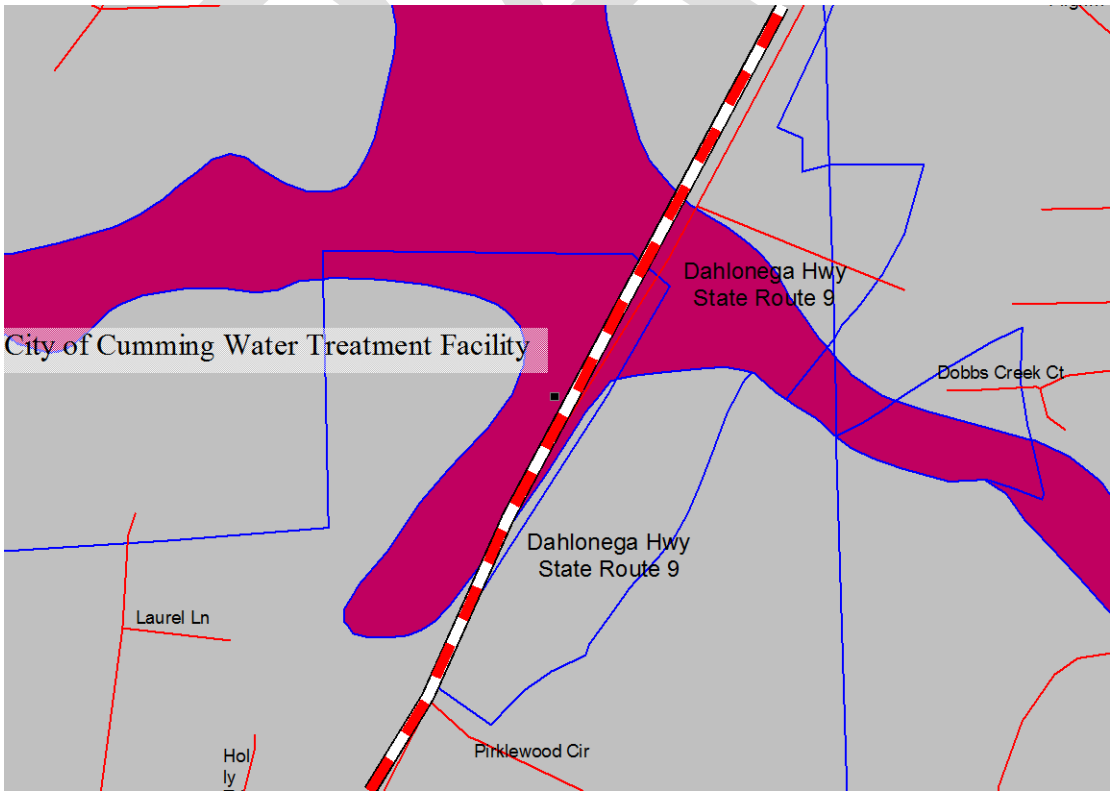
The next two maps show in more detail the location of the Big Creek problem area, which is located on the south side of the County near Big Creek and State Route 9.



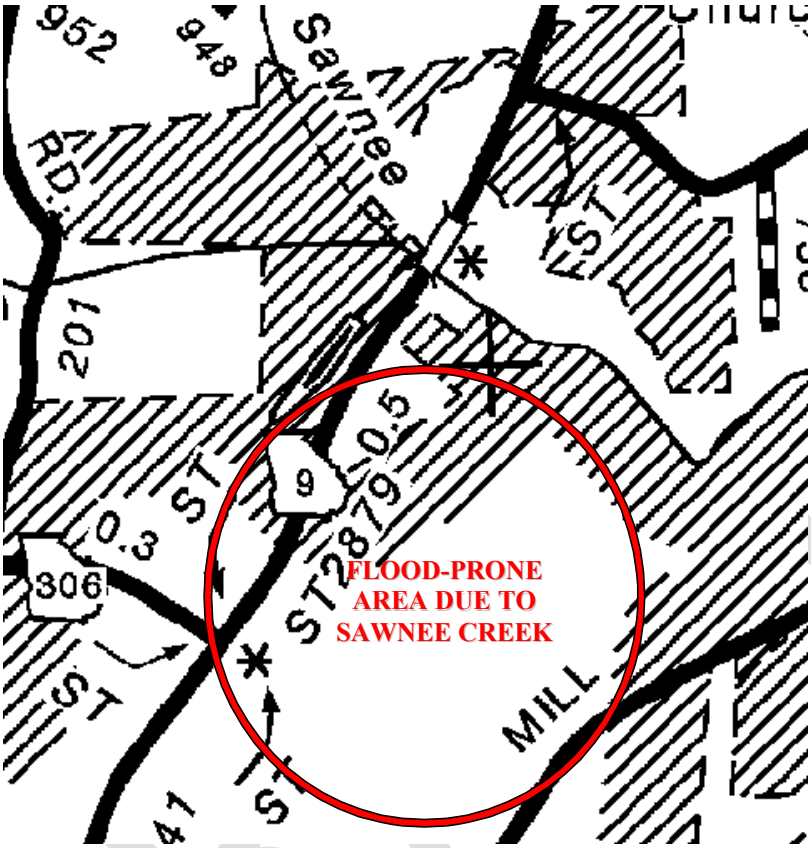


The two maps below identify the location of the City of Cumming Water Treatment Facility on State Route 9 which is impacted by Sawnee Creek.

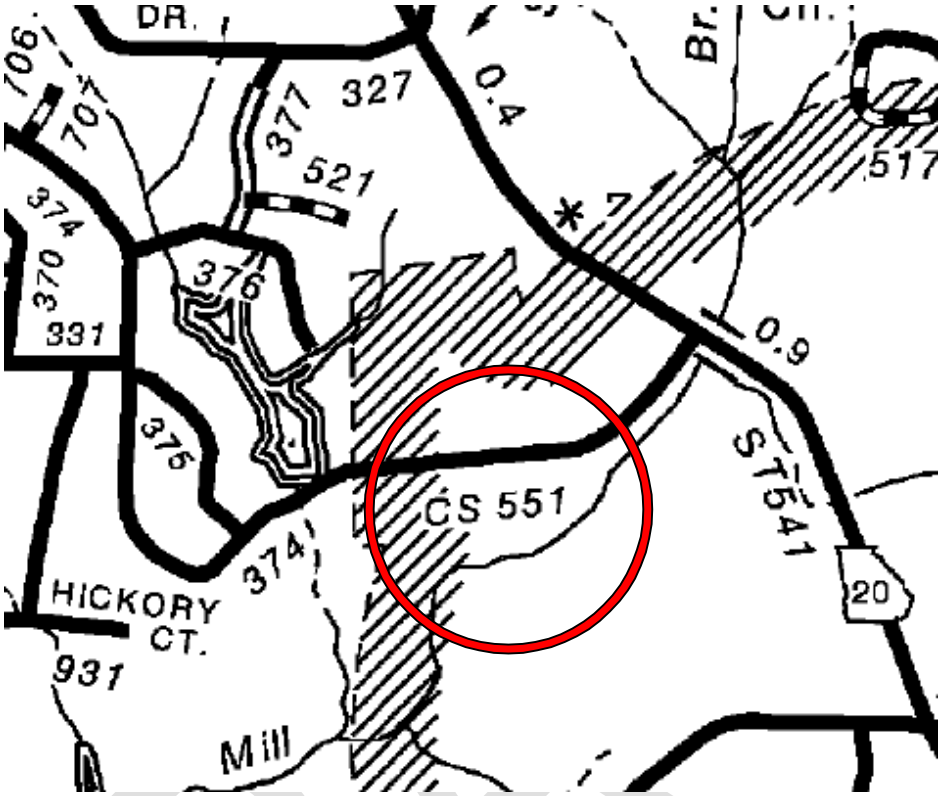




Sawnee Creek is also the main contributing factor to flooding in the vicinity of Pirklewood Circle, Franklin Way, and surrounding areas in the City of Cumming. See the following two maps.



Finally, the Hickory Ridge Subdivision is impacted by Mill Branch along Pine Lake Drive and Hickory Knoll. See the following two maps.



D. Estimate of Potential Losses – For loss estimate information, please refer to Appendix A, the Critical Facilities Database, and Appendix D, Worksheet 3a (Flooding), for each jurisdiction. Currently, no Worksheet 3a is available for the City of Cumming for flooding. However, a mitigation action item has been added to this Plan that will address this lack of information and will include the Worksheet 3a for the City of Cumming in an update to this Plan.

E. Multi-Jurisdictional Concerns – With a large enough flood event, many portions of Forsyth County can potentially be impacted by flooding; however, the areas most prone to flooding have historically been those areas located within the 100-year floodplain. As a general rule, most of the flooding problems associated with Forsyth County and the City of Cumming are in the areas where flood insurance claims have occurred. These are the areas of potential repetitive flood losses, although at this time there is only one reported residential repetitive flood loss on file. It should be noted that, although there is only one such loss on file, there have undoubtedly been other locations over the years that have flooded multiple times even though a claim may not have been filed.

F. Hazard Summary – Flooding has the potential to inflict significant damage within Forsyth County. Mitigation of flood damage requires the community to have knowledge of flood-prone areas, including roads, bridges, bodies of water, and critical facilities, as well as the location of the County's designated shelters. The Forsyth County HMPC identified flooding as a hazard requiring mitigation measures and identified specific mitigation goals, objectives and action items they deemed necessary to lessen the impact of flooding. These findings are found in Chapter 5.

2.4 Tornados

A. Hazard Identification – A tornado is a dark, funnel-shaped cloud containing violently rotating air that develops below a heavy cumulonimbus cloud mass and extends toward the earth. The funnel twists about, rises and falls, and where it reaches the earth causes great destruction. The diameter of a tornado varies from a few feet to a mile; the rotating winds attain velocities of 200 to 300 mph, and the updraft at the center may reach 200 mph. A tornado is usually accompanied by thunder, lightning, heavy rain, and a loud "freight train" noise. In comparison with a hurricane, a tornado covers a much smaller area but can be just as violent and destructive. The atmospheric conditions required for the formation of a tornado include great thermal instability, high humidity, and the convergence of warm, moist air at low levels with cooler, drier air aloft. A tornado travels in a generally northeasterly direction with a speed of 20 to 40 mph. The length of a tornado's path along the ground varies from less than one mile to several hundred.

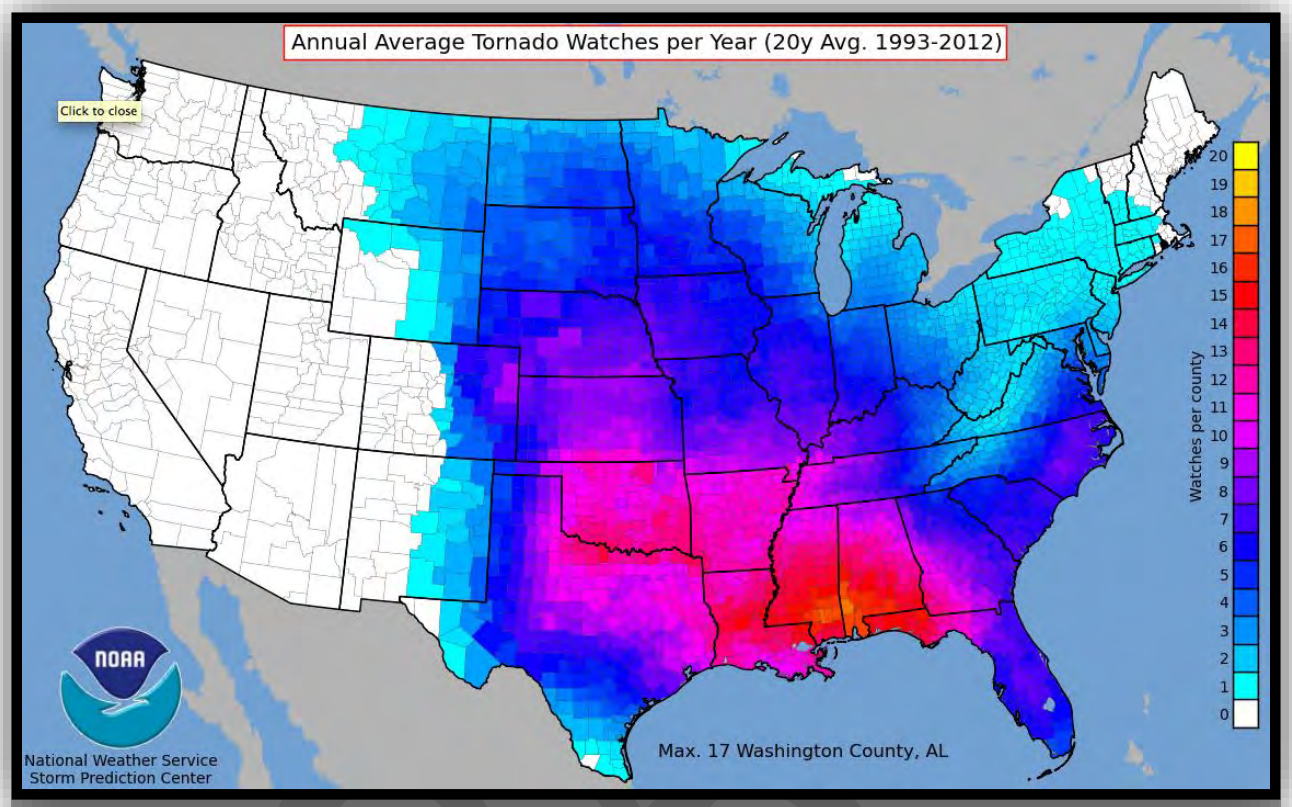
The Fujita Scale was the standard scale in the United States for rating the severity of a tornado as measured by the damage it causes from 1971 to 2007 (see table below).

The Fujita Scale of Tornado Intensity

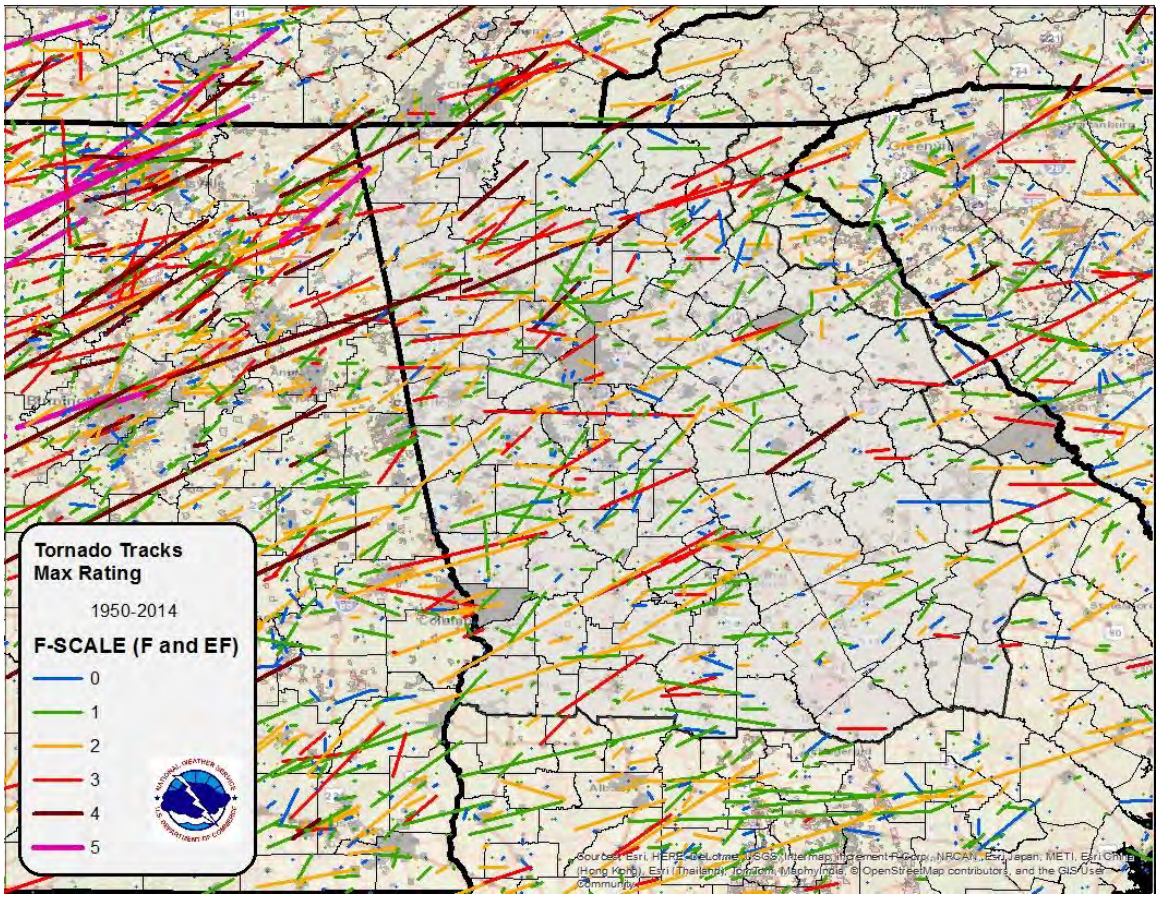
F-Scale Number	Intensity Phrase	Wind Speed	Type of Damage Done
F0	Gale tornado	40-72 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.
F1	Moderate tornado	73-112 mph	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant tornado	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	Severe tornado	158-206 mph	Roof and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted
F4	Devastating tornado	207-260 mph	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	Incredible tornado	261-318 mph	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures badly damaged.

The Enhanced Fujita (EF) Scale for Tornado Damage is an update to the original Fujita Scale by a team of meteorologists and wind engineers that was implemented in the United States in 2007. The EF Scale is still a set of wind estimates (not measurements) based on damage. It uses three-second gusts estimated at the point of damage based on a judgment of 8 levels of damage to 28 indicators. These estimates vary with height and exposure. The three-second gust is not the same wind as in standard surface observations. Standard measurements are taken by weather stations in open exposures, using a directly measured, "one-minute mile" speed.

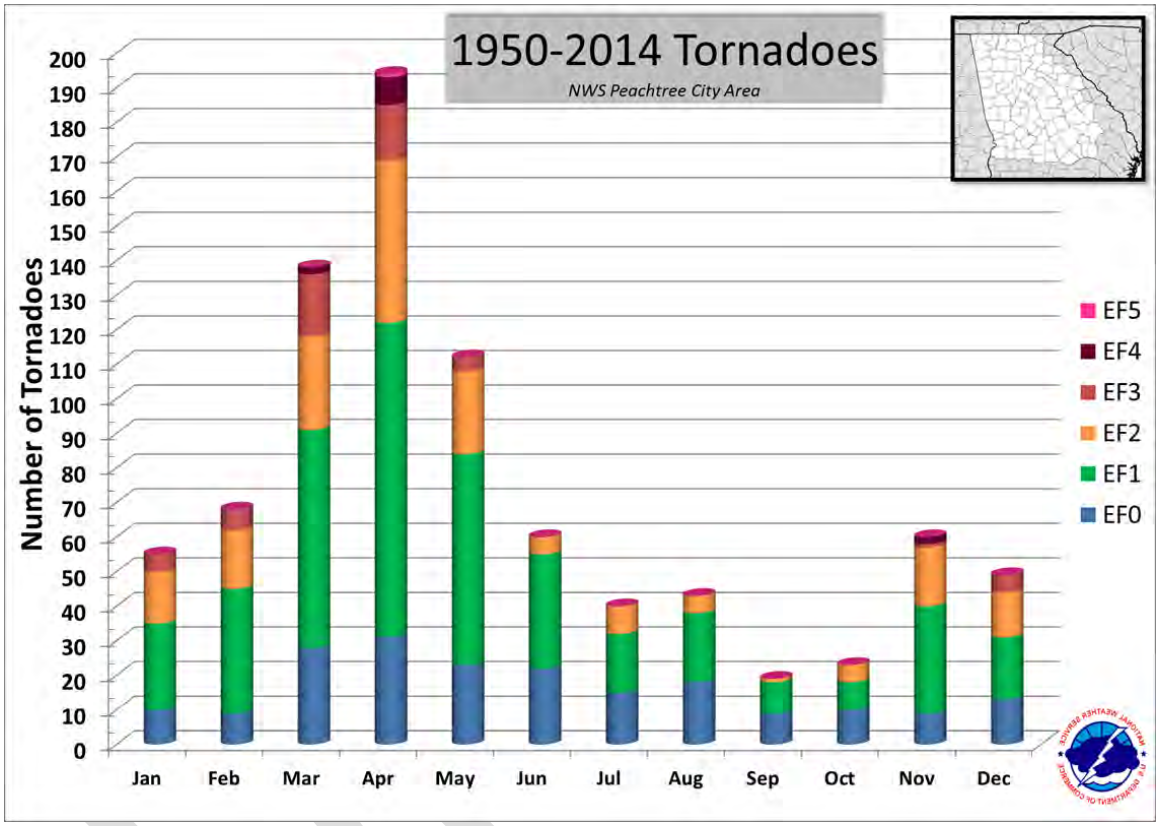
The NOAA map below represents the average annual number of NOAA Storm Prediction Center tornado watches (per county) from 1993 through 2012. This is the latest version of this NOAA Map. Forsyth County averaged six per year during this time period. Although this 20 year time period does not match up exactly with the timelines reviewed within this Plan, the map is a valuable visual aid by providing a nationwide perspective on potential tornado activity.


Annual Average Tornado Watches per Year (20y Avg. 1993-2012)
Click to close
Watches per county
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Max. 17 Washington County, AL
NOAA
National Weather Service
Storm Prediction Center

The following NOAA maps represent the United States severe report database (tornadoes 1950-2014) converted into shapefile (.shp) file format along with a Geographic Information System (GIS) database. In other words, these maps show the estimated paths and intensities of recorded tornados over this time period. Although this 64-year time period does not match up exactly with the 50-year timeline reviewed within this Plan, the map remains a valuable visual aid by providing a regional perspective on historical tornado activity.



Tornados are considered to be the most unpredictable and destructive of weather events in Georgia, even though they are not the most frequently occurring natural hazard within Forsyth County. Tornado season in Georgia is ordinarily said to run from March through August, with the peak activity being in April. However, tornados can strike at any time of the year when certain atmospheric conditions are met, including during the coldest months of the year. See the National Weather Service graph below, which covers the NWS Peachtree City Area of Georgia.



B. Hazard Profile – All areas within Forsyth County are vulnerable to the threat of a tornado. There is simply no method to determine exactly when or where a tornado will occur. The Forsyth County Hazard Mitigation Planning Committee (HMPC) reviewed historical data from the Georgia Tornado Database, the National Climatic Data Center, and various online resources in researching the past effects of tornados within the County. With most of the County's recorded tornado events, only basic information was available. However, dozens of tornado watches have been recorded during this period, and certainly some tornados go undetected or unreported. Therefore, any conclusions reached based upon available information on tornados within Forsyth County should be treated as the minimal possible threat.

In the Peachtree City County Warning Area (CWA), which includes Forsyth County, the average number of tornado days per year is six, according to the National Weather Service. While tornadoes have been reported in all months of the year, most occur in the months of March, April, and May. During this "tornado season" the most likely time of occurrence is from mid-afternoon through early evening. Tornado intensities of F2 or greater are involved in 37% of the events when the data is broken down into a county-by-county basis. These strong tornados are more likely to occur during the month of April than in any other month.

National Climatic Data Center (NCDC) and other records show that ten tornados occurred within the County over the past fifty years, which equates to a 20% annual frequency of reported events. It would appear that tornado activity has fluctuated over time within the County. This may be the case or it may simply be that record keeping and technology have improved significantly over the course of time. It may also be a combination of these two factors. The following chart provides annual frequency of reported events over the past five, ten, twenty, and fifty-year periods. The most recent five-year period, covering the span of time since the last update to this Plan, is highlighted in gold.

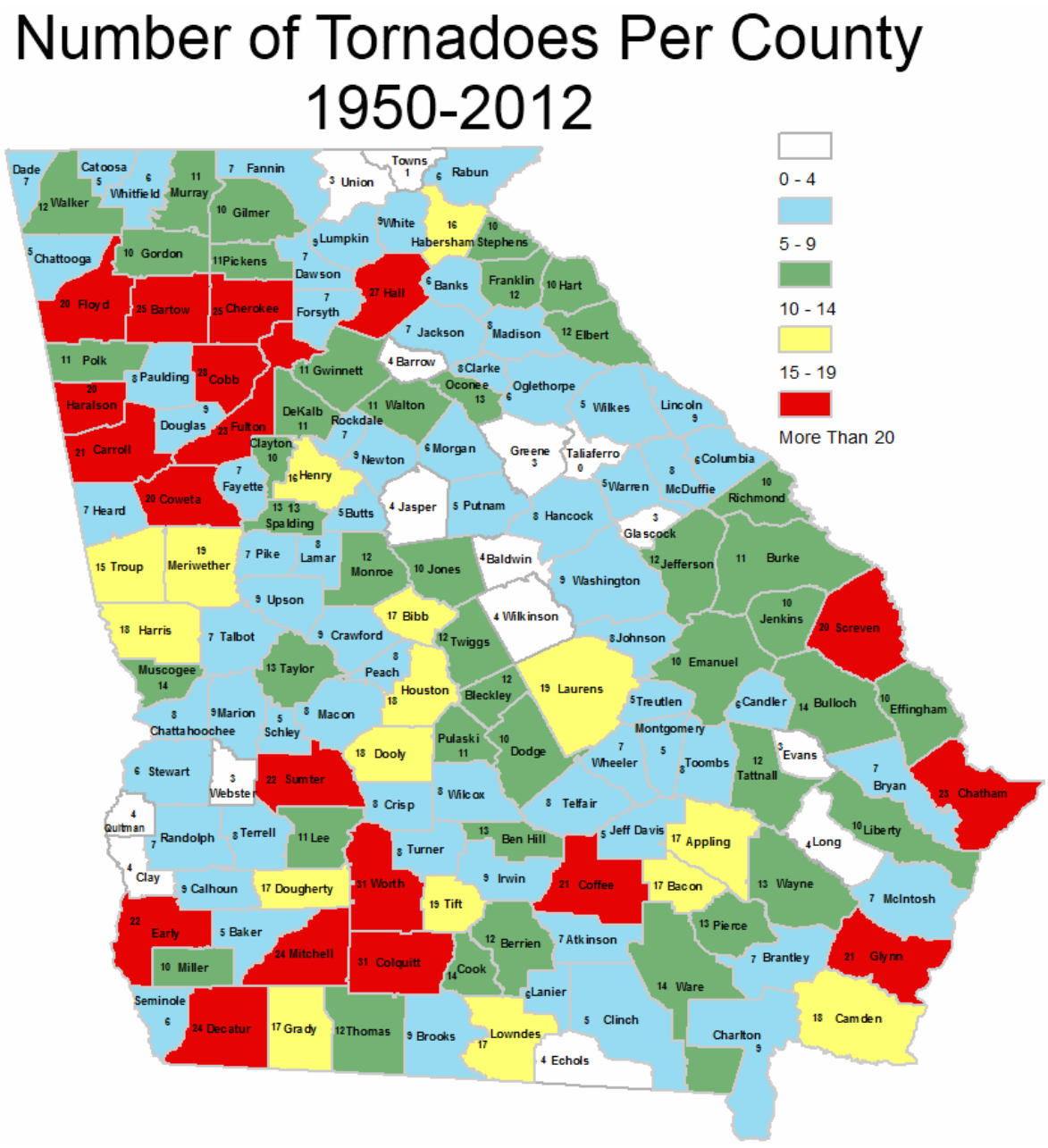
Forsyth County – Tornado Frequency (based on Reported Events)				
Time Period	**5yrs (2010-2015)**	**10yrs (2005-2015)**	**20yrs (1995-2015)**	**50yrs (1965-2015)**
Number of Reported Events	**1**	**4**	**7**	**10**
Frequency Average per Year	**0.20**	**0.40**	**0.35**	**0.20**
Frequency Percent per Year	**20%**	**40%**	**35%**	**20%**

The National Weather Service statewide map on the following page shows seven Forsyth County tornados on record from the specific time period of 1950 to 2012. However, a total

of ten tornados have actually been recorded over the past fifty years (1965-2015). See the following chart which shows all recorded tornados.

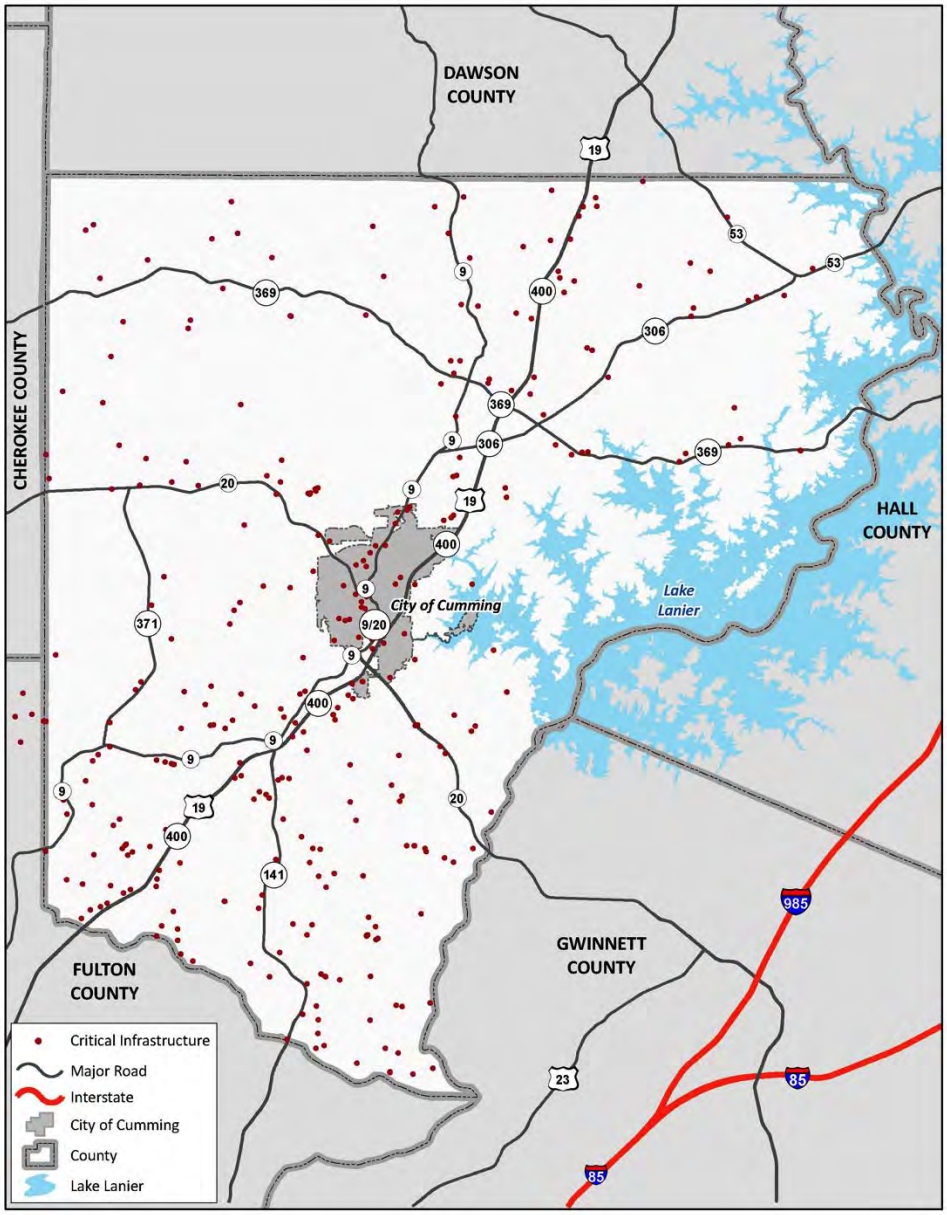
Forsyth County - Recorded tornados 1965 to present		
Date	Time	Intensity
4/2/1970	5:00pm	F3
3/7/1975	3:00pm	F1
3/13/1975	7:35pm	F1
5/7/1998	7:00pm	--
6/12/2003	6:30pm	--
8/29/2005	5:15pm	F0
3/15/2008	12:38pm	--
2/18/2009	5:25pm	--
4/10/2009	5:57pm	EF1
10/14/2014	5:08pm	EF0

The most recent version of this National Weather Service map below covers the period from 1950-2012. It demonstrates historic tornado activity of the County in relationship to surrounding counties, and the entire state.

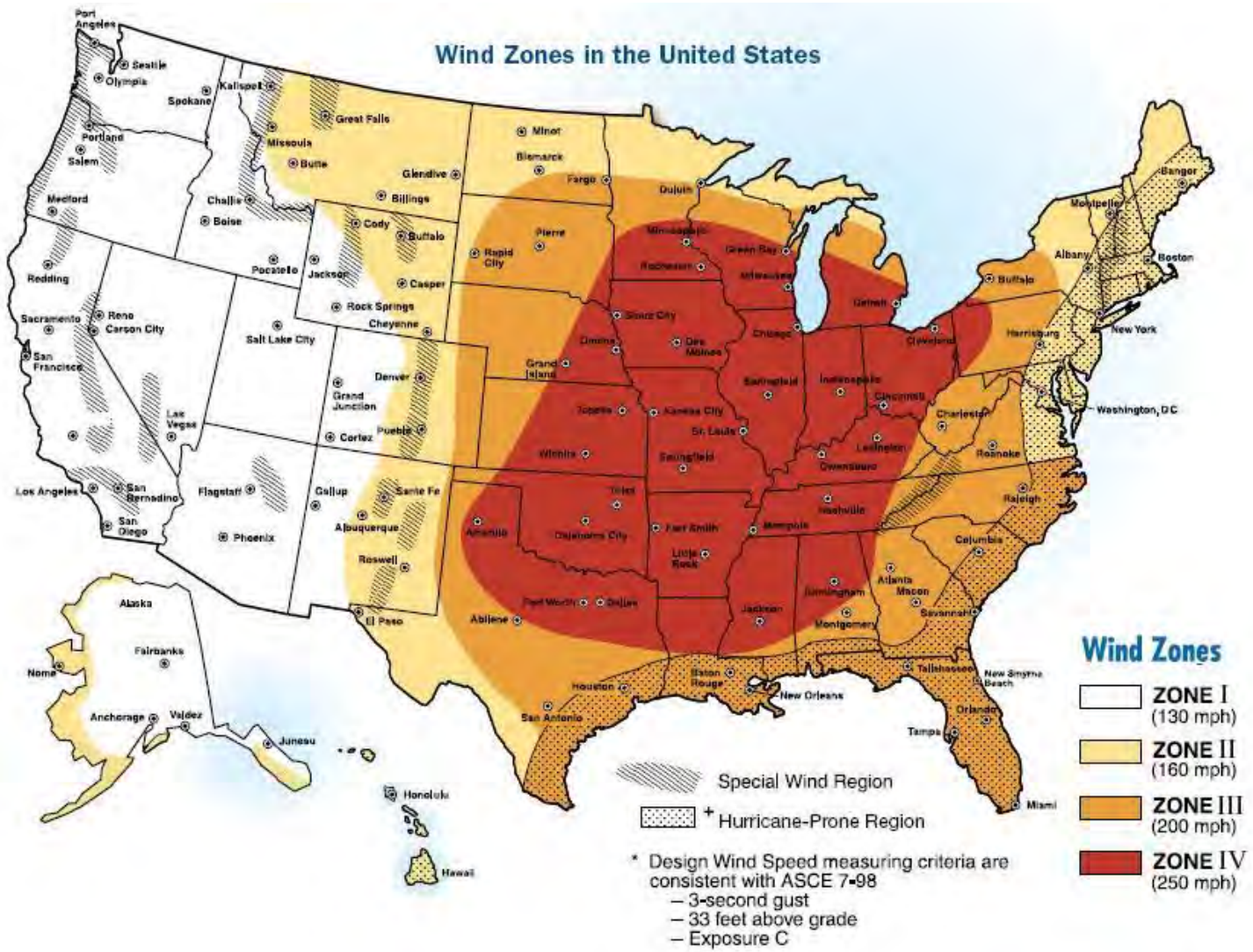


C. Assets Exposed to Hazard - Tornados are unpredictable and are indiscriminate as to when or where they strike. In evaluating assets that may potentially be impacted by the effects of tornados, the HMPC determined that all critical facilities, public and private

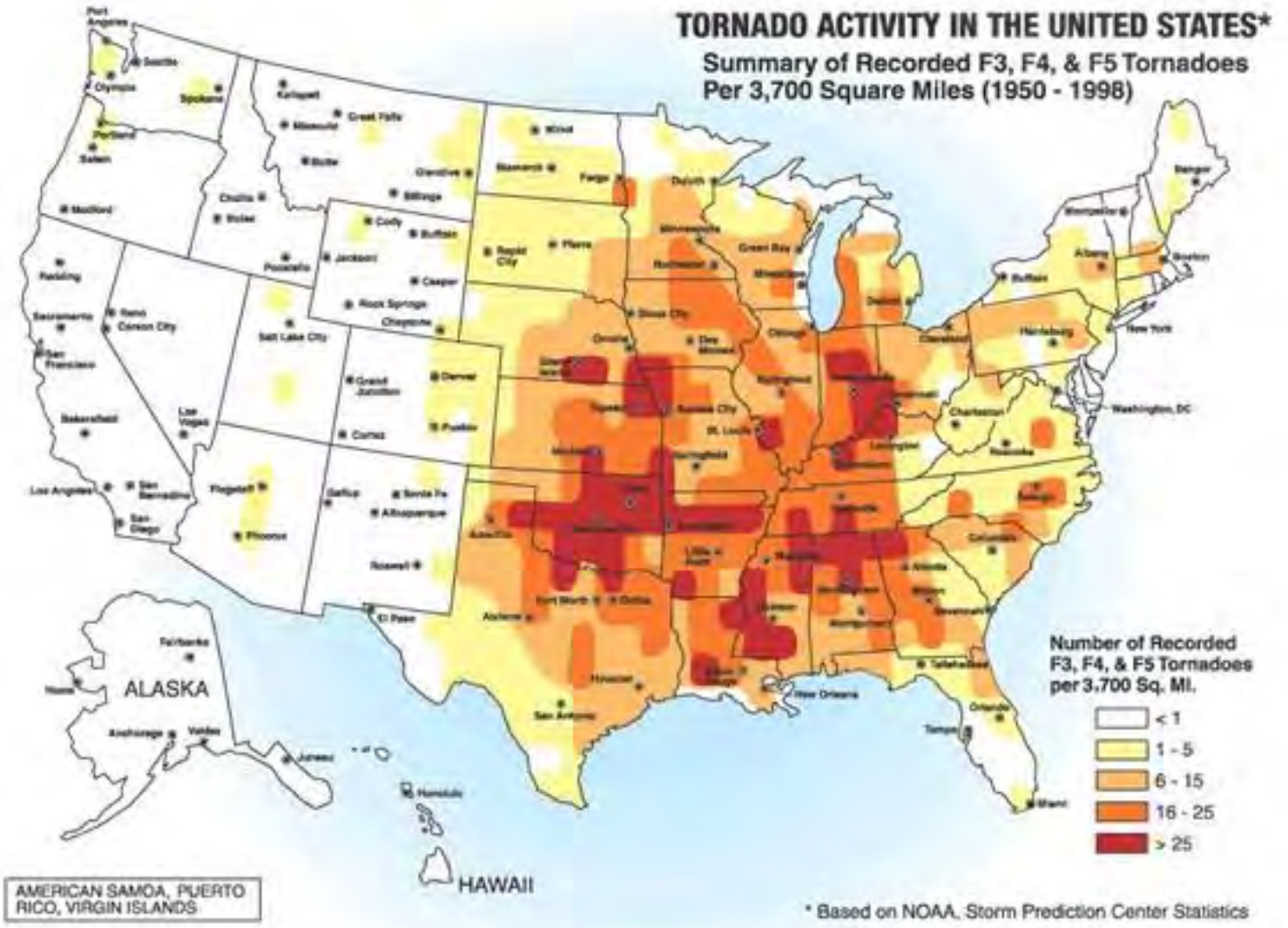
property, are susceptible. The map below identifies critical facilities located within the hazard area which, in the case of tornados, includes the entire County.



D. Estimate of Potential Losses – For loss estimate information, please refer to Appendix A, the Critical Facilities Database, and Appendix D, Worksheet 3a (Non-Spatially Defined Hazards), for each jurisdiction.


Wind Zones in the United States
Port Angeles
Seattle
Olympia
Spokane
Kalispell
Great Falls
Portland
Salem
Missoula
Butte
Glendive
Billings
Medford
Challis
Boise
Cody
Buffalo
Pocatello
Jackson
Casper
Redding
Rock Springs
Cheyenne
Sacramento
Reno
Carson City
Salt Lake City
San Francisco
Denver
Grand Junction
Las Vegas
Cortez
Pueblo
Los Angeles
San Bernadino
Flagstaff
Gallup
Santa Fe
San Diego
Albuquerque
Phoenix
Roswell
El Paso
Alaska
Fairbanks
Nome
Anchorage
Valdez
Juneau
Honolulu
Hawaii
Minot
Bismarck
Fargo
Duluth
Pierre
Rapid City
Minneapolis
Green Bay
Rochester
Milwaukee
Sioux City
Omaha
Des Moines
Chicago
Detroit
Cleveland
Grand Island
Springfield
Indianapolis
Cincinnati
Topeka
Kansas City
St. Louis
Charleston
Wichita
Springfield
Lexington
Roanoke
Owensboro
Tulsa
Nashville
Raleigh
Amarillo
Oklahoma City
Fort Smith
Memphis
Columbia
Little Rock
Atlanta
Macon
Birmingham
Fort Worth
Dallas
Jackson
Savannah
Abilene
Montgomery
Tallahassee
New Smyrna Beach
Houston
Baton Rouge
New Orleans
San Antonio
Orlando
Tampa
Miami
Bangor
Montpelier
Albany
Boston
Buffalo
New York
Harrisburg
Washington, DC
Special Wind Region
+ Hurricane-Prone Region
* Design Wind Speed measuring criteria are consistent with ASCE 7-98
– 3-second gust
– 33 feet above grade
– Exposure C
Wind Zones
ZONE I (130 mph)
ZONE II (160 mph)
ZONE III (200 mph)
ZONE IV (250 mph)

Wind Zones	Areas Affected
Zone I (130 mph)	All of Washington, Oregon, California, Idaho, Utah, and Arizona. Western parts of Montana, Wyoming, Colorado and New Mexico. Most of Alaska except the east and south coastlines.
Zone II (160 mph)	Eastern parts of Montana, Wyoming, Colorado, New Mexico. Most of North Dakota. Northern parts of Minnesota, Wisconsin and Michigan.Western parts of South Dakota, Nebraska and Texas. All New England States. Eastern parts of New York, Pennsylvania, Maryland, and Virginia. Washington, DC.
Zone III (200 mph)	Areas of Minnesota, South Dakota, Nebraska, Colorado, Kansas, Oklahoma, Texas, Louisiana, Mississippi, Alabama, Georgia, Tennessee, Kentucky, Pennsylvania, New York, Michigan, and Wisconsin. Most or all of Florida, Georgia, South Carolina, North Carolina, Virginia, West Virginia. All of American Somoa, Puerto Rico, and Virgin Islands.
Zone IV (250 mph)	Mid US including all of Iowa, Missouri, Arkansas, Illinois, Indiana, and Ohio and parts of adjoining states of Minnesota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Louisiana, Mississippi, Alabama, Georgia, Tennessee, Kentucky, Pennsylvania, Michigan, and Wisconsin. Guam.
Special Wind Region	Isolated areas in the following states: Washington, Oregon, California, Idaho, Utah, Arizona, Montana, Wyoming, Colorado, New Mexico. The borders between Vermont and New Hampshire; between NewYork, Massachusetts and Connecticut; between Tennessee and North Carolina.
Hurricane Susceptible Region	Southern US coastline from Gulf Coast of Texas eastward to include entire state of Florida. East Coastline from Maine to Florida, including all of Massachusetts, Connecticut, Rhode Island, Delaware, and Washington DC. All of Hawaii, Guam, American Samoa, Puerto Rico and Virgin Islands.


TORNADO ACTIVITY IN THE UNITED STATES*
Summary of Recorded F3, F4, & F5 Tornadoes
Per 3,700 Square Miles (1950 - 1998)
Number of Recorded
F3, F4, & F5 Tornadoes
per 3,700 Sq. Mi.
< 1
1 - 5
6 - 15
16 - 25
> 25
ALASKA
HAWAII
AMERICAN SAMOA, PUERTO
RICO, VIRGIN ISLANDS
* Based on NOAA, Storm Prediction Center Statistics

Tornado Activity in the United States Summary of Recorded F3, F4 & F5 Tornadoes per 3,700 Square Miles (1950 - 1998) Based on NOAA, Storm Prediction Center Statistics	
Number of Recorded Major Tornadoes	**Areas Affected**
< 1	All or most of Washington, Oregon, California, Idaho, Utah, Arizona, Montana, Wyoming, Colorado, New Mexico, Maine, New Hampshire, Vermont and Rhode Island. Parts of North Dakota, Minnesota, Wisconsin, Michigan, Texas, Florida, Delaware, Alaska, Hawaii, American Somoa, Puerto Rico and Virgin Islands. Isolated areas in Massachusetts, New York, Connecticut, Pennsylvania, Maryland, Ohio, Kentucky and Louisiana.
1 - 5	Most of South Dakota, Virginia, West Virginia, and North Carolina. Parts of North Dakota, Nebraska, Texas, Minnesota, Wisconsin, Michigan, New York, Pennsylvania, Maryland, Washington DC, and South Carolina. Isolated areas in Washington, Oregon, Montana, Wyoming, Kansas, New Mexico, Ohio, Kentucky, Tennessee, Maine, Georgia and Florida.
6 - 15	Parts of South Dakota, Nebraska, Kansas, Texas, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Mississippi, Ohio, Alabama, and Pennsylvania. Isolated areas of Oklahoma, Arkansas, Louisiana, New Hampshire, Massachusetts, New York, West Virginia, Kentucky, North Carolina, South Carolina, Georgia, and Florida.
16 - 25	Half of Indiana, parts of Kansas, Texas, Iowa, Kansas, Missouri, Arkansas, Louisiana, Indiana, Kentucky, Tennessee, Mississippi, Alabama and Georgia. Isolated areas in the following states: North Dakota, Minnesota, Wisconsin, Michigan, Louisiana, Michigan, Ohio, Virginia, North Carolina, and South Carolina.
> 25	Most of Oklahoma, half of Indiana, and isolated areas in the following states: Nebraska, Kansas, Texas, Missouri, Arkansas, Louisiana, Ohio, Kentucky, Tennessee, Mississippi, Alabama and Georgia.

Last Modified: Wednesday, 11-Aug-2010 14:25:54 EDT

Levels of Risk for High-Wind Events

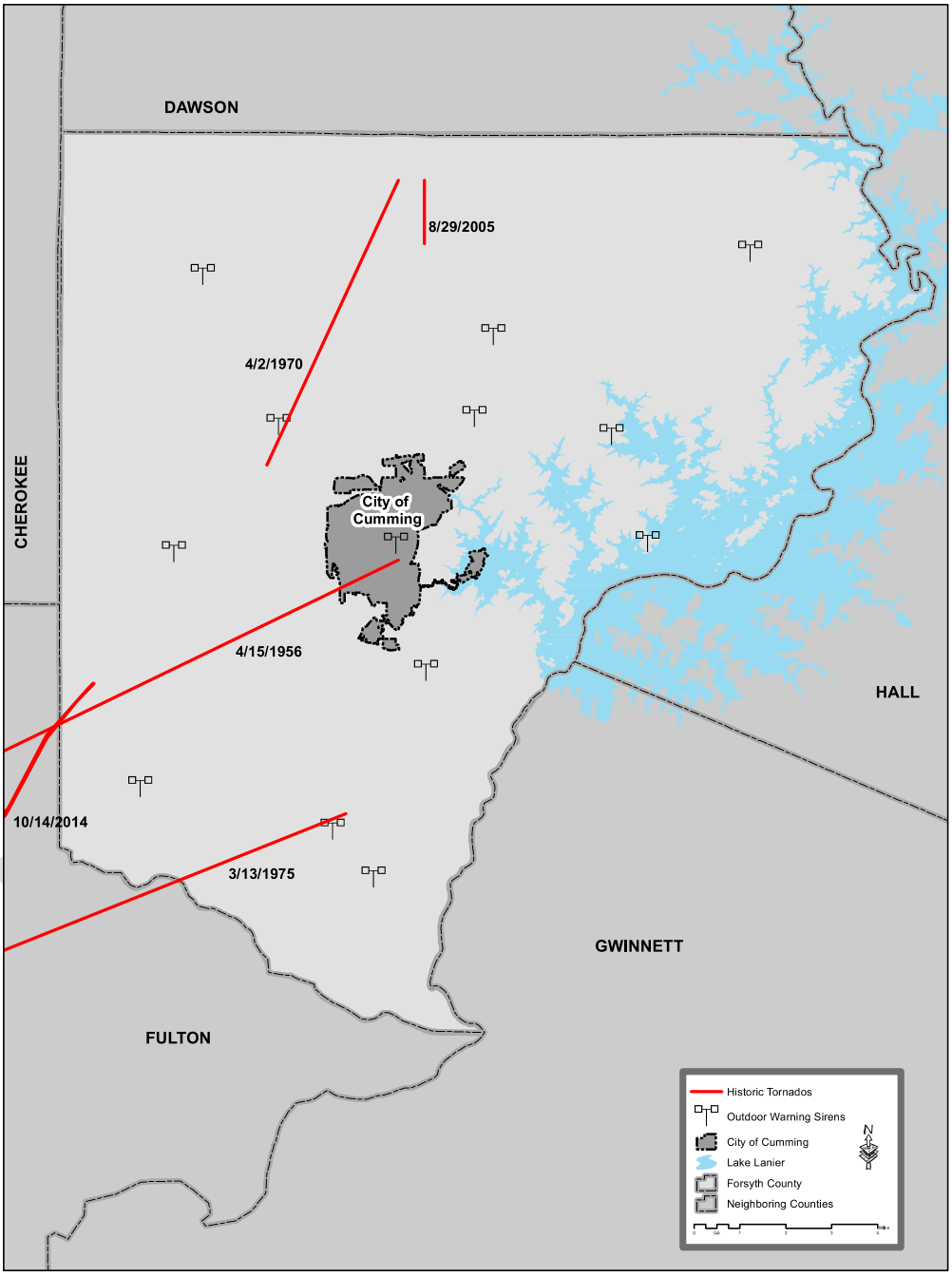
Number of Tornadoes (see Wind Zone Map)	Wind Zone (see Frquency Map)			
	I	II	III	IV
<1	LOW Risk	LOW Risk	LOW Risk	MODERATE Risk
1–5	LOW Risk	MODERATE Risk	HIGH Risk	HIGH Risk
6–10	LOW Risk	MODERATE Risk	HIGH Risk	HIGH Risk
11–15	HIGH Risk	HIGH Risk	HIGH Risk	HIGH Risk
>15	HIGH Risk	HIGH Risk	HIGH Risk	HIGH Risk

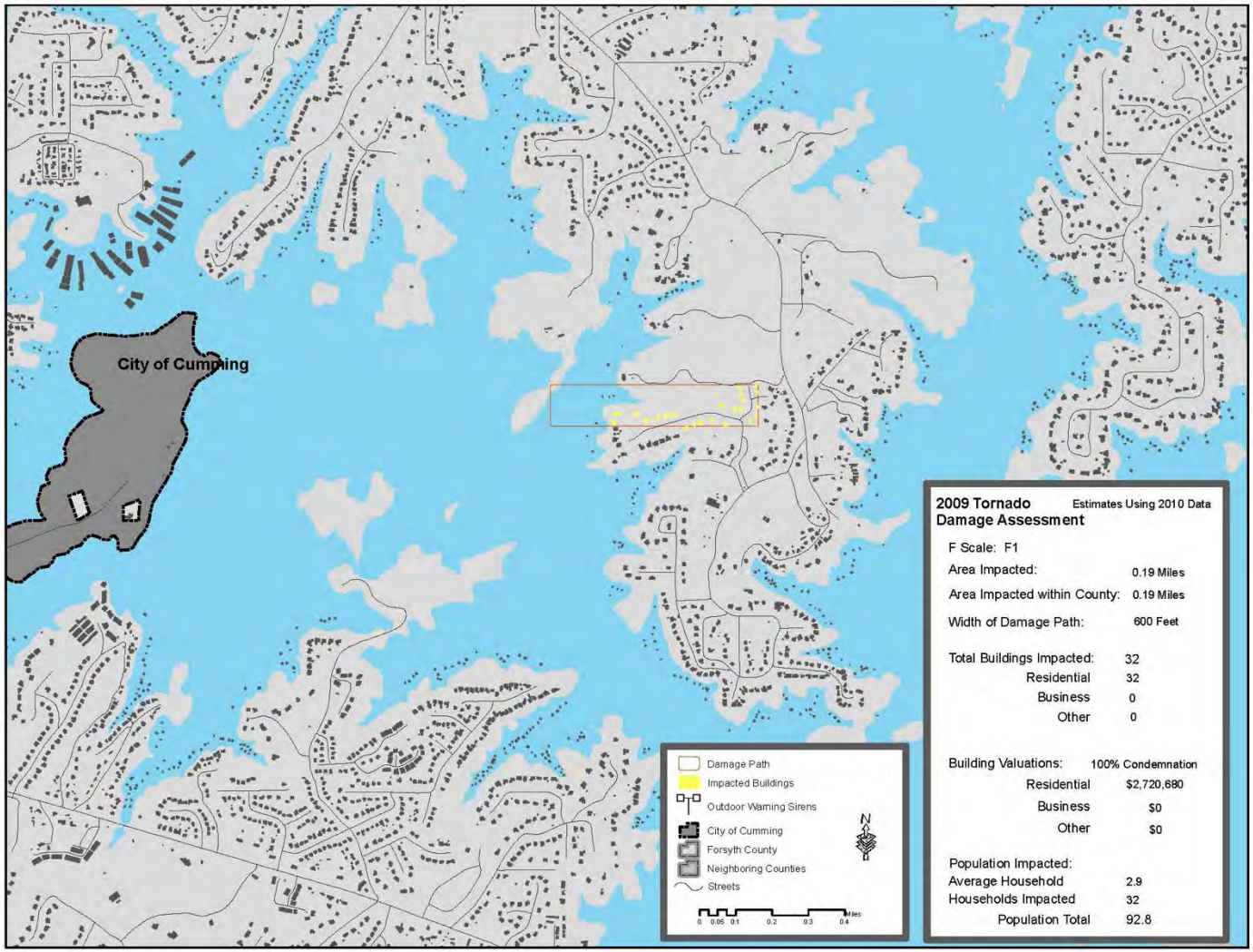
LOW Risk – Sheltering from high winds is a matter of preference.

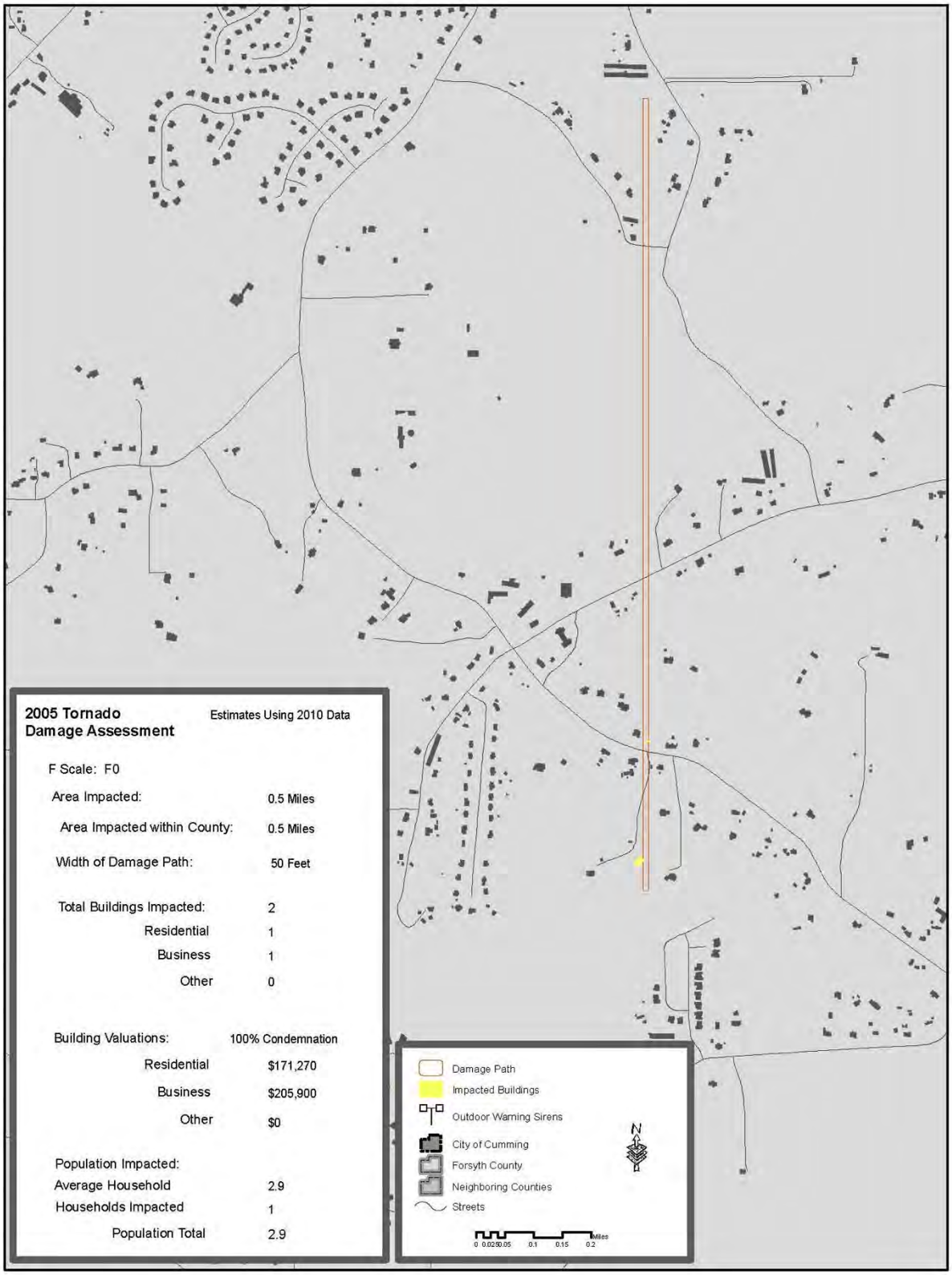
MODERATE Risk – Shelter should be considered for protection from high winds.

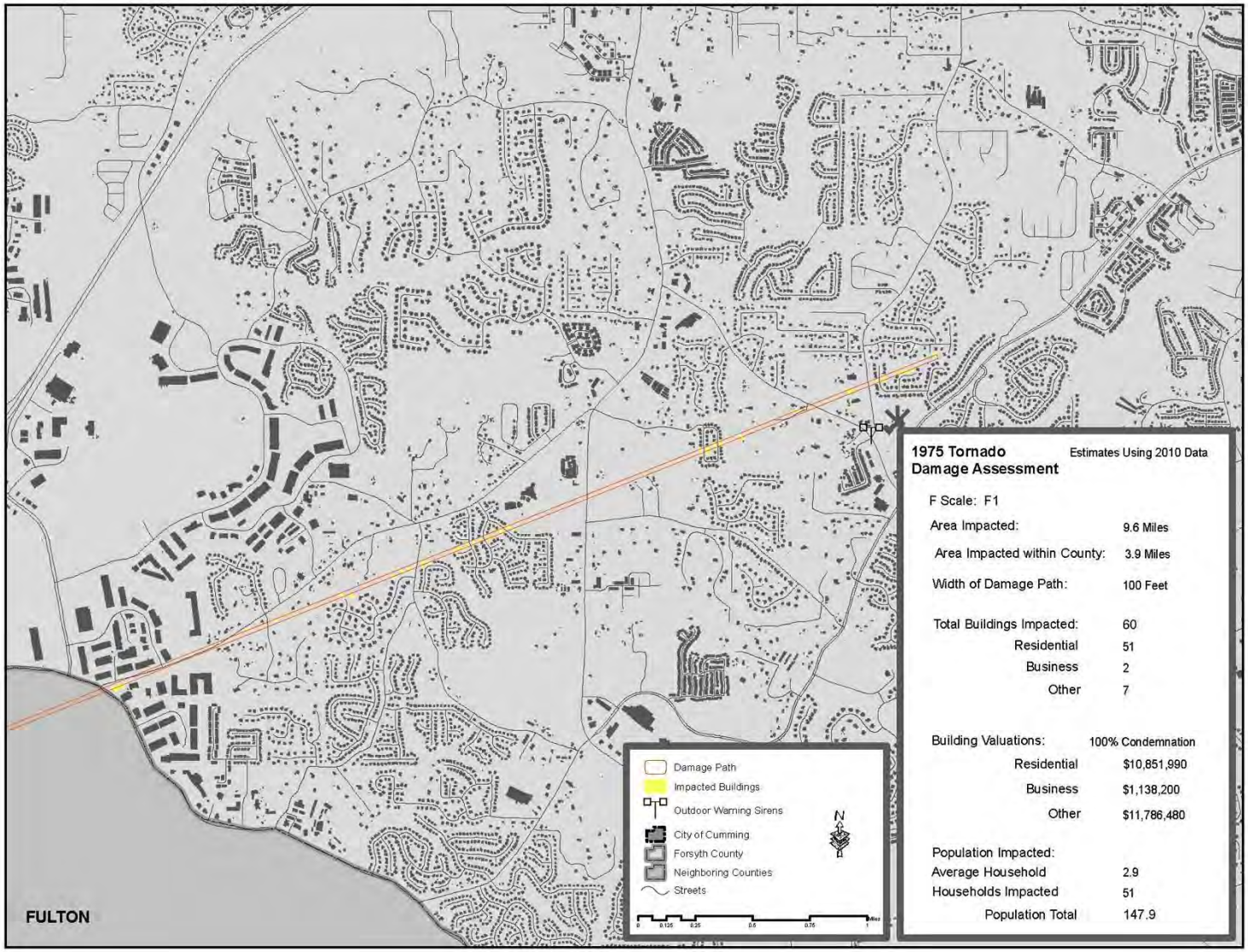
HIGH Risk – Shelter is the preferred method of protection from high winds.

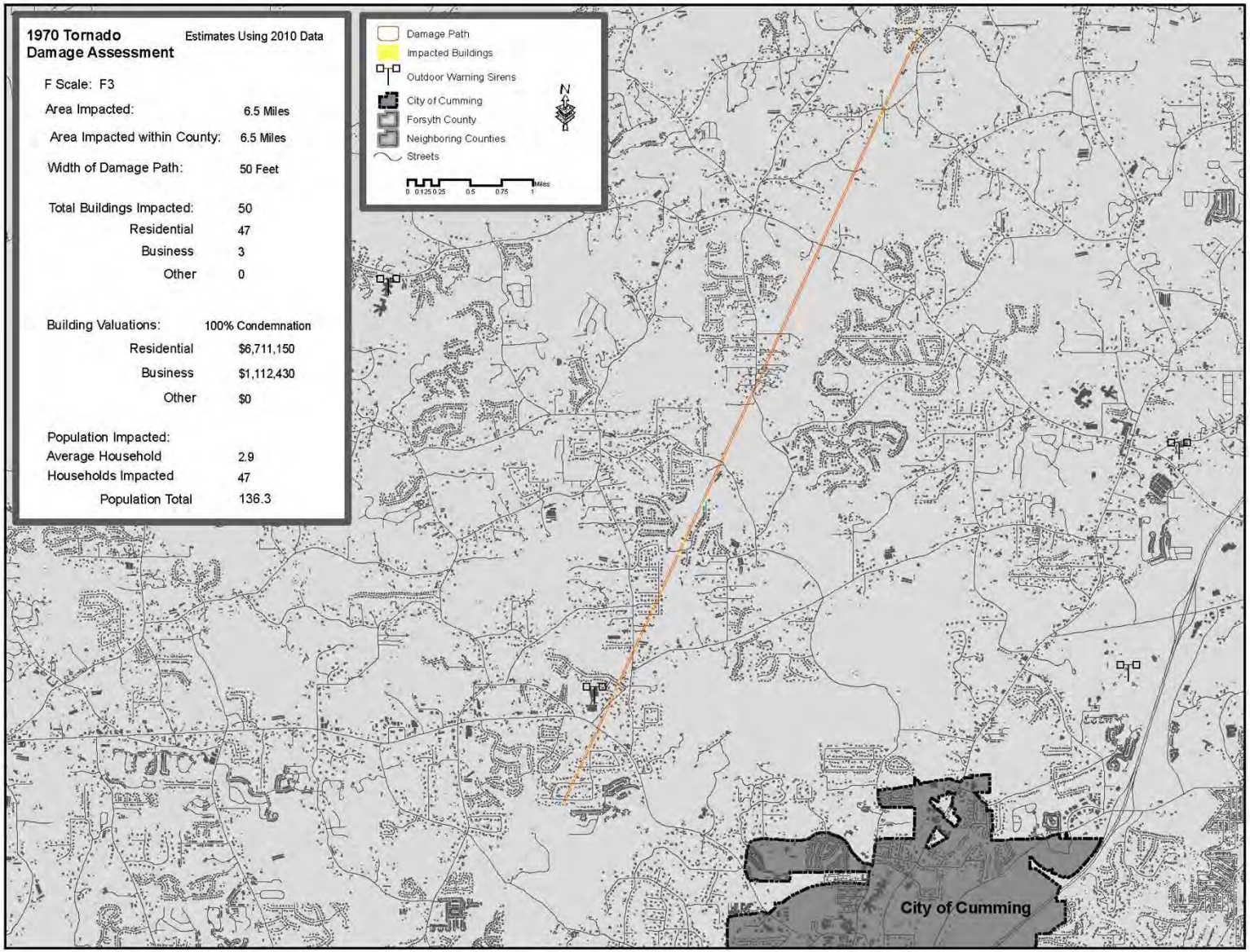
The maps on the following pages represent a general overview of historical tornado paths and damages throughout the County and the estimated range of existing warning sirens.

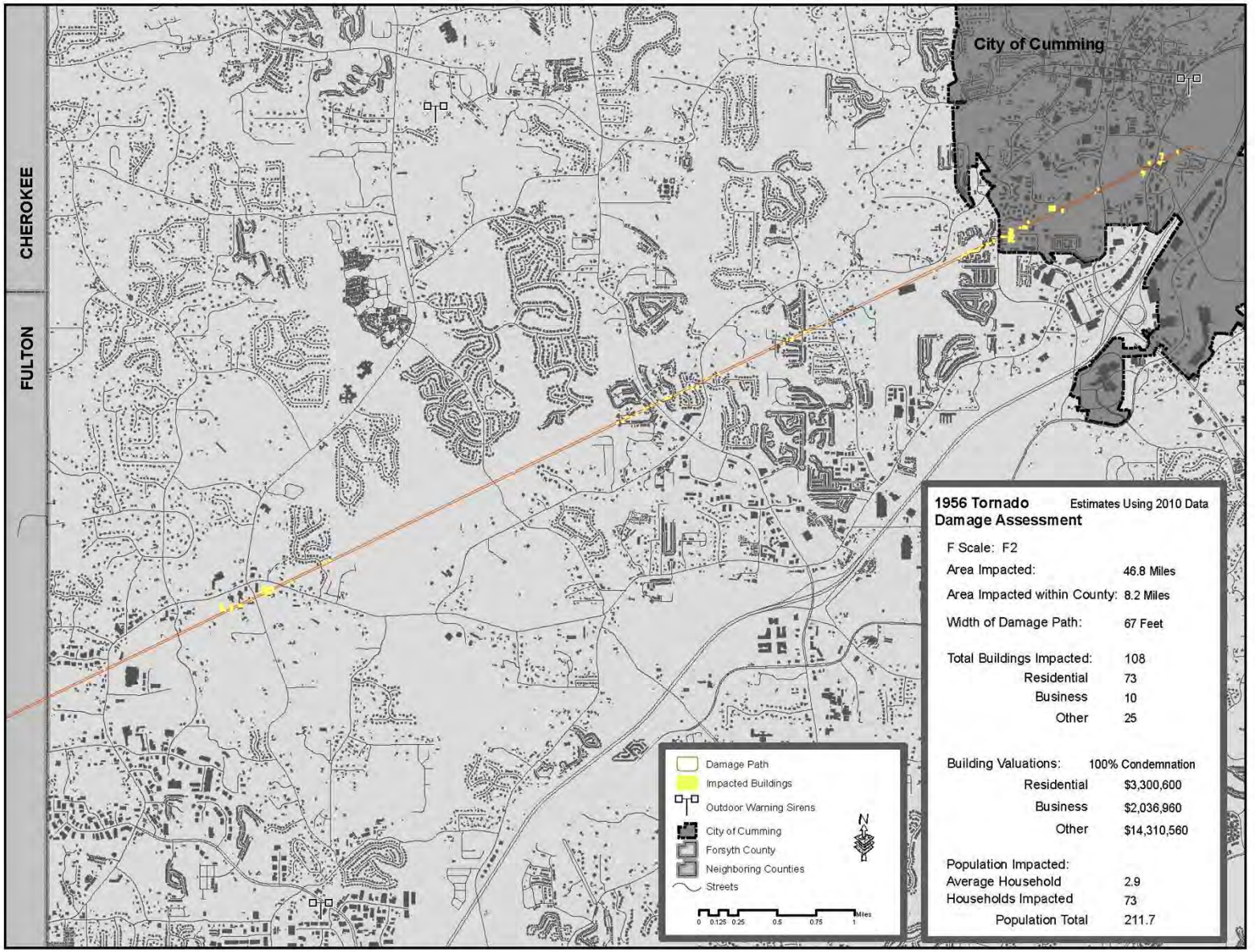


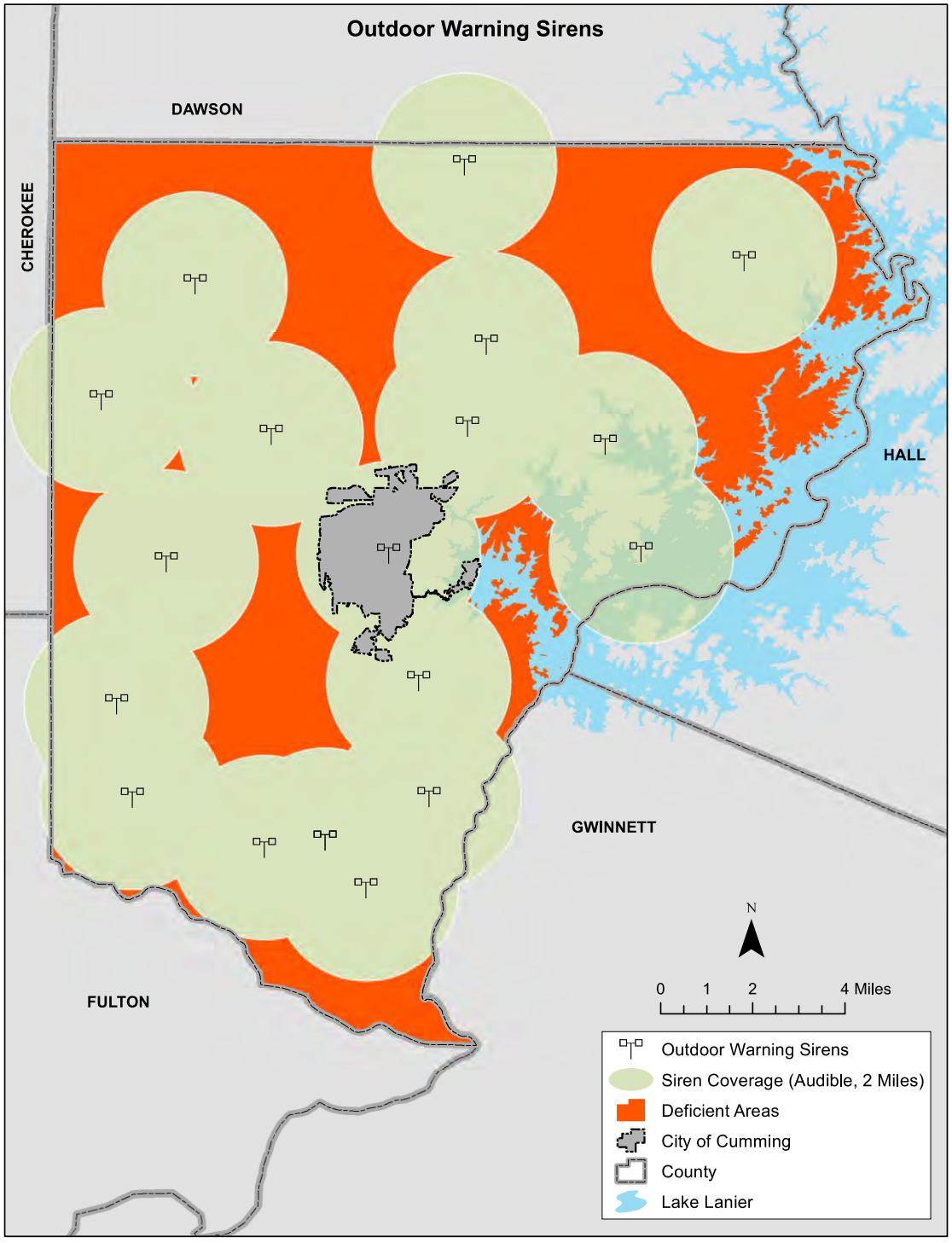

City of Cumming
Damage Path
Impacted Buildings
Outdoor Warning Sirens
City of Cumming
Forsyth County
Neighboring Counties
Streets
N
0 0.05 0.1 0.2 0.3 0.4
Miles
2009 Tornado
Damage Assessment
Estimates Using 2010 Data
F Scale: F1
Area Impacted: 0.19 Miles
Area Impacted within County: 0.19 Miles
Width of Damage Path: 600 Feet
Total Buildings Impacted: 32
Residential 32
Business 0
Other 0
Building Valuations: 100% Condemnation
Residential $2,720,680
Business $0
Other $0
Population Impacted:
Average Household 2.9
Households Impacted 32
Population Total 92.8


2005 Tornado
Damage Assessment
Estimates Using 2010 Data
F Scale: F0
Area Impacted: 0.5 Miles
Area Impacted within County: 0.5 Miles
Width of Damage Path: 50 Feet
Total Buildings Impacted: 2
Residential 1
Business 1
Other 0
Building Valuations: 100% Condemnation
Residential $171,270
Business $205,900
Other $0
Population Impacted:
Average Household 2.9
Households Impacted 1
Population Total 2.9
Damage Path
Impacted Buildings
Outdoor Warning Sirens
City of Cumming
Forsyth County
Neighboring Counties
Streets
N
0 0.025 0.05 0.1 0.15 0.2
Miles


1975 Tornado
Damage Assessment
Estimates Using 2010 Data
F Scale: F1
Area Impacted: 9.6 Miles
Area Impacted within County: 3.9 Miles
Width of Damage Path: 100 Feet
Total Buildings Impacted: 60
Residential 51
Business 2
Other 7
Building Valuations: 100% Condemnation
Residential $10,851,990
Business $1,138,200
Other $11,786,480
Population Impacted:
Average Household 2.9
Households Impacted 51
Population Total 147.9
Damage Path
Impacted Buildings
Outdoor Warning Sirens
City of Cumming
Forsyth County
Neighboring Counties
Streets
N
FULTON


1970 Tornado Damage Assessment
Estimates Using 2010 Data
F Scale: F3
Area Impacted: 6.5 Miles
Area Impacted within County: 6.5 Miles
Width of Damage Path: 50 Feet
Total Buildings Impacted: 50
Residential 47
Business 3
Other 0
Building Valuations: 100% Condemnation
Residential $6,711,150
Business $1,112,430
Other $0
Population Impacted:
Average Household 2.9
Households Impacted 47
Population Total 136.3
Damage Path
Impacted Buildings
Outdoor Warning Sirens
City of Cumming
Forsyth County
Neighboring Counties
Streets
N
0 0.125 0.25 0.5 0.75 1 Miles
City of Cumming


City of Cumming
CHEROKEE
FULTON
Damage Path
Impacted Buildings
Outdoor Warning Sirens
City of Cumming
Forsyth County
Neighboring Counties
Streets
N
0 0.125 0.25 0.5 0.75 1 Miles
1956 Tornado
Estimates Using 2010 Data
Damage Assessment
F Scale: F2
Area Impacted: 46.8 Miles
Area Impacted within County: 8.2 Miles
Width of Damage Path: 67 Feet
Total Buildings Impacted: 108
Residential 73
Business 10
Other 25
Building Valuations: 100% Condemnation
Residential $3,300,600
Business $2,036,960
Other $14,310,560
Population Impacted:
Average Household 2.9
Households Impacted 73
Population Total 211.7


Outdoor Warning Sirens
DAWSON
CHEROKEE
HALL
GWINNETT
FULTON
N
0 1 2 4 Miles
Outdoor Warning Sirens
Siren Coverage (Audible, 2 Miles)
Deficient Areas
City of Cumming
County
Lake Lanier

E. Multi-Jurisdictional Concerns - All of Forsyth County and the City of Cumming have the same design wind speed of 200 mph as determined by the American Society of Civil Engineers (ASCE). Since no part of the County is immune from tornados, any mitigation steps taken related to tornados should be undertaken on a countywide basis, including the City of Cumming.

F. Hazard Summary – Forsyth County has a high exposure to potential damage from tornados, especially due to the County's population explosion. Should a tornado strike dense residential areas or certain critical facilities, significant damage and loss of life could occur. Due to the destructive power of tornados it is essential that the mitigation measures identified in this plan receive full consideration. Specific mitigation recommendations related to tornados are identified in Chapter 5.

2.5 Wildfire

A. Hazard Identification – The Forsyth County HMPC utilized data from the Georgia Forestry Commission in researching wildfires and their impact on the County.

A wildfire is defined as an uncontrolled fire occurring in any natural vegetation. For a wildfire to occur, there must be available oxygen, a supply of fuel, and enough heat to kindle the fuel. Often, these fires are begun by combustion and heat from surface and ground fires and can quickly develop into a major conflagration. A large wildfire may crown, which means it may spread rapidly through the topmost branches of the trees before involving undergrowth or the forest floor. As a result, violent blowups are common in forest fires, and on rare occasion they may assume the characteristics of a firestorm. A firestorm is a violent convection caused by a continuous area of intense fire and characterized by destructively violent surface indrafts. Sometimes it is accompanied by tornado-like whirls that develop as hot air from the burning fuel rises. Such a fire is beyond human intervention and subsides only upon the consumption of everything combustible in the locality. No records were found of such an event ever occurring within Forsyth County, but this potential danger should be considered when planning mitigation efforts.

The threat of wildfire varies with weather conditions: drought, heat, and wind participate in drying out the timber or other fuel, making it easier to ignite. Once a fire is burning, drought, heat, and wind all increase its intensity. Topography also affects wildfire, which spreads quickly uphill and slowly downhill. Dried grass, leaves, and light branches are considered flash fuels; they ignite readily, and fire spreads quickly in them, often generating enough heat to ignite heavier fuels such as tree trunks, heavy limbs, and the

matted duff of the forest floor. Such fuels, ordinarily slow to kindle, are difficult to extinguish. Green fuels (growing vegetation) are not considered flammable, but an intense fire can dry out leaves and needles quickly enough to allow ready ignition. Green fuels sometimes carry a special danger: evergreens, such as pine, cedar, fir, and spruce, contain flammable oils that burst into flames when heated sufficiently by the searing drafts of a wildfire.

Tools for fighting wildfires range from the standard equipment of fire departments to portable pumps, tank trucks, and earth-moving equipment. Firefighting forces specially trained to deal with wildfire are maintained by local, state and federal entities including the Forsyth County Fire Department, Georgia Forestry, and U.S. Forest Service. These trained firefighters may attack a fire directly by spraying water, beating out flames, and removing vegetation at the edge of the fire to contain it behind a fire line. When the very edge is too hot to approach a fire line is built at a safe distance, sometimes using strip burning or backfire to eliminate fuel in the path of the uncontrolled fire or to change the fire's direction or slow its progress. Backfiring is used only as a last resort.

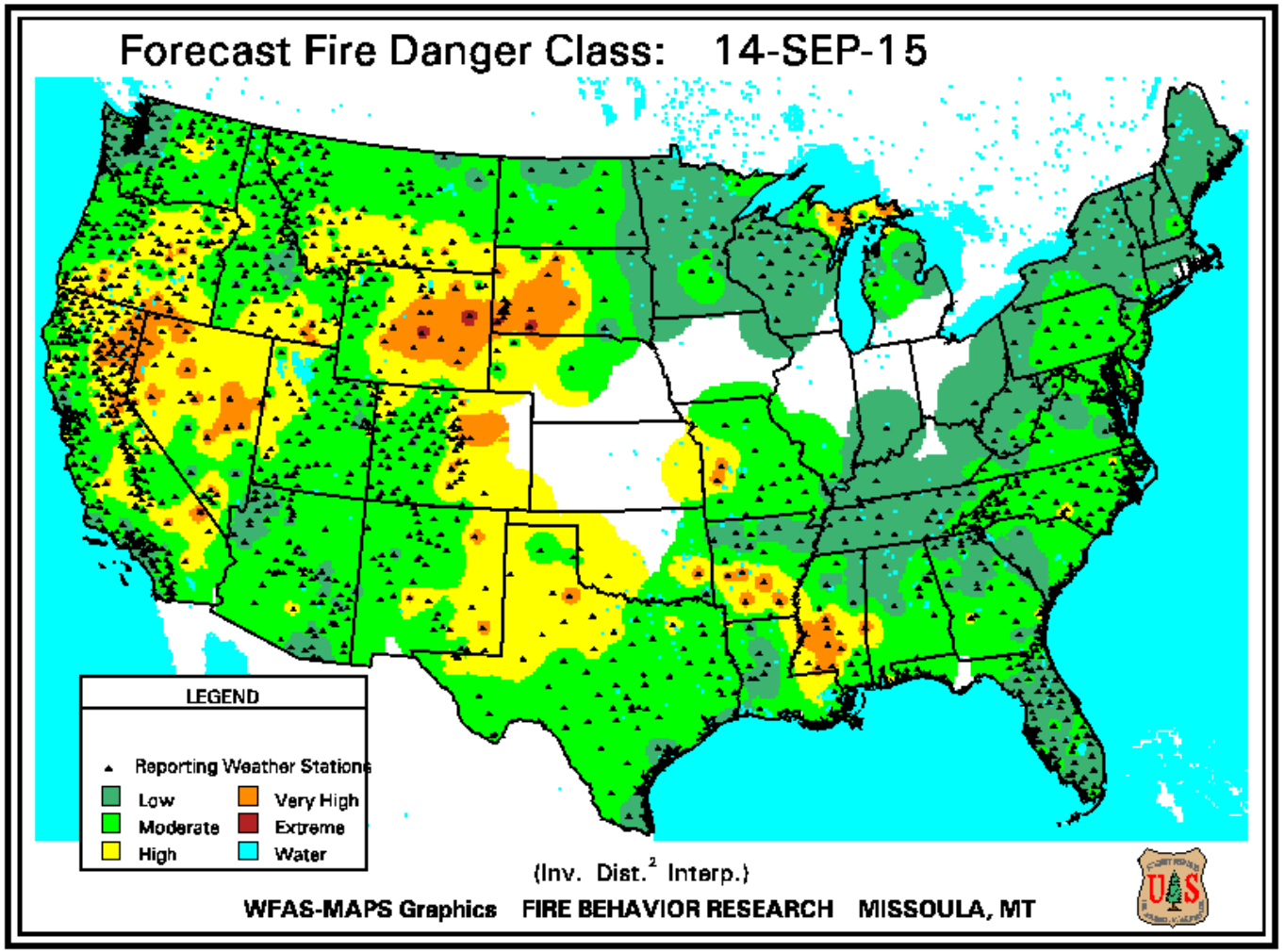
The control of wildfires has developed into an independent and complex science costing approximately $100 million annually in the United States. Because of the extremely rapid spreading and customary inaccessibility of fires once started, the chief aim of this work is prevention. However, despite the use of modern techniques (e.g., radio communications, rapid helicopter transport, and new types of chemical firefighting apparatus) more than 10 million acres of forest are still burned annually. Of these fires, about two thirds are started accidentally by people, almost one quarter are of incendiary origin, and more than 10% are due to lightning.

B. Hazard Profile – GFC records show that 1,925 wildfires occurred within the County over the past fifty years, which equates to a 3,850% annual frequency based upon reported events. However, that frequency has dropped to 460% in the most recent five-year period. It would appear that wildfire activity has steadily decreased over time within the County. It is also likely that reporting requirements have changed over the decades resulting in fewer reported events. It may also be a combination of these two factors. The following chart provides annual frequency of reported events over the past five, ten, twenty, and fifty-year periods. The most recent five-year period, covering the span of time since the last update to this Plan, is highlighted in gold.

Forsyth County – Wildfire
(based on Reported Events)

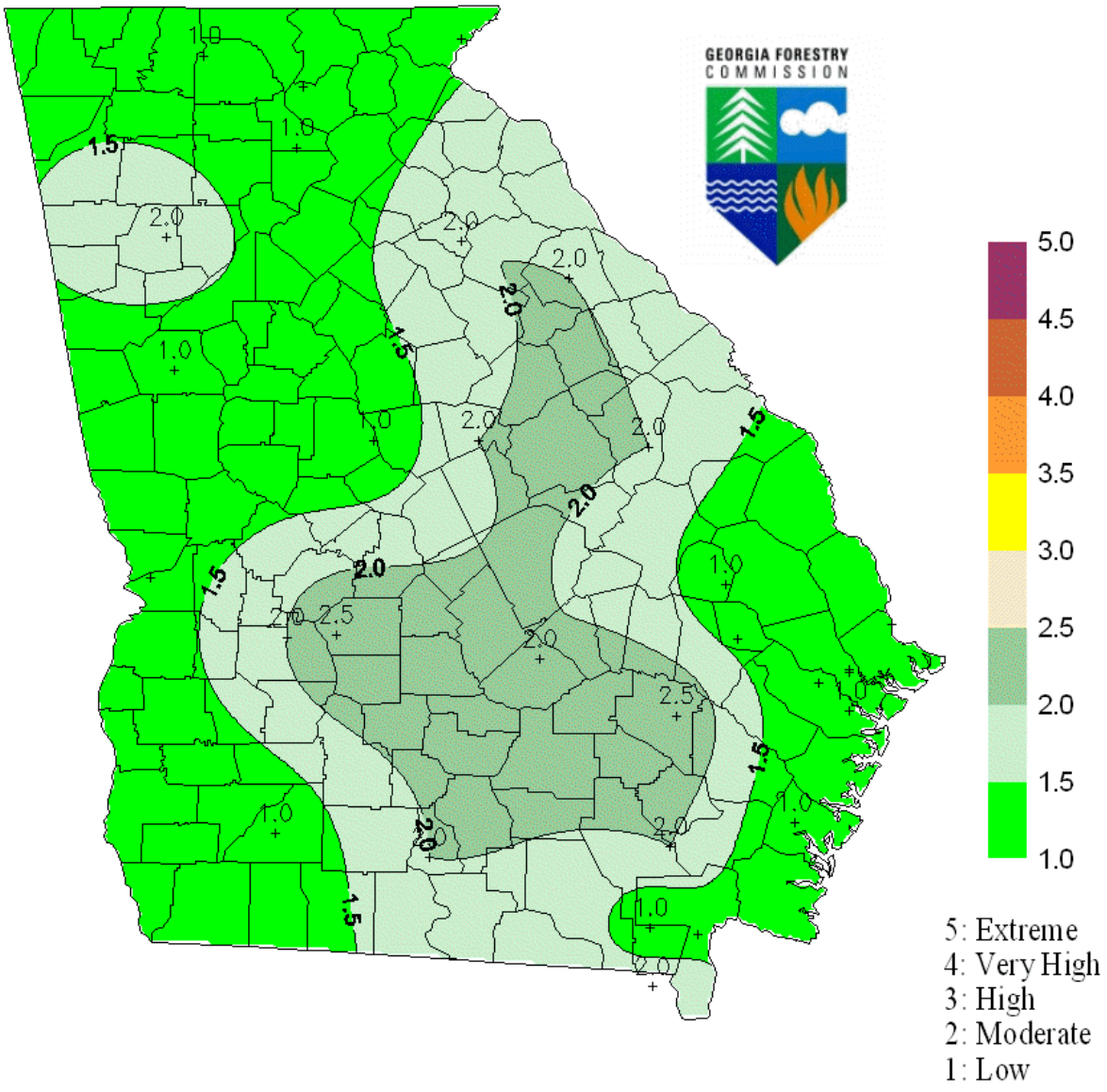
Time Period	5yrs (2010-2015)	10yrs (2005-2015)	20yrs (1995-2015)	50yrs (1965-2015)
Number of Reported Events	23	98	327	1925
Frequency Average per Year	4.6	9.8	16.35	38.5
Frequency Percent per Year	460%	980%	1635%	3850%

At the time this planning effort took place, Forsyth County's threat of wildfire was classified as "low". However, this status can change from week to week. See map below.

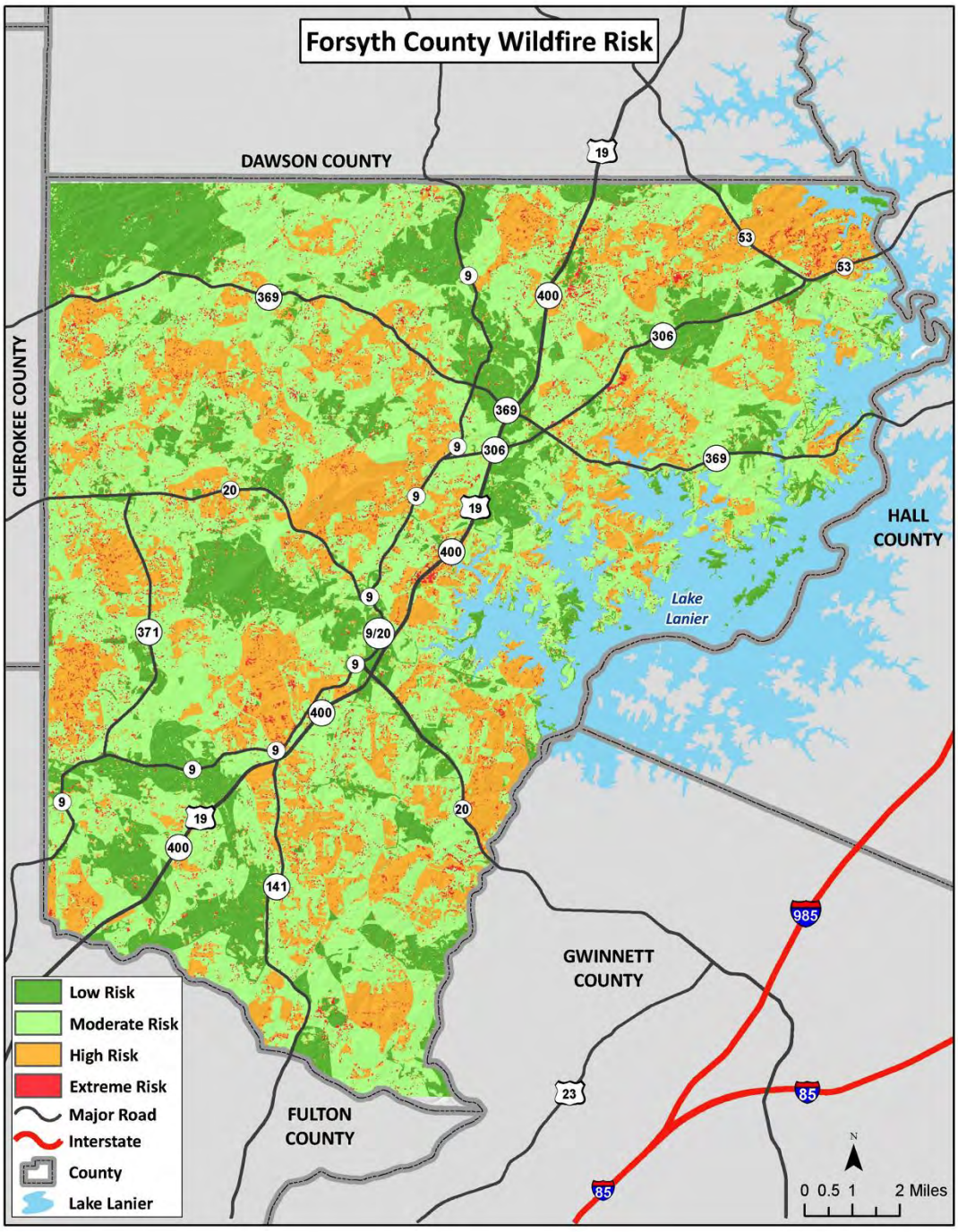


The GFC Forecast Fire Danger Map below forecasts the fire danger threat on a daily basis.

Forecast Fire Danger for Tomorrow
Produced at September 11, 2015 130pm EST



C. Assets Exposed to Hazard – In evaluating assets that are susceptible to wildfire, the committee determined that all public and private property is susceptible to wildfire, including all critical facilities. The map below displays the wildfire risk potential for Forsyth County, including locations of critical facilities within the hazard areas. This map is the result of a detailed analysis, the results of which are to be considered for strategic reasons instead of tactical decision making (i.e. identifying risk for individual homes). See Exhibit D for explanation of methodology.



Virtually all of Forsyth County can be affected by wildfire due to the common interface between urban development and wooded areas. "Low", "moderate", and "high" risk levels appear to be quite evenly dispersed throughout the County and the City of Cumming. "Extreme" risk areas are quite limited and are also spread somewhat uniformly across the County and City, though the extreme northeastern corner of the County does seem to have a slightly higher concentration of extreme risk areas. Perhaps the only area that is mostly consistent with regard to risk level is the extreme northwestern corner of the County which has a consistent "low" risk rating.

D. Estimate of Potential Losses – In most of the documented cases of wildfire within Forsyth County, relatively little information on damages, in terms of dollars, was available. The potential commercial value of the land lost to wildfire cannot be accurately calculated, other than replacement costs of structures and infrastructure. With regard to the land itself, aside from the loss of timber and recreation, the damage is inestimable in terms of land rendered useless by ensuing soil erosion, elimination of wildlife cover and forage, and the loss of water reserves collected by a healthy forest. For existing loss estimate information, please refer to the Critical Facilities Database, Appendix A, for each jurisdiction.

E. Multi-Jurisdictional Concerns –Both the County and the City have areas identified as "extreme" risk for wildfire, though these areas are extremely limited. Any steps taken to mitigate the effects of wildfire should be undertaken on a countywide basis and include the City of Cumming.

F. Hazard Summary – Wildfires pose a serious threat to Forsyth County in terms of property damage, as well as injuries and loss of life. Wildfires are one of the most frequently occurring natural hazards within the County each year. Based on the frequency of this hazard, as well as its ability to inflict devastation most anywhere in the County, the mitigation measures identified in this plan should be aggressively pursued. Specific mitigation actions related to wildfire are identified in Chapter 5.

2.6 Drought

A. Hazard Identification –The term "drought" has various meanings, depending upon context. To a farmer, a drought is a period of moisture deficiency that affects the crops under cultivation (even two weeks without rainfall can stress many crops during certain periods of the growing cycle). To a water manager, a drought is a deficiency in water supply that affects water availability and water quality. To a meteorologist, a drought is a prolonged period when precipitation is less than normal. To a hydrologist, a drought is an extended period of decreased precipitation and streamflow.

Drought is a normal, recurrent feature of climate. It occurs almost everywhere, although its features vary from region to region. Droughts in Georgia historically have severely affected municipal and industrial water supplies, agriculture (including both livestock and crops), stream water quality, recreation at major reservoirs, hydropower generation, navigation, and forest resources. Drought is also a key factor in wildfire development by making natural fuels (grass, brush, trees, dead vegetation) more fire prone.

In Georgia, droughts have been documented at U.S. Geological Survey (USGS) streamflow gaging stations since the 1890's. From 1910 to 1940, about 20 streamflow gaging stations were in operation. Since the early 1950's through the late 1980's, about 100 streamflow gaging stations were in operation. Currently, the USGS streamflow gaging network consists of more than 135 continuous-recording gages. Groundwater levels are currently monitored at 165 wells equipped with continuous recorders.

Note: When researching drought, one term that is frequently used is *recurrence interval*. The recurrence interval is the average time between droughts of a given severity. For instance, in a drought with a 25-year recurrence interval the low streamflows occur, on average, once every 25 years.

B. Hazard Profile – The Forsyth County HMPC reviewed historical data from the National Oceanic and Atmospheric Administration (NOAA), the National Climatic Data Center (NCDC), the U.S. Geological Survey (USGS), the Georgia Department of Natural Resources (GA DNR) and the Georgia Forestry Commission (GFC) in researching drought events of the County and the State. Most historical information related to drought within this Plan has been derived from USGS streamflow data and NOAA precipitation data. Due to the nature of drought to affect large areas of the State simultaneously and the availability of only very limited County-specific drought information, the threat of drought is looked at within this Plan from a statewide perspective. Similarly, due to limited month-by-month information on drought, this hazard will be quantified on an annual basis (either there was a drought or there was not for any given year within the State). These guidelines are also used in Appendix B and Appendix C with regard to historical hazard information.

In the State of Georgia significant drought events, as identified by USGS, NOAA and other sources, have occurred in 23 of the last 50 years. Forsyth County was affected to varying degrees in each of those years. According to this information, drought conditions were experienced approximately 46% of the time during this 50-year period.

Some of the most extreme droughts to affect the State include the following:

1903-1905: According to the USGS, the 1903 to 1905 drought is "the earliest recorded severe drought in Georgia." In 1904, the U.S. Weather Bureau (today's National Weather Service) reported, "Levels in streams and wells were the lowest in several years. Many localities had to conserve water for stock and machinery and many factories were forced to close or operate at half capacity." When the 1903 drought struck, farm jobs dried up as quickly as the fields. The cities attracted many of these workers who migrated to Atlanta.

1924-1927: The drought that struck from 1924 to 1927 affected a wider area than simply north Georgia, affecting the Coosa River and Altamaha Basin as well at the Chattahoochee River. The U.S. Weather Bureau reported the lowest stream levels ever recorded in north Georgia in July-September of 1925, stating that the drought not only affected agricultural operations, but industrial operations as well. The scarcity of water had a profound influence on industrial and agricultural conditions in Georgia. This may have been the first time Georgia media used the term "Drought of the Century". Combined with the ongoing devastation from the boll weevil and technological advances in agriculture that increased efficiency and thereby reduced the number of farm jobs, migration from rural Georgia to urban Georgia increased significantly. The impact of this drought, plus other natural events, helped send the Georgia economy into a depression well before the rest of the United States.

1930-1935: Although the drought of 1930-1935 had little long term impact on north Georgia, it contributed to the ongoing economic problems throughout the state and the United States as a whole. The USGS reports that the severity of this drought "exceeded a 25-year recurrence interval" in central and southwestern Georgia and affected much of the Country. In extreme northern and southeastern Georgia, the recurrence interval was 10–25 years. This period was also referred to as the "Drought of the Century."

Central Georgia - 1936

1938-1944: Many of the same areas that suffered during the 1930 to 1935 drought endured severe drought again from 1938 to 1944. The drought of 1938-1944 struck the upper Coosa River basin and the Chattahoochee River basin. According to USGS the recurrence interval exceeded 50 years in those areas. In extreme northern and southwestern Georgia, the drought had recurrence intervals of 10–25 years. It was this drought that convinced politicians to move towards massive hydroelectric projects that would supply power and keep water available to constituents throughout long dry spells. One of the key supporters of hydroelectric power in the United States was Senator Richard B. Russell, member of the Senate Appropriations Committee. The first such dam in the State, Allatoona, was begun in 1941 and completed after World War II.

1950-1957: A large statewide drought lasted from 1950 to 1957. Most streamflows had recurrence intervals exceeding 25 years according to USGS. The catastrophic drought devastated crops by 1954. This event also earned the title as "Drought of the Century." This drought was most severe in southern Georgia, with most streamflows having recurrence intervals exceeding 25 years. In northeastern Georgia, the drought severity also exceeded the 25-year recurrence interval. The low rainfall affected the length of time it took to fill Lake Lanier for the first time since its creation in 1950 and completion in 1956. In northwestern Georgia, the recurrence interval of the drought was between 10 and 25 years.

1976-1978: According to USGS, beginning in 1976, the weather over southwest Georgia turned towards a persistent pattern of late-summer drought including parts of the Chattahoochee Valley.

1980-1982: The 1980 to 1982 drought resulted in the lowest streamflows since 1954 in most areas, and the lowest streamflows since 1925 in others. Recurrence intervals of 10–25 years were common in most of Georgia. Pool levels at four major reservoirs receded to the lowest levels since first filling. Groundwater levels in many observation wells were lower than previously observed. Nearly continuous declines were recorded in some wells for as long as 20 consecutive months, and water levels remained below previous record lows for as long as nine consecutive months.

1985-1989: Many North Georgia residents remember the drought of 1985 to 1989 that saw Lake Lanier reach its lowest levels since it was filled in 1950. Streamflows touched the lows reached during the 1925 drought. Water-supply shortages occurred in Georgia in 1986. Shortages first occurred in a few Atlanta metropolitan systems, primarily because of large demand and small reservoir storage. As the drought continued, other systems in the southern part of the metropolitan area also had water-supply problems, as did several municipalities in northern and central Georgia. During 1986, the U.S. Army Corps of Engineers significantly decreased the release of water from Lake Lanier, but reservoir levels continued to recede to about 2 feet above the record minimum lake level. Ground-water levels in northern Georgia were significantly less than normal during the 1985 to 1989 drought, and shortages in ground-water supplies from domestic wells occurred in the northern one-third of the State.

1998-2003: From 1998 until 2003, with a brief respite in 2000-2001, North Georgia suffered through a historic drought. The term "historic," in this instance, is used by weathermen to describe a drought of unusually long duration, one of the three measures of a drought. While the regional impact of a long-term drought is massive, in North Georgia's case, the drought's effect was mitigated, simply because of technology, mostly the dams built by the Corps of Engineers and others. Earlier droughts, however, did not have the benefit of these dams and had a "historic" impact on North Georgia. Shortages of surface-water supplies similar to those during 1986 occurred in the 1998 to 2003 drought. Water shortages during the summer of 2000 prompted the Georgia Department of Natural Resources to institute statewide restrictions on outdoor water use.

2006-2009: Beginning in late 2006 another drought struck north Georgia, on the heels of the earlier 5-year drought. River levels plummeted, causing lakes to fill up more slowly when water was released. Georgia politicians battled against the Army Corps of Engineers' continuous flow requirement for Lake Lanier due to the looming water shortages. The

Georgia Environmental Protection Division (EPD) declared a level four drought response across the northern third of Georgia, including Forsyth County, which prohibits most types of outdoor residential water use effective immediately.

Lake Lanier and Lake Allatoona 2007 (L to R)

Lake Hartwell 2008

2011-2012: The most recent drought period in which Forsyth County was affected.

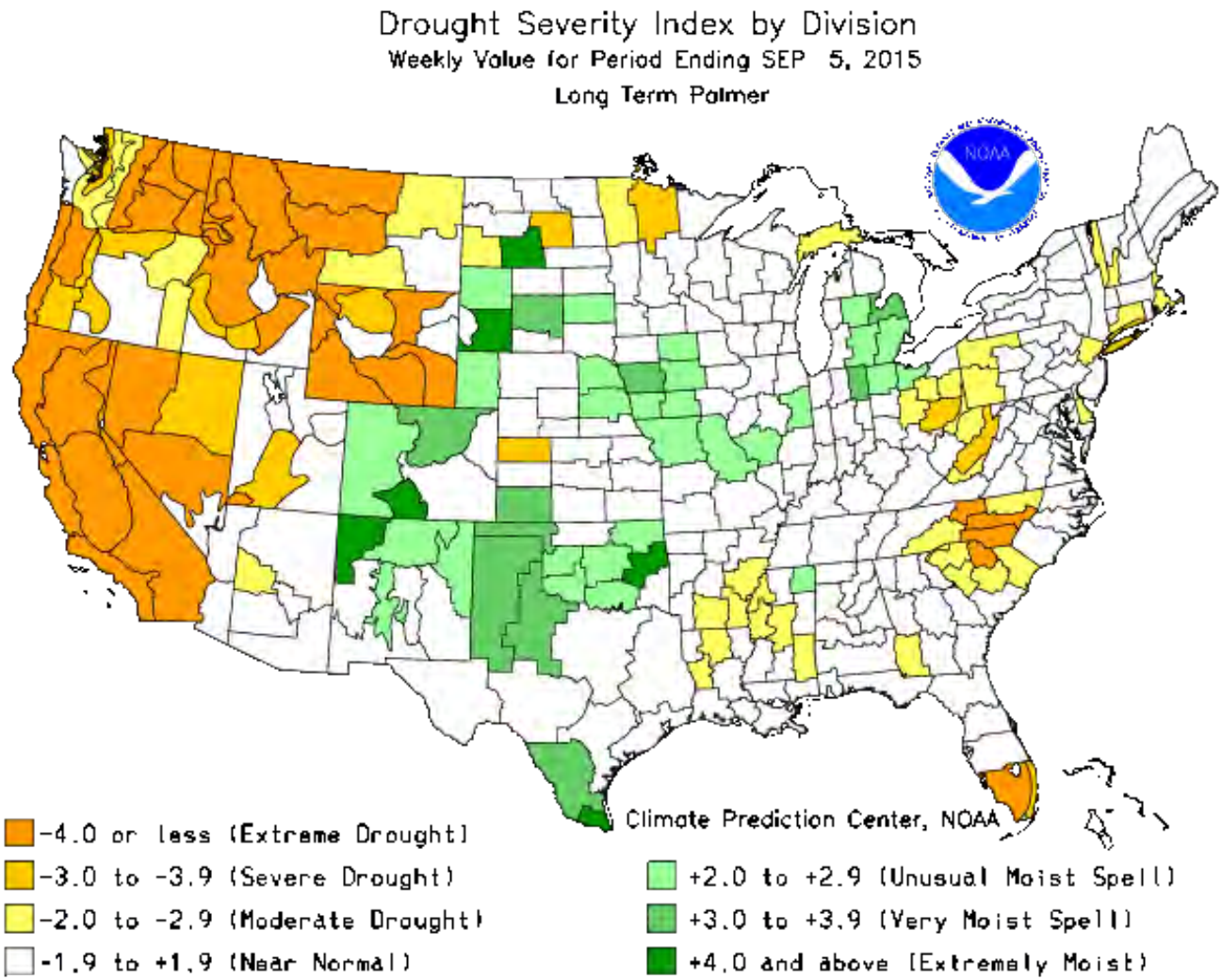
Agricultural crop damage during periods of drought is difficult to estimate. Water supplies, industries, power generation, agriculture, forests, wetlands, stream water quality, navigation, and recreation for the State of Georgia have been severely impacted over time. Because of the extremely unpredictable nature of drought (to include duration), reliably calculating a recurrence interval is difficult. The Hazard Frequency Table in Appendix C analyzes historical data from the past fifty years to provide a general idea of the frequency of drought within the State.

The following four maps represent current and forecasted drought conditions. Each of these maps is updated on a regular basis. Drought conditions can change very rapidly and must be continuously monitored.

The first map is the Palmer Drought Severity Index map which shows current drought conditions nationwide and is updated weekly. According to the map, the County's current drought status, as of September 5, 2015, is "near normal".

The second map, the U.S. Seasonal Drought Outlook, forecasts likely drought conditions through November 2015, which indicates that drought conditions in Forsyth County may develop.

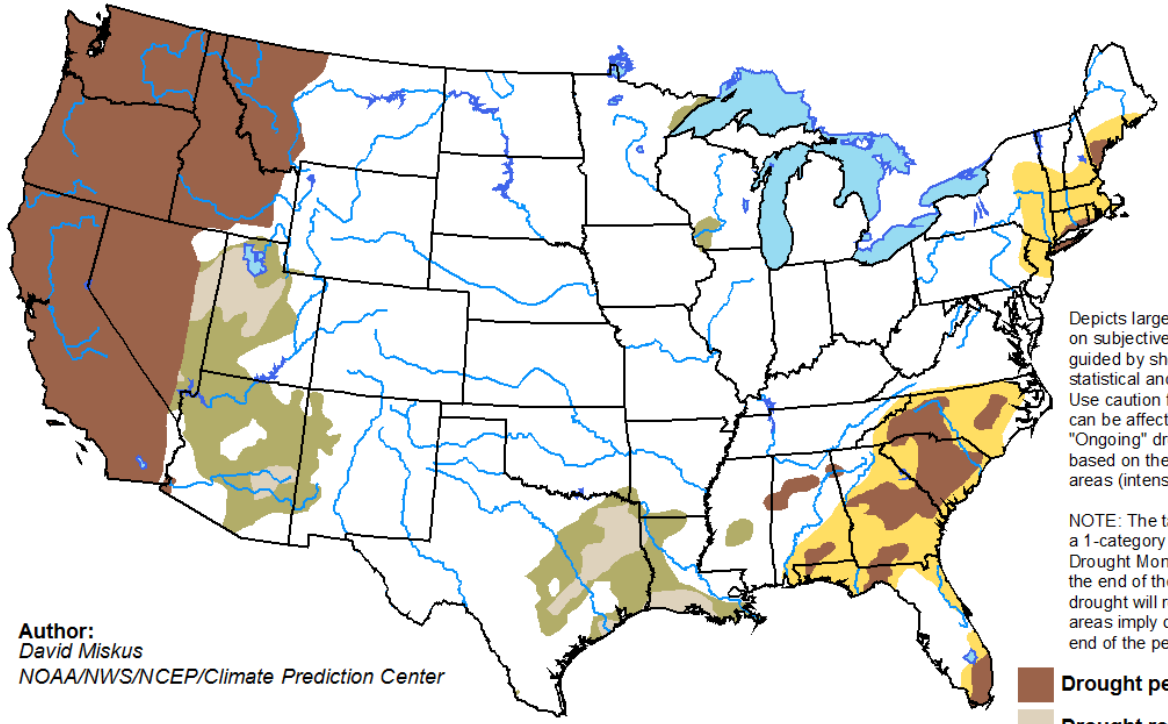
The third map, U.S. Drought Monitor, indicates that as of September 8, 2015, Forsyth County is not experiencing drought conditions.


Drought Severity Index by Division
Weekly Value for Period Ending SEP 5, 2015
Long Term Palmer
NOAA
Climate Prediction Center, NOAA
-4.0 or less (Extreme Drought)
-3.0 to -3.9 (Severe Drought)
-2.0 to -2.9 (Moderate Drought)
-1.9 to +1.9 (Near Normal)
+2.0 to +2.9 (Unusual Moist Spell)
+3.0 to +3.9 (Very Moist Spell)
+4.0 and above (Extremely Moist)

U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for August 20 - November 30, 2015
Released August 20, 2015



Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

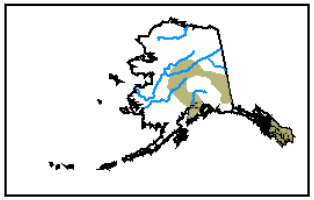
Drought persists/intensifies

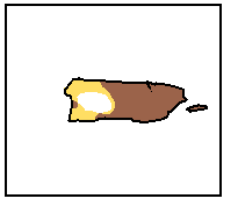
Drought remains but improves

Drought removal likely

Drought development likely

Author:
David Miskus
NOAA/NWS/NCEP/Climate Prediction Center

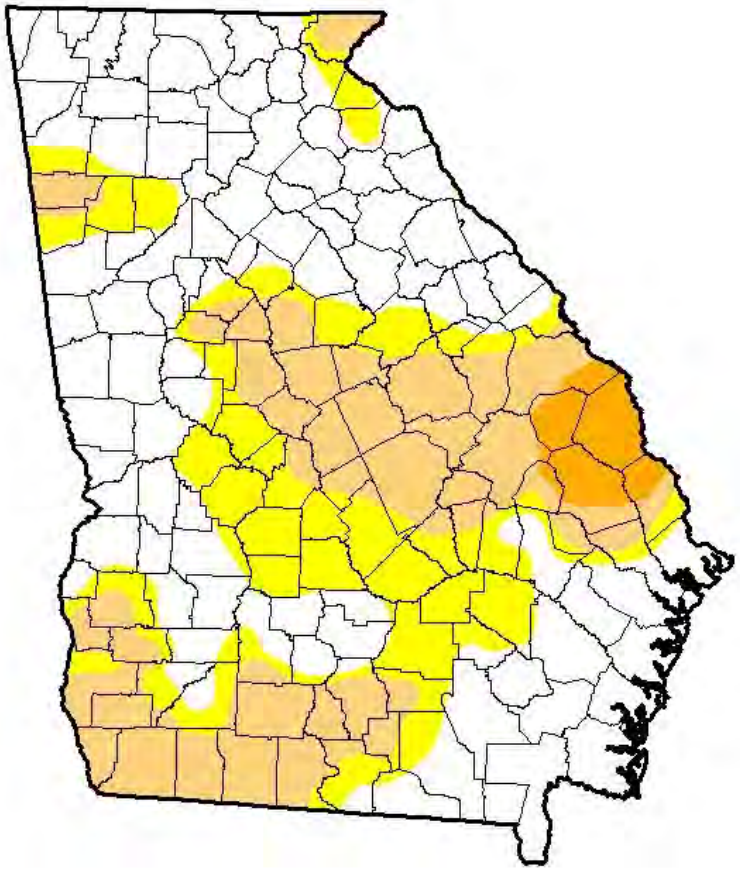




http://go.usa.gov/hHTe

U.S. Drought Monitor

Georgia



September 8, 2015

(Released Thursday, Sep. 10, 2015)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	51.40	48.60	27.12	3.25	0.00	0.00
Last Week 9/1/2015	50.17	49.83	27.05	2.99	0.00	0.00
3 Months Ago 6/9/2015	76.65	23.35	5.87	0.00	0.00	0.00
Start of Calendar Year 12/30/2014	94.23	5.77	0.00	0.00	0.00	0.00
Start of Water Year 9/30/2014	41.99	58.01	15.39	4.76	0.00	0.00
One Year Ago 9/9/2014	41.97	58.03	16.57	10.55	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Richard Tinker
CPC/NOAA/NWS/NCEP

http://droughtmonitor.unl.edu/

C. Assets Exposed to Hazard – Drought conditions typically pose little threat to structures. However, wildfire can be a direct result of drought and does present a significant threat to a majority of public and private property within the County, including critical facilities. Water resources are also vulnerable during drought conditions including public water supplies.

D. Estimate of Potential Losses – No damage to facilities is anticipated as a result of drought conditions, aside from the threat of wildfire. Crop damage cannot be accurately quantified due to several unknown variables: duration of the drought, temperatures during the drought, severity of the drought, rainfall requirements for specific crops and livestock, and the different growing seasons. There may also be financial losses related to water system shortages. For loss estimate information, please refer to Appendix A, the Critical Facilities Database, and Appendix D, Worksheet 3a (Non-Spatially Defined Hazards), for each jurisdiction.

E. Multi-Jurisdictional Concerns – Agricultural losses associated with drought are more likely to occur in the rural, less concentrated areas of the County. Although the City of Cumming is probably slightly less likely to experience agricultural-related drought losses than the County, it can be financially impacted by water resource-related drought losses since it operates a water distribution system serving both the City and parts of the County. The County also operates a water distribution system.

F. Hazard Summary – Unlike other hazard events, drought causes damage slowly. A sustained drought can cause severe economic stress to the agricultural interests of the County and even the entire State or Region. The potential negative effects of sustained drought are numerous. In addition to an increased threat of wildfires, drought can affect water supplies, stream-water quality, water recreation facilities, hydropower generation, as well as agricultural and forest resources. The HMPC realized the limitations associated with mitigation actions for drought, but did identify some basic mitigation measures in Chapter 5.

2.7 Earthquakes

A. Hazard Identification – One of the most frightening and destructive natural hazards is a severe earthquake. An earthquake is a sudden movement of the Earth, caused by the abrupt release of strain that has accumulated over a long time. The forces of plate tectonics shape the Earth as the huge plates that form the Earth's surface slowly move over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free. If the earthquake occurs in a populated area, it may cause many deaths, injuries and extensive property damage.

The goal of earthquake prediction is to give warning of potentially damaging earthquakes early enough to allow appropriate response to the disaster, enabling people to minimize loss of life and property. The U.S. Geological Survey conducts and supports research on the likelihood of future earthquakes. This research includes field, laboratory, and theoretical investigations of earthquake mechanisms and fault zones. A primary goal of earthquake research is to increase the reliability of earthquake probability estimates. Ultimately, scientists would like to be able to specify a high probability for a specific earthquake on a particular fault within a particular year. Scientists estimate earthquake probabilities in two ways: by studying the history of large earthquakes in a specific area and the rate at which strain accumulates in the rock.

Scientists study the past frequency of large earthquakes in order to determine the future likelihood of similar large shocks. For example, if a region has experienced four magnitude 7 or larger earthquakes during 200 years of recorded history, and if these shocks occurred randomly in time, then scientists would assign a 50 percent probability (that is, just as likely to happen as not to happen) to the occurrence of another magnitude 7 or larger quake in the region during the next 50 years. But in many places, the assumption of random occurrence with time may not be true, because when strain is released along one part of the fault system, it may actually increase on another part.

Another way to estimate the likelihood of future earthquakes is to study how fast strain accumulates. When plate movements build the strain in rocks to a critical level, like pulling a rubber band too tight, the rocks will suddenly break and slip to a new position. Scientists measure how much strain accumulates along a fault segment each year, how much time has passed since the last earthquake along the segment, and how much strain was released in the last earthquake. This information is then used to calculate the time required for the accumulating strain to build to the levels that result in an earthquake. This simple model is complicated by the fact that such detailed information about faults is rare. In the United States, only the San Andreas Fault system has adequate records for using this prediction method.

Magnitude and intensity measure different characteristics of earthquakes. Magnitude measures the energy released at the source of the earthquake and is determined from measurements on seismographs. Intensity measures the strength of shaking produced by the earthquake at a certain location and is determined from effects on people, human structures, and the natural environment. The following two tables describe the Abbreviated Modified Mercalli Intensity Scale, and show intensities that are typically observed at locations near the epicenter of earthquakes of different magnitudes.

Magnitude / Intensity Comparison

Magnitude	Typical Maximum Modified Mercalli Intensity
1.0 - 3.0	**I**
3.0 - 3.9	**II - III**
4.0 - 4.9	**IV - V**
5.0 - 5.9	**VI - VII**
6.0 - 6.9	**VII - IX**
7.0 and higher	**VIII** or higher

Abbreviated Modified Mercalli Intensity Scale

I. Not felt except by a very few under especially favorable conditions.

II. Felt only by a few persons at rest, especially on upper floors of buildings.

III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.

IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.

V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.

VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.

VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.

VIII. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.

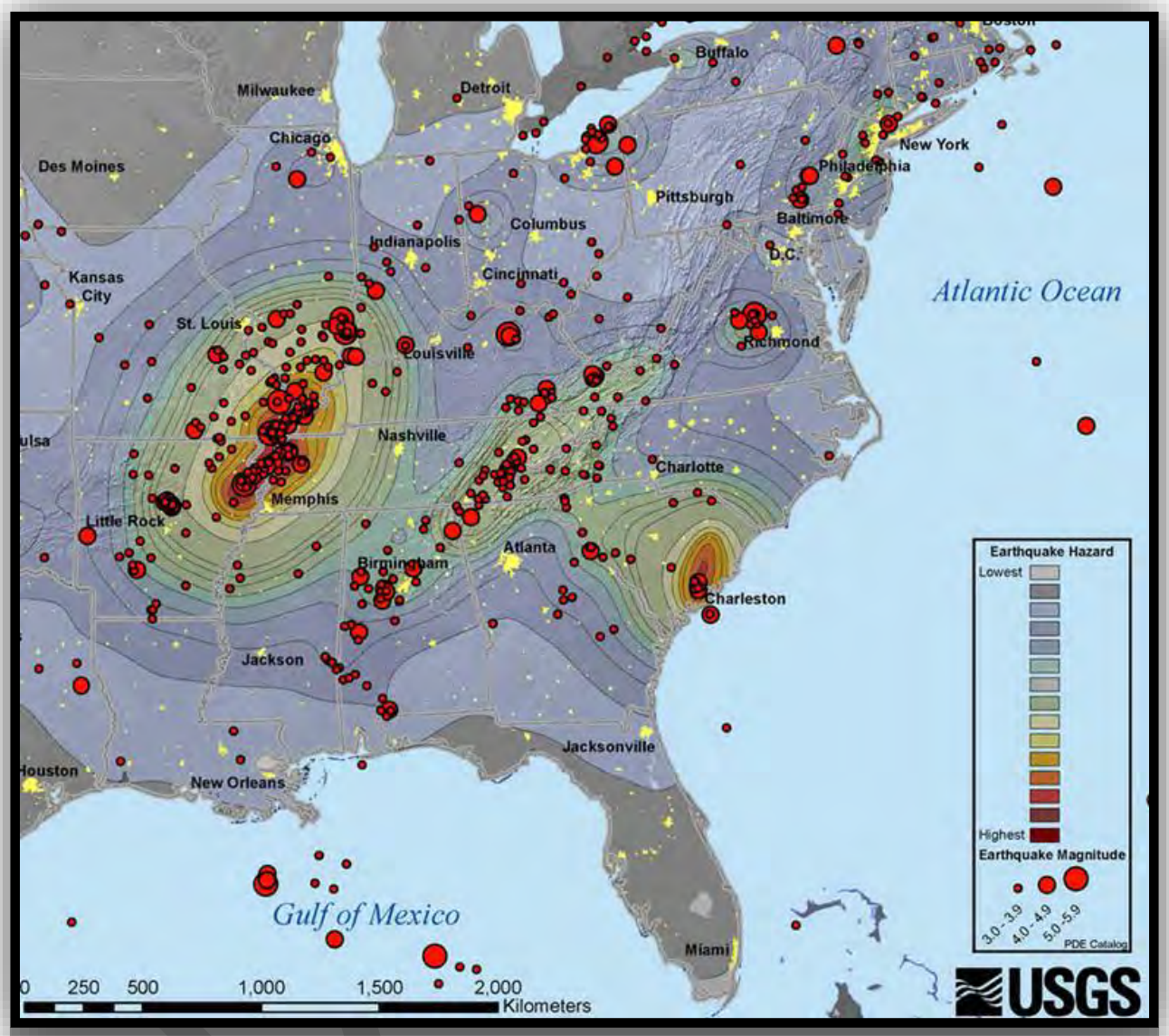
IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.

X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.

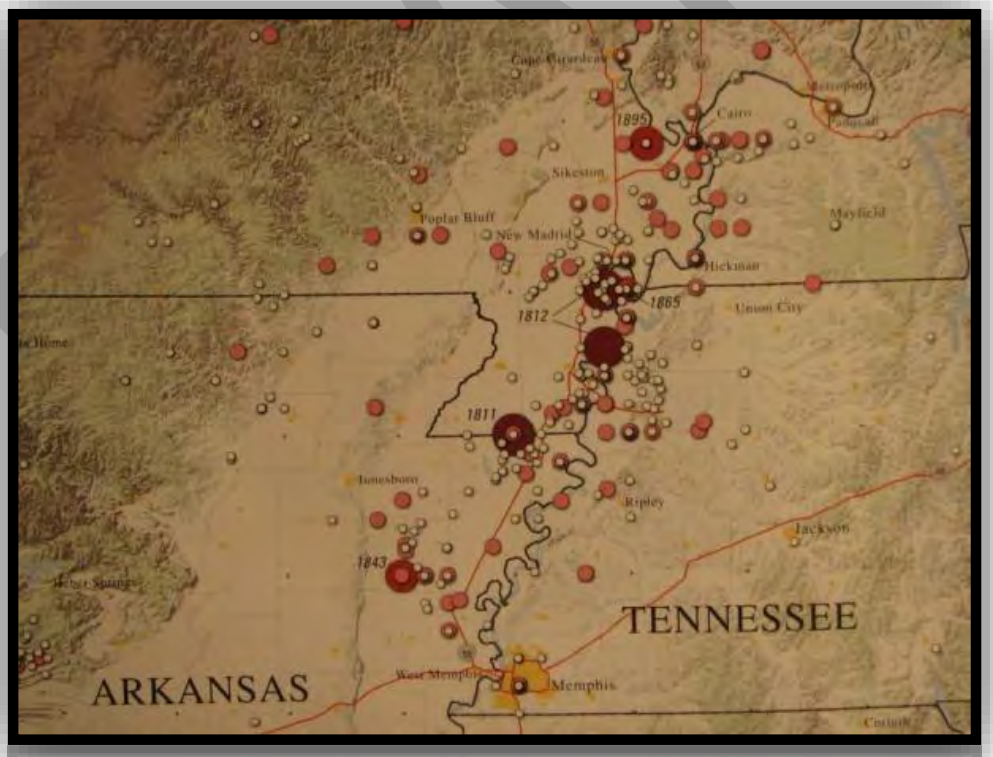
XII. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

The following USGS map provides a historical view of earthquakes in the Eastern United



States.

B. Hazard Profile – The first earthquakes recorded as being felt in Georgia were the great New Madrid earthquakes of 1811-1812 (also known as the Mississippi River Valley earthquakes) centered in northeast Arkansas and New Madrid, Missouri. There were hundreds of earthquakes during the two month period between December 16, 1811 and February 7, 1812. On the basis of the large area of damage (600,000 square kilometers), the widespread area of perceptibility (5,000,000 square kilometers), and the complex physiographic changes that occurred, this series of earthquakes rank as some of the largest in the United States since its settlement by Europeans. The area of strong shaking associated with these shocks is two to three times larger than that of the 1964 Alaska earthquake and 10 times larger than that of the 1906 San Francisco earthquake. The first three major earthquakes occurred in northeast Arkansas on December 16, 1811 (three shocks - Mfa 7.2/MSn 8.5; Mfa 7.0/MSn 8.0; and MSn 8.0). There were six aftershocks on December 16th and 17th alone in the range of M5.5 to M6.3 (Note: aftershocks actually *are* earthquakes). The fourth earthquake occurred in Missouri on January 23, 1812 (Mfa 7.1/MSn 8.4). The fifth earthquake occurred in New Madrid, Missouri on February 7, 1812 (Mfa 7.4/ MSn 8.8). This is the earthquake that created Reelfoot Lake, located in northwest Tennessee. It was reported to have been formed as the Mississippi River flowed backward for 10–24 hours to fill the lake. As a result of this earthquake, the original town of New Madrid now lies under the Mississippi River.



This accounted for a total of five earthquakes of magnitude MSn 8.0 or higher occurring in a period of 54 days. The first earthquake caused only slight damage to man-made structures, mainly because the region was so sparsely populated. However, as the earthquakes continued, they began to open deep cracks in the ground, created landslides on the steeper bluffs and hillsides, large areas of land were uplifted, and sizable sink areas were created. These five main earthquakes, and several aftershocks, were felt over almost all of the eastern United States including the State of Georgia. In Georgia this series of earthquakes was strong enough to have shaken bricks from chimneys and other minor damage.

The great Charleston, South Carolina, earthquake of 1886 killed approximately 60 people. The magnitude 7.3 earthquake is the most damaging earthquake to occur in the Southeast United States and one of the largest historic shocks in Eastern North America. It damaged or destroyed many buildings in the old city of Charleston. Property damage was estimated at $5-$6 million. Structural damage was reported several hundred

kilometers from Charleston including in the State of Georgia. On August 31, 1886 at 9:25 pm, preceded by a low rumble, the shock waves reached Savannah. People had difficulty remaining standing. One woman died of fright as the shaking cracked walls, felled chimneys, and broke windows. Panic at a revival service left two injured and two more were injured in leaping from upper story windows. Several more were injured by falling bricks. Ten buildings in Savannah were damaged beyond repair and at least 240 chimneys

damaged. People spent the night outside. At Tybee Island light station the 134 foot lighthouse was cracked near the middle where the walls were six feet thick, and the one-ton lens moved an inch and a half to the northeast. In Augusta the shaking was the most severe (VIII on the Modified Mercalli scale) in the State. An estimated 1000 chimneys and many buildings were damaged. The business and social life was paralyzed for two days. Brunswick and Darien were affected as well.

June 17, 1872: An earthquake on June 17, 1872 in Milledgeville, GA and had an intensity of at least V on the Modified Mercalli scale, the lowest intensity in which some damage may occur. It was reported as a sharp shock, jarring brick buildings and rattling windows.

November 1, 1875: On November 1, 1875, at 9:55 in the evening, an intensity VI earthquake occurred near the South Carolina border. It was felt from Spartanburg and Columbia, South Carolina, to Atlanta and Macon, Georgia, from Gainesville to Augusta, and generally over an area of 25,000 square miles.

October 18, 1902: A more local event occurred on October 18, 1902, with a sharp shock felt along the east face of Rocky Face Mountain, just west of Dalton, GA with intensity VI and at LaFayette, GA with intensity V. The earthquake was felt over an area of about 1500 square miles including Chattanooga, Tennessee.

January 23, 1903: The Savannah, GA area was shaken with an intensity VI earthquake on January 23, 1903. Centering near Tybee Island, it was felt over an area of 10,000 square miles including Savannah (intensity VI), Augusta (intensity III), Charleston (intensity IV-V), and Columbia (intensity III-IV). Houses were strongly shaken.

June 20, 1912: Another shock was felt on June 20, 1912, at Savannah with intensity V.

March 5, 1914: According to USGS, Georgia experienced another earthquake on March 5, 1914. Magnitude 4.5.

March 5, 1916: On March 5, 1916, an earthquake centered 30 miles southeast of Atlanta was felt over an area of 50,000 square miles, as far as Cherokee County, North Carolina, by several people in Raleigh, and in parts of Alabama and Tennessee.

March 12, 1964: An earthquake of intensity V or over occurred on March 12, 1964, centered near Haddock, GA less than 20 miles northeast of Macon. Intensity V was recorded at Haddock while shaking was felt in four counties over a 400-square-mile area.

April 29, 2003: On April 29, 2003 just before 5:00 a.m. a moderate earthquake, rated 4.9 on the Richter Scale, shook most of the northwest corner of Georgia, south to Atlanta. The epicenter was located in Menlo, GA, about 37 miles south of Chattanooga.

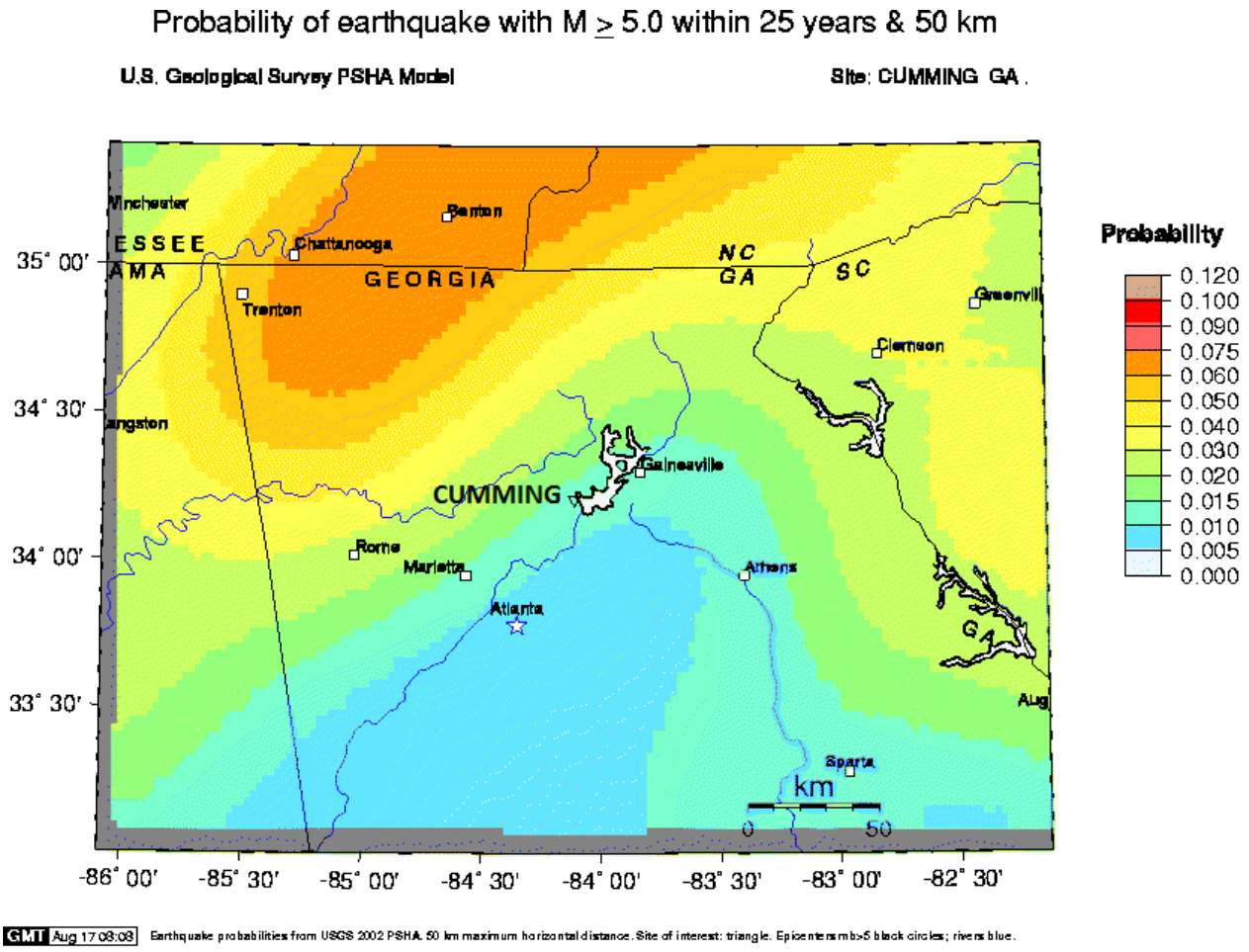
August 23, 2011: On August 23, 2011 at 1:51pm, a 5.8 magnitude earthquake originated near Louisa and Mineral, Virginia. It struck Washington DC (about 100 miles away from epicenter) causing moderate shaking and potentially significant damage. The earthquake

was recorded all along the Appalachians, from Georgia to New England. The earthquake was felt so widely because it was a shallow earthquake, and geologic conditions in the eastern U.S. allow the effects of earthquakes to propagate and spread much more efficiently than in the western United States. Only mild movement was felt in Forsyth County.

To a large extent, the HMPC was unable to determine which of these earthquakes affected Forsyth County and, if so, to what degree. Nevertheless, the HMPC has determined that most of the earthquakes documented above would have been strong enough or would have occurred close enough to Forsyth County to merit consideration. Three of these earthquakes occurred within the 50-year study period and are included in the hazard history of this Plan. The threat of earthquakes in Forsyth County may be more significant than the documented earthquake history would seem to indicate. More recent seismic activity for the State of Georgia is shown on the following map for the period 1990 to 2006. This activity was limited and only minor in nature.

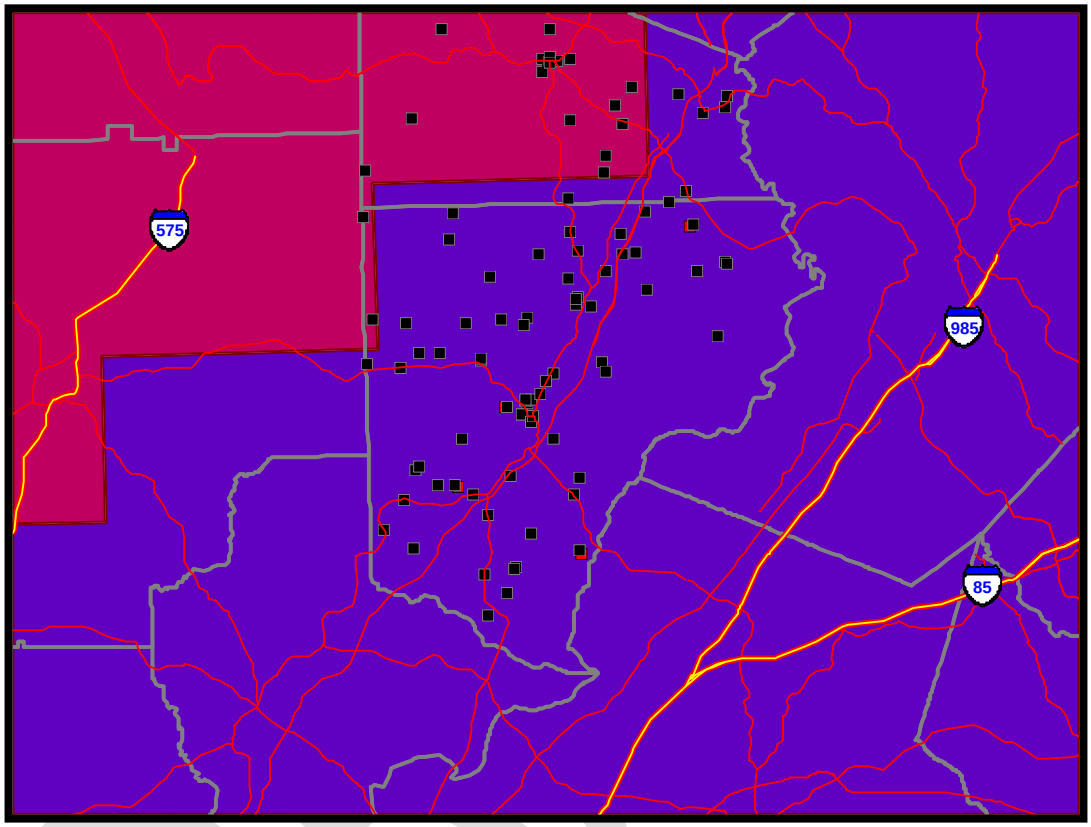
Based on U.S. Geological Survey estimations using the earthquake frequency method described in the section above, the probability of an earthquake of Magnitude 5.0 or more

occurring within Forsyth County over the next 25 years is between 1% and 3% (see map below). As discussed above, such predictions are based on limited information, and cannot necessarily be relied upon for their precision. However, they do help demonstrate that the threat of earthquakes cannot be overlooked even in a relatively inactive geographic area such as Forsyth County.



C. Assets Exposed to Hazard - All structures and facilities within Forsyth County are susceptible to earthquake damage since they can occur in any portion of the County or City. Although the likelihood of a severe earthquake is slim, it may be just slightly higher in the

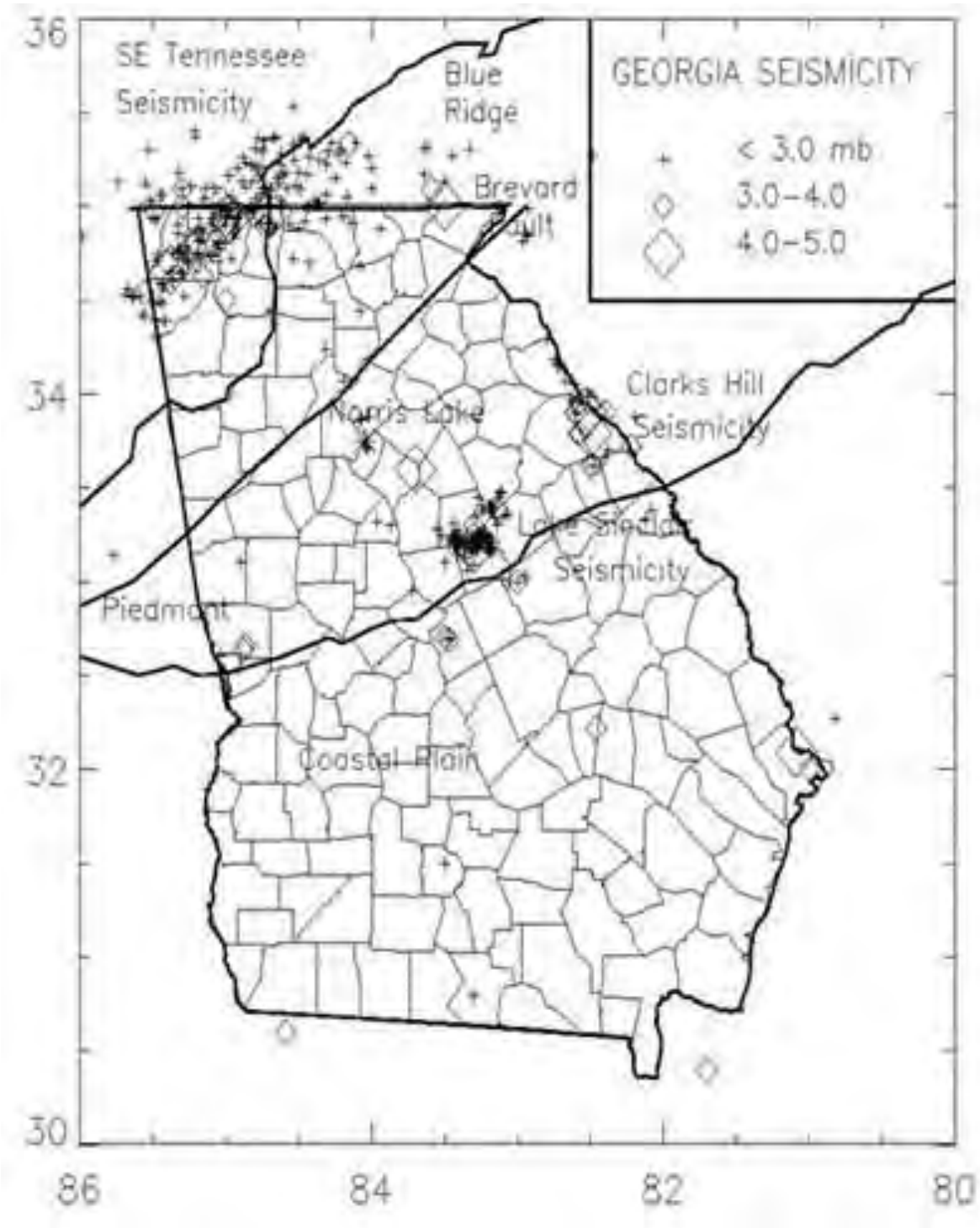
northwest corner of the County. The seismic hazard layer below is based on the USGS Probabilistic Seismic Hazard Map, showing the percentage of gravity that the area has a 2 percent probability of exceedance in 50 years. The score classification reflects that used by the IRC Seismic Design Categories. The horizontal positional accuracy is unknown for this layer.



Score	Original Value	Description
4	D1	50-83% gravity (highest threat)
3	C	33-50% gravity (moderate to high threat)
2	B	17-33% gravity (low to moderate threat)
1	A	0-17% gravity (lowest threat)

Georgia has a few large faults, including the Brevard fault. The Brevard fault extends from Alabama through Georgia into South Carolina and follows the Chattahoochee River. The

fault is located in parts of southern and western Forsyth County along the county border. However, this fault, along with the others, is not active at this time.



D. Estimate of Potential Losses – For loss estimate information, please refer to Appendix A, the Critical Facilities Database, and Appendix D, Worksheet 3a (Non-Spatially Defined Hazards), for each jurisdiction.

E. Multi-Jurisdictional Concerns – All of Forsyth County has the potential to be affected by earthquakes. The threat appears to be no greater within the City than it is within the County, other than a slightly elevated risk in the northwest portion of the County. Any steps taken to mitigate the effects of earthquake should be undertaken on a countywide basis and include the City of Cumming.

F. Hazard Summary – Scientific understanding of earthquakes is of vital importance to the Nation. As the population increases, expanding urban development and construction works encroach upon areas susceptible to earthquakes. With a greater understanding of the causes and effects of earthquakes, we may be able to reduce damage and loss of life from this destructive phenomenon. The HMPC was limited in its ability to develop mitigation measures associated with earthquakes, but did provide some guidance in Chapter 5.

Chapter 3
Local Technological Hazard, Risk and Vulnerability (HRV) Summary

In accordance with FEMA guidelines, the Forsyth County Hazard Mitigation Planning Committee (HMPC) also included information relating to technological or "human-caused" hazards into this plan. The term, "technological hazard" refers to incidents resulting from human activities such as the manufacture, transportation, storage, and use of hazardous materials. This plan assumes that hazards resulting from technological sources are accidental, and that their consequences are unintended. Unfortunately, the information relating to technological hazards is much more limited, due largely to the very limited historical data available. This causes a greater level of uncertainty with regard to mitigation measures. However, enough information has been gathered to provide a basic look at technological hazards within Forsyth County.

The Forsyth County Hazard Mitigation Planning Committee (HMPC) identified two technological hazards the County is vulnerable to based upon available data including scientific evidence, known past events, and future probability estimates. As a result of this planning process, which included an analysis of the risks associated with probable frequency and impact of each hazard, the HMPC determined that each of these technological hazards pose a threat significant enough to address within this Plan. These include hazardous materials release and dam failure. Each of these technological hazards is addressed in this chapter of the Plan. An explanation and results of the vulnerability assessment are found in Tables 3-1 and 3-2.

Table 3.1 – Hazards Terminology Differences

Hazards Identified in 2008 Georgia State Plan	Equivalent/Associated Hazards Identified in the 2011 Forsyth County Plan	Difference
Dam Failure	Dam Failure	None

Table 3.2 – Vulnerability Assessment - Technological Hazards *(see Keys below)*

HAZARD	FORSYTH	CUMMING
Dam Failure		
Frequency	VL	VL
Severity	H	H
Probability	EX	EX
Hazardous Materials Release		
Frequency	H	H
Severity	EX	EX
Probability	EX	EX

Key for Table 3.2 – Vulnerability Assessment Frequency and Probability Definitions

NA = Not applicable; not a hazard to the jurisdiction
VL = Very low risk/occurrence
L = Low risk; little damage potential (for example, minor damage to less than 5% of the jurisdiction)
M = Medium risk; moderate damage potential (for example, causing partial damage to 5-15% of the jurisdiction, infrequent occurrence)
H = High risk; significant risk/major damage potential (for example, destructive, damage to more than 15% of the jurisdiction, regular occurrence)
EX = Extensive risk/probability/impact

3.1 Hazardous Materials Release

A. Hazard Identification – Hazardous materials (hazmat) refers to any material that, because of its quantity, concentration, or physical or chemical characteristics, may pose a real hazard to human health or the environment if it is released. Hazmat includes flammable and combustible materials, toxic materials, corrosive materials, oxidizers, aerosols, and compressed gases. Specific examples of hazmat are gasoline, bulk fuels, propane, propellants, mercury, asbestos, ammunition, medical waste, sewage, and chemical, biological, radiological, nuclear, and explosive (CBRNE) threat agents. Specific federal and state guidelines exist on transport and shipping hazardous materials. Research institutes, industrial plants, individual households, and government agencies all generate chemical waste. Approximately one percent is classified as hazardous.

A hazmat spill or release occurs when hazardous material or waste gets into the environment in an uncontrolled fashion. Many manufacturing processes use hazardous materials or generate hazardous waste, but a hazardous spill doesn't always come from a chemical plant or a factory. Any substance in the wrong place at the wrong time in too large an amount can cause harm to the environment. The response to a spill depends on the situation. When the emergency response team is notified of a spill, it must quickly decide what sort of danger is likely. Members of the team collect appropriate clothing and equipment and travel to the scene. There they try to contain the spill, sometimes testing a

sample to identify it. If necessary, they decontaminate themselves before leaving the area. Once the material has been identified, other personnel arrive to remove it.

B. Hazard Profile – Hazmat spills are usually categorized as either fixed releases, which occur when hazmat is released on the site of a facility or industry that stores or manufactures hazmat, or transportation-related releases, which occur when hazmat is released during transport from one place to another. Both fixed and transportation-related hazmat spills represent tremendous threats to Forsyth County. Potential fixed hazmat spills within the County would come from local commercial and industrial establishments. Unfortunately, Georgia EPD no longer makes specific hazmat spill information available to the public as they once did. If at some point this changes, that data will be considered at the next Plan update.

C. Assets Exposed to Hazard – The environment is especially vulnerable to hazardous materials releases. Waterways are at greatest risk of contamination, including potential contamination to Lake Lanier, Big Creek, Chattahoochee River, Six Mile Creek, Etowah River, Settendown Creek, Dick's Creek, Hall Creek, Chestatee River, Yellow Creek, Hurricane Creek, Edwards Creek, Bear Creek, Orr's Creek, Cheatham Creek, James Creek, Daves Creek, Bald Ridge Creek, Young Deer Creek, and Bethel Park Lake, as well as dozens of unnamed creeks, lakes, storm sewers, wells, and drainage ditches. Such releases are also a potential threat to all property and persons within any primary highway corridors of Forsyth County, including GA 400, State Routes 9, 20, 53, 141, 306, and 369, due to the fact that certain hazmat releases can create several square miles of contamination. The same holds true of property and persons located in the vicinity of facilities or industries that produce or handle large amounts of hazardous materials.

D. Estimate of Potential Losses - It is difficult to determine potential damage to the environment caused by hazardous materials releases. What can be calculated are the significant response costs incurred once a hazmat release does occur including emergency response, road closings, evacuations, watershed protection, expended man-hours, and cleanup materials and equipment. Corridors for GA 400, State Routes 9, 20, 53, 141, 306, and 369 are most vulnerable to transportation-related releases. However, such releases can occur in virtually any part of the County accessible by road. Fixed location releases are not as likely to affect the more rural areas of the County. For additional loss estimate information, please refer to the Critical Facilities Database (Appendix A).

E. Multi-Jurisdictional Concerns – All of Forsyth County, including the City of Cumming, is vulnerable to both fixed and transportation-related hazardous materials releases. Both jurisdictions contain numerous commercial and industrial facilities and experience busy state route traffic.

F. Hazard Summary – Hazardous materials releases are one of the most significant threats to Forsyth County. Unknown quantities and types of hazmat are transported through the County by truck on a daily basis. The main highways of concern are GA 400, State Routes 9, 20, 53, 141, 306, and 369. These hazmat shipments pose a great potential threat to all of Forsyth County. The fact that the County is unable to track these shipments

seriously limits the mitigation measures that can be put into place. Fixed hazmat releases are also considered to be a threat to Forsyth County. Therefore, the Forsyth County HMPC has identified some specific mitigation actions for hazardous materials releases in Chapter 5.

3.2 Dam Failure

A. Hazard Identification – Georgia law defines a dam as any artificial barrier which impounds or diverts water, is 25 feet or more in height from the natural bed of the stream, or has an impounding capacity at maximum water storage evaluation of 100 acre-feet (equivalent to 100 acres one foot deep) or more. Dams are usually constructed to provide a ready supply of water for drinking, irrigation, recreation and other purposes. They can be made of rock, earth, masonry, or concrete or of combinations of these materials.

Dam failure is a term used to describe the major breach of a dam and subsequent loss of contained water. Dam failure can result in loss of life and damage to structures, roads, utilities, crops, and livestock. Economic losses can also result from a lowered tax base, lack of utility profits, disruption of commerce and governmental services, and extraordinary public expenditures for food relief and protection. National statistics show that overtopping due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest account for one third of all U.S. dam failures. Foundation defects, including settlement and slope instability, account for another third of all failures. Piping and seepage, and other problems cause the remaining third of national dam failures. This includes internal erosion caused by seepage, seepage and erosion along hydraulic structures, leakage through animal burrows, and cracks in the dam. The increasing age of dams nationwide is a contributing factor to each of the problems above.

B. Hazard Profile – Congress first authorized the US Army Corps of Engineers to inventory dams in the United States with the National Dam Inspection Act (Public Law 92-

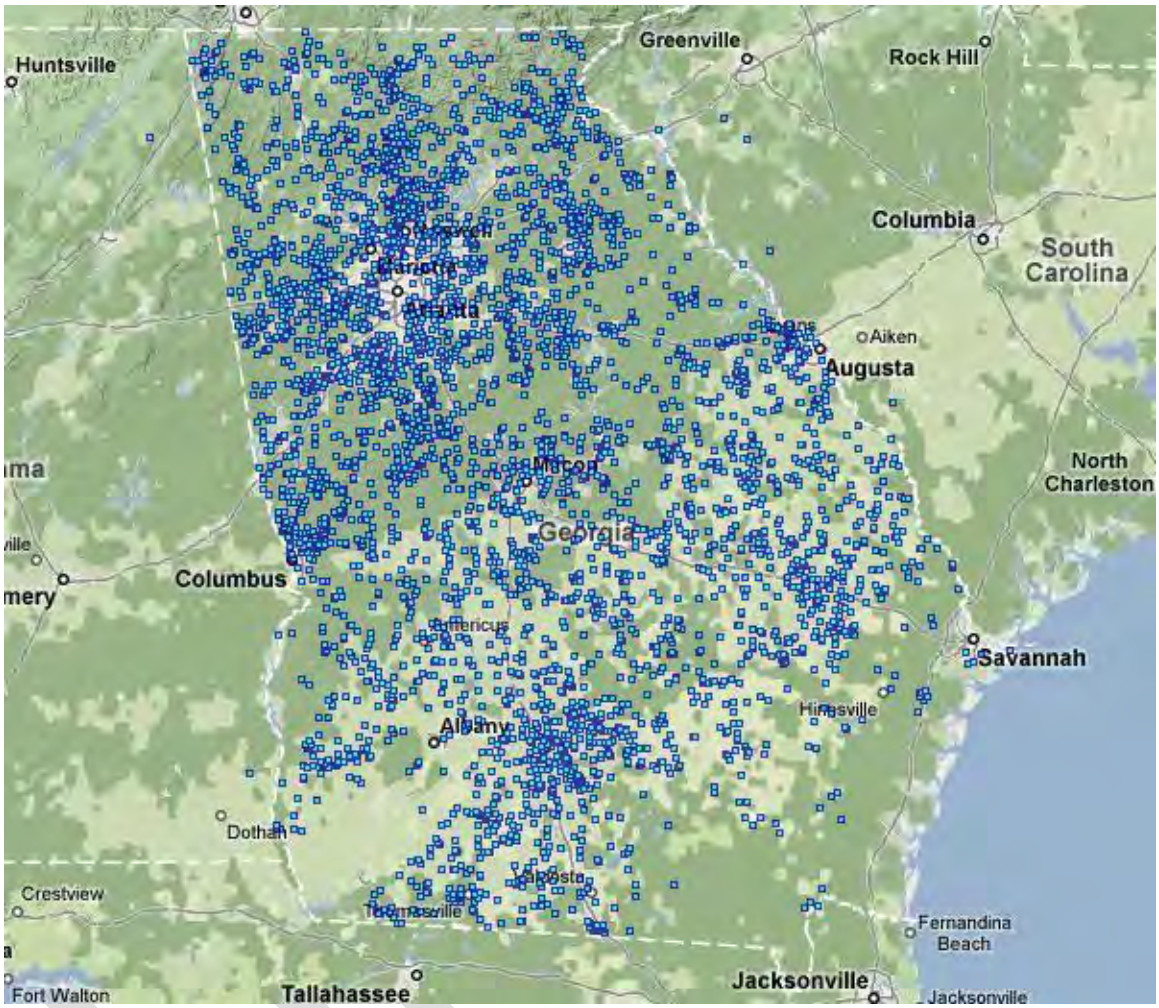
367) of 1972. The Water Resources Development Act of 1986 (P.L. 99-662) authorized the Corps to maintain and periodically publish an updated National Inventory of Dams (NID), with re-authorization and a dedicated funding source provided under the Water Resources Development Act of 1996 (P.L. 104-3). The Corps also began close collaboration with the Federal Emergency Management Agency (FEMA) and state regulatory offices to obtain more accurate and complete information. The National Dam Safety and Security Act of 2002 (P.L. 107-310) reauthorized the National Dam Safety Program and included the maintenance and update of the NID by the Corps of Engineers.

The most recent Dam Safety Act of 2006 reauthorized the maintenance and update of the NID. The NID consists of dams meeting at least one of the following criteria:

1) High hazard classification - loss of one human life is likely if the dam fails,
2) Significant hazard classification - possible loss of human life and likely significant property or environmental destruction,
3) Equal or exceed 25 feet in height and exceed 15 acre-feet in storage,
4) Equal or exceed 50 acre-feet storage and exceed 6 feet in height.

The goal of the NID is to include all dams in the U.S. that meet these criteria, yet in reality, is limited to information that can be gathered and properly interpreted with the given funding. The inventory initially consisted of approximately 45,000 dams, which were gathered from extensive record searches and some feature extraction from aerial imagery. Since continued and methodical updates have been conducted, data collection has been focused on the most reliable data sources, which are the various federal and state government dam construction and regulation offices. In most cases, dams within the NID criteria are regulated (construction permit, inspection, and/or enforcement) by federal or state agencies, who have basic information on the dams within their jurisdiction. Therein lies the biggest challenge, and most of the effort to maintain the NID; periodic collection of dam characteristics from states, territories, and 18 federal offices. Database management software is used by most state agencies to compile and export update information for the NID. With source agencies using such software, the Corps of Engineers receives data that can be parsed and has the proper NID codes. The Corps can then resolve duplicative and conflicting data from the many data sources, which helps obtain the more complete, accurate, and updated NID.

The National Inventory of Dams Map for the State of Georgia is located below and displays the State's current inventory of 5,132 dams.



The Forsyth County HMPC reviewed historical data from the Environmental Protection Division (EPD) within the Georgia Department of Natural Resources (DNR) as well as County records in their research involving dam failure within Forsyth County. Fortunately, Forsyth County has never experienced a major dam failure. It is possible that some small private dams have been breached at some point in the past, but no records have been found to indicate any type of emergency response related to such a failure, or even that such a failure has taken place. However, the potential for such a disaster does exist, and the appropriate steps must be taken to minimize such risks. The Safe Dams Program helps to accomplish that.

The Georgia Safe Dams Act of 1978 established Georgia's Safe Dams Program following the November 6, 1977 failure of the Kelly Barnes Dam in Toccoa, GA, in which 39 people

lost their lives when the breached dam, which held back a 45-acre lake, sent a 30-foot-high wall of water sweeping through Toccoa Falls College. The Environmental Protection Division (EPD) within the Georgia Department of Natural Resources (DNR) is responsible for administering the Program. The purpose of the Program is to *provide for the inspection and permitting of certain dams in order to protect the health, safety, and welfare of all citizens of the state by reducing the risk of failure of such dams.* The Program has two main functions: (1) to inventory and classify dams and (2) to regulate and permit high hazard dams.

The Georgia Stormwater Management Manual provides the definition for a Category I and a Category II dam in the State of Georgia:

- "Category I" means the classification where improper operation or dam failure would result in probable loss of human life. Situations constituting "probable loss of life" are those situations involving frequently occupied structures or facilities, including, but not limited to, residences, commercial and manufacturing facilities, schools and churches.

- "Category II" means the classification where improper operation or dam failure would not expect to result in probable loss of human life.

Structures below the State minimum height and impoundment requirements (25 feet or more in height or an impounding capacity of 100 acre-feet or more) are exempt from regulation by the Georgia Safe Dams Program. The Program checks the flood plain of the dam to determine its hazard classification. Specialized software is used to build a computer model to simulate a dam breach and establish the height of the flood wave in the downstream plain. If the results of the dam breach analysis, also called a flood routing, indicate that a breach of the dam would result in a probable loss of human life, the dam is classified as Category I. As of December 2011, the Program's statewide inventory of dams consisted of 475 Category I dams, 3,410 Category II dams and 1,186 exempt dams. The Program noted that an additional 120 Category II dams needed to be studied for possible reclassification to Category I dams. The Safe Dams Program also approves plans and specifications for construction and repair of all Category I dams. In addition, Category I dams are continuously monitored for safety by Georgia EPD.

To date, the Safe Dam Program has identified **nine Category I dams** that reside within Forsyth County. These dams are Buford Dam, Settingdown Creek Watershed Structure No. 6, Settingdown Creek Watershed Structure No. 25, Settingdown Creek Sub-Watershed Structure No. 27, Settingdown Creek Watershed Structure No. 54, Settingdown Creek Watershed Structure No. 56, Etowah River Sub-Watershed Structure No. 1, Dunroven Lake Dam, and Pine Lake Dam. The additional 27 identified dams located within the County are Category II dams (21) or exempt (6). There may be a number of unclassified dams within the County as well. The Program requires all Category II dams to be inventoried at least every five years. The Program also offers assistance to local governments in understanding, implementing and maintaining compliance with the National Flood Insurance Program (NFIP).

C. Assets Exposed to Hazard – Areas most vulnerable to the physical damages associated with dam failure within Forsyth County are the low-lying and downstream areas associated with Buford Dam, Settingdown Creek, Etowah River, Dunroven Lake, and Pine Lake. Physical damages and the effect on local economies would be devastating if Buford Dam were to fail. The Buford Dam Break Study (referenced in Appendix E), created by the U.S. Army Corps of Engineers in 1982, provides estimates of the probable timeline and flood elevations downstream from Buford Dam in the event of a break. Although physical damages associated with other dam failures within the County would be limited to certain areas, the damage to the local economy and problems associated with delivery of water and other utilities could be felt Countywide. Note: Due to security concerns, the Buford Dam Break Study will not be available to the public without authorization from the Forsyth County EMA Director.

D. Estimate of Potential Losses - Loss estimation due to dam failure is an approximate effort, at best. Direct loss to infrastructure, critical facilities, and businesses in terms of repair and replacement can be roughly estimated. However, estimating indirect costs, such as losses to the Lake Lanier tourism industry, is less accurate. For additional loss estimate information, please refer to the Critical Facilities Database (Appendix A).

E. Multi-Jurisdictional Concerns – All of Forsyth County, including the City of Cumming, is vulnerable to the negative impact of dam failure.

F. Hazard Summary – A dam failure has never been recorded in Forsyth County. However, with nine Category I dams located in the County, including Buford Dam, risks associated with dam failure cannot be ignored. The Forsyth County HMPC has identified some specific mitigation actions for dam failure in Chapter 5.

Chapter 4
Land Use and Development

After review by the HMPC, it was determined that current and future development does not appear to significantly impact the vulnerabilities of Forsyth County or the City of Cumming. Nevertheless, the most current development information available is outlined below.

A. Existing Land Use

A comprehensive land use survey was conducted for Forsyth County in the spring of 2010 using aerial photographs and field review. The Georgia Department of Community Affairs (DCA) has established a state-wide land use classification system for regional and local government agencies in the State of Georgia. The land uses shown in Table 1 and Figure 1 follow these standards.

TABLE I: EXISTING LAND USE WITHIN FORSYTH COUNTY

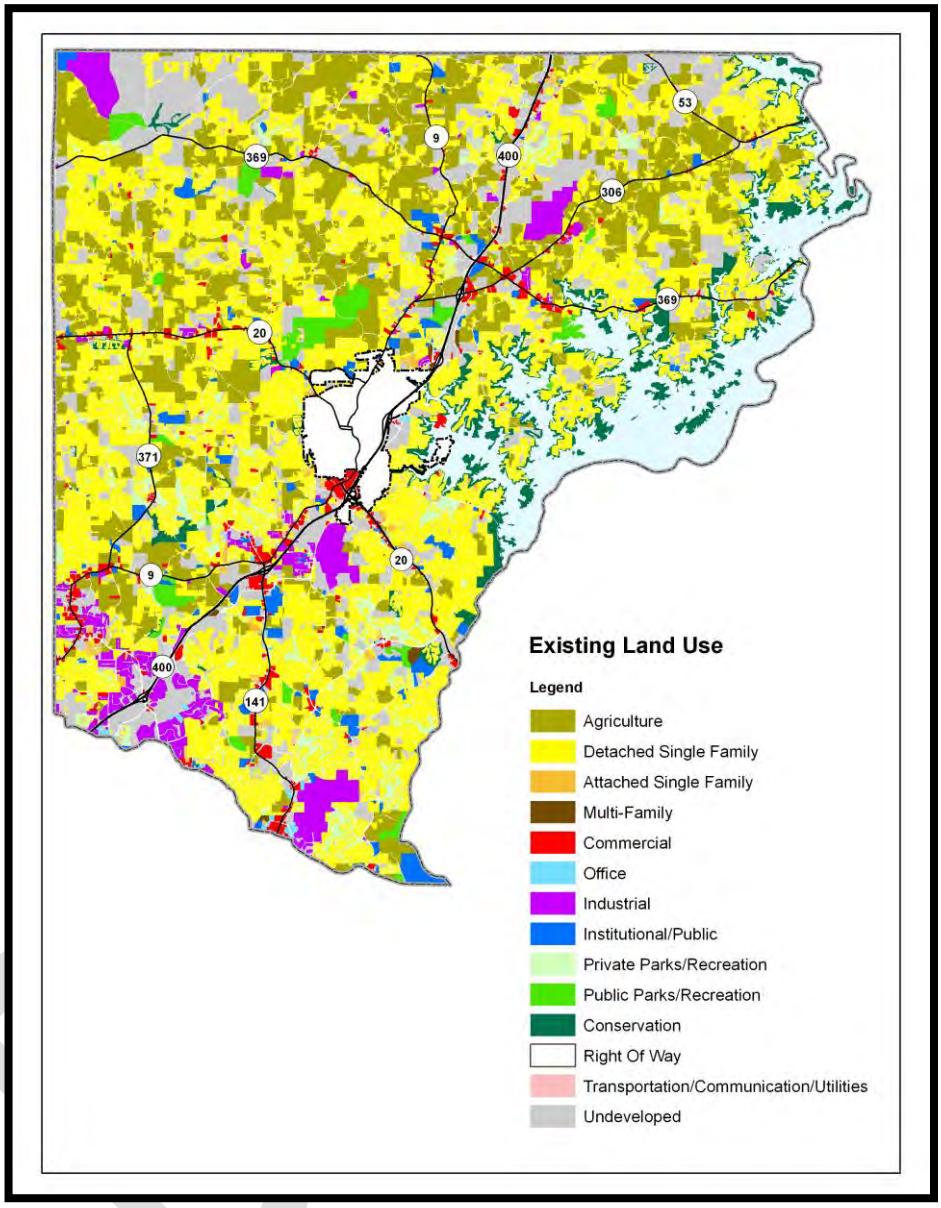
Land Use	Acres	Percent
Residential	54,540	37.5%
Agriculture	29,068	20.0%
Undeveloped	23,382	16.1%
Parks/Recreation/Conservation	12,675	8.7%
Road Right-of-Way	10,678	7.3%
Industrial	5,386	3.7%
Institutional/Public	2,993	2.1%
Commercial	2,879	2.0%
Office	258	0.2%
Transportation/Communication/Utilities	145	0.1%
City of Cumming	3,301	2.3%
Total Land Acreage for the County	145,305	100%
Total Land Square Miles for the County	227.0	N/A

Please note: County totals do not include Lake Sidney Lanier

The largest land use category in the county is residential land, comprising approximately 38 percent of the total land area. Residential development is found throughout the county with the largest concentration in the southern and central portions and along Lake Sidney Lanier's perimeter. Single-family detached units are the predominate dwelling type within the county.

The second largest use is agriculture, which accounts for 20 percent of the total land area. Most of the agricultural land can be found in the northern section of the county. There is very little crop production in the county; most of the agricultural uses are poultry and cattle related. Many of the identified agricultural lands receive a tax credit for agricultural use and production.

Figure 1: Existing Land Use of Forsyth County



The third largest category is undeveloped land, which accounts for 16 percent of the total land area. Undeveloped land is found dispersed across the county with numerous large tracts in the northern portion of the county, located on both sides of SR 400. The other substantial undeveloped section is located in the southern end of the county in the vicinity of the McFarland Parkway interchange.

The remaining land uses comprise approximately a quarter of the county's land area and include commercial, industrial, office, public and institutional uses as well as parks. Much of the commercial land uses are concentrated along the SR 400 corridor, other state routes, particularly SR 20 and SR 9, and SR 141. Industrial uses are clustered in the southern segment of the county along SR 400, SR 9, McFarland Parkway, Shiloh Road and SR 141.

B. Historic Considerations

Prior to the construction of Buford Dam and the creation of Lake Sidney Lanier in the mid-1950s, unincorporated Forsyth County was primarily utilized as farmland. Until the widening of SR 400 in the mid-1980s, most of the new growth was associated with the development of lake front homes. Over the last twenty years, however, the growth of metropolitan Atlanta has been the catalyst for rapid development. In particular, the development of suburban employment centers in Fulton and Gwinnett Counties has led to extensive expansion of single-family housing as well as the creation of a strong employment base within the county itself.

The nature of the county's fast paced growth is illustrated by comparing the 2003 existing land use survey prepared for the previous comprehensive plan with the 2010 survey. In 2003, 27 percent of the county was undeveloped whereas in 2010 this figure has decreased to 16.1 percent. The other notable change in comparing the existing land use surveys is that agricultural land increased in 2010, but this is due to the survey method. In addition, the park/recreation/conservation category increased as a result of county property purchases through the parks, recreation and greenspace bond that was approved in 2008.

Transportation networks have made a significant impact on Forsyth County's development pattern. SR 400, SR 141, SR 9 and SR 20 continue to emerge as strong development corridors. These roads have made it easier for people to commute to work either outside the county or within its borders as employment areas have expanded within the county.

The availability of sewer has also had a major influence on the location and magnitude of development. Sewer accessibility assists in determining the density or intensity of developments, and to some extent, the location as well. High-density developments such as apartments, manufacturing or large scale retail require sewer; whereas, low-density developments can be supported by septic tanks that necessitate relatively large drainage fields. There are areas of the county that are not presently served by sewer so development impacts must be kept relatively low at these sites until infrastructure improvements are available; these locales are predominately in the north section of the county.

C. Land Use Patterns in Relation to Infrastructure

Owing to the swift expansion of Forsyth's population and employment growth, the county's public infrastructure has been placed under strain in its attempts to keep pace with rising demand. The county has spent considerable resources to improve its transportation network and water and sewer infrastructure in order to accommodate the significant increase in population and the expanded number of employment areas. To date, the southern segment of the county has placed the greatest pressure on county infrastructure, yet the concern is county-wide as more development spreads to the north and east portions of the county. A key factor that exacerbates this concern is the low- density, auto-oriented development patterns that neglect to concentrate growth around existing infrastructure networks.

D. Blighted and Transitional Areas

The suburban development in the unincorporated portions of Forsyth County is relatively new. Yet, like most counties in metropolitan Atlanta, Forsyth County has some areas that may be considered to be declining due to the time period of construction or the need for infrastructure improvements. These segments include residential areas in older neighborhoods that need reinvestment, which are located primarily along the perimeter of Lake Sidney Lanier with some subdivisions situated close to the City of Cumming. In addition, commercial uses along portions of SR 9 as well as the intersection of SR 369 and SR 306 are in need of redevelopment; the latter intersection is now a state designated opportunity zone that offers tax credits to businesses that wish to locate or expand their establishment around this state highway intersection.

E. Environmentally Sensitive or Locally Valued Land

Forsyth County is fortunate to possess a number of natural and cultural resources that are worthy of protection. In particular, state and local laws help to protect all of the county's water resources including Lake Sidney Lanier, the Chattahoochee River and the Etowah River as described in the natural resources section of the plan. There are approximately 24,358 acres of floodplain areas in the county. Floodplain development is regulated by the Federal Emergency Management Agency, Georgia Department of Natural Resources (DNR) and the Metropolitan North Georgia Water Planning District through the provision of county ordinances that must comply with state, regional and federal guidelines.

There are an estimated 33,556 acres of land associated with groundwater recharge areas in the county. Significant recharge areas have been mapped by DNR at the state level. State provisions outline restrictions on locating landfills and hazardous waste facilities, above ground chemical or petroleum storage tanks, agricultural waste, impoundment sites, septic tank drain fields, slow rate land treatment, stormwater infiltration basins and waste treatment basins.

Steep slopes, defined as slopes over fifteen percent, comprise approximately 44,830 acres in the county. This acreage amounts to approximately 31 percent of the total land area. Where steep slopes are present, greater care must be taken to control erosion and sedimentation.

A number of man-made resources are valued by the community such as Lake Sidney Lanier and 2,431 acres of county parklands, the largest of which is Sawnee Mountain Preserve, which occupies over 963 acres in the central portion of the county.

A variety of archaeological and historic sites also exist in the county. A portion of the famous Trail of Tears has been traced within Forsyth County and there are documented sites of Cherokee Indian villages and mounds dispersed throughout the area. In the mid-1990s, a historic resources inventory was completed and an update of these identified resources maybe found in the cultural resource section.

F. Existing Development Concerns

Forsyth County, like other rapidly growing suburban counties, has developed through auto-oriented growth patterns common to traditional suburban development patterns that are typically characterized by large spans of low-density, single purpose development and strip commercial areas along arterial roads. This growth model is prevalent within the county, mainly south of the City of Cumming and next to state highways. However, as infrastructure expands, leap-frog development could perhaps become the most costly manifestation of this form of growth. Leap-frog development is the premature construction of low-density housing distant from existing development. The consequences of this premature development usually entail higher infrastructure costs. In addition, the quality and capacity of infrastructure may not be upgraded in a suitable time frame therefore necessitating larger lots in order to accommodate septic tanks and ditched streets. This means lower 'yield' for the developer, but may also create a decreased tax base for the county to pay the costs of community services.

Traditional suburban development also has an important impact on the quantity of land available for future generations. Expanding suburban communities often experience the amount of land being consumed by development increases at a faster rate than population growth. Over the long run, this outward expansion narrows future land use options. Eventually, the diminishing supply of developable land drives land prices, causing the cost of housing and public facilities to rise.

Given a diminishing supply of undeveloped land, Forsyth County could incorporate land use planning tools that direct and orient development patterns and economic incentives away from traditional suburban configurations to patterns that support compact development. Compact development is not synonymous with higher residential density. Residential density is a measure of the quantity of development since it is defined as the number of housing units per acre. It is not, however, a reliable gauge of qualitative characteristics such as the amount of open space, impervious area, building mass or achieving a jobs-housing balance. These attributes relate more directly to the quality of living within a community and are linked with the arrangement between land uses and site design factors rather than a sole density calculation.

Compact development manages density and intensity of development through design to conserve land, reduce impacts on traffic and stormwater and maximize use of existing infrastructure. It also protects against the negative impacts of traditional suburban development by placing varied, but complementary land uses in proximity to each other. Compact development promotes a mix of land uses that are conducive to pedestrian activity and alternative modes of transportation. With well-designed compact development, more everyday destinations such as retail shops, churches and schools, are within convenient walking distance with benefits ranging from a more pedestrian-friendly environment to reductions in land consumption through the preservation of open space as well as lower infrastructure costs.

G. Infill and Traditional Neighborhood Development

The American Planning Association defines infill development as "the construction of a building on a vacant parcel located in a predominately built up area. It also refers to the reuse or change of use of a previously developed parcel or group of parcels, or the intensification of use or change or use by remodeling or renovating an entire structure" (APA Planning Advisory Service Report Number 491/492). Since most of the county's building stock is relatively new, there are few potential sites for infill development, but the opportunities for Traditional Neighborhood Development (TND) are much greater.
A TND can be defined as "an innovative development approach that fosters more compact, walkable communities. TND emphasizes a return to the way we used to build neighborhoods. . . . TND neighborhoods typically include small-lot single-family homes, multi-family residences and neighborhood commercial developments within easy walking distance of one another" (Georgia Quality Growth Partnership). In recent years there have been a number of mixed use communities approved in the county that incorporate TND design in their concept plans. The county's Unified Development Code (UDC) has specific regulations for this development type to ensure a mix of land uses and the promotion of land use connections and pedestrian access through site design guidelines.

H. Local Policies That Could Affect Future Land Use Patterns

Market demand, population growth, economic development, community infrastructure and the environmental suitability of the land are major factors affecting Forsyth County future land use needs and development patterns. Adopted land use goals and implementation strategies are also influential in defining those patterns. Whether qualitative or quantitative, these factors will play a significant role in guiding the intensity, location and timing of future growth.

The major shapers in a community typically involve the availability of community facilities and services such as roads, water and sewer, schools, libraries and public safety. From both a social and market perspective, land that provides access to a network of supporting infrastructure and community facilities has greater development value. As such, the availability of these facilities and services is a key determinant for land development decisions.

As previously indicated, current transportation routes in Forsyth County play a significant role in the accessibility of land parcels, and thereby the potential for development. As in most communities, extensions of transportation, water and sewer infrastructure greatly expand the supply of land for development. Also influential to future growth are established environmental standards, which have played a more significant role in shaping community growth as metropolitan Atlanta has expanded. Air and water quality programs at the federal and state level recognize the connection between land use and environmental quality. At the local level, this is likely to necessitate more sophisticated studies of environmental quality and more precise performance standards for environmentally sensitive lands such as wetlands and floodplains.

Finally, a policy of promoting TND and compact type developments can have a significant effect on the future land use patterns of the county. Such developments will offer a greater variety of housing choices and help to encourage wider access to retail markets and employment opportunities. These types of development also lend a greater sense of character and community identity, which could help distinguish Forsyth County from other surrounding jurisdictions.

I. Future Land Use Needs Analysis

Population, housing and employment forecasts are helpful in determining the amount of land necessary to accommodate both residential and non-residential future land use needs.

Based on county-wide future population projections of 370,479 persons by 2030 and the future household projection of 156,677 by 2030, Forsyth County will see major construction of new housing units with this substantial population growth. The 2010 county tax digest indicated that there are 73,260 existing dwelling units including mobile homes and apartments. It is reasonable to assume that as the county matures and more people move to the City of Cumming and the unincorporated portion of the county, additional land will be developed for residential use and the overall housing density will also rise to accommodate future housing demand.

Forecasting the land use needs for non-residential growth is a critical element in the relationship between land use and economic development planning. The application of land requirements associated with industry type aid the county in facilitating concurrence of community needs with the availability of appropriate land or infrastructure. Table 2 provides 2010 through 2030 estimates of the quantity of land necessary to satisfy estimates of employment by industry sector, per Woods & Poole Economics, Inc. data presented in the Economic Development element. This assessment involves a projection of the future employment level within Forsyth County at a given time, and correlates the estimated quantity of land for private development with respect to use. This particular model based on density standards published in the 4th edition of Urban Land Use Planning, applies a control factor for the type of land use to the projected value of growth for each employment category between 2010 and 2030.

TABLE 2: FUTURE EMPLOYMENT LAND ACREAGE REQUIREMENTS 2010 - 2030
FORSYTH COUNTY

Employment Category	Land Use Type	2010 Total Employment*	2030 Total Employment*	Employment Change*	Acres/ Employee**	Acres Gained/ Lost
Farm Employment	Resource Based	0.5	0.46	-0.04	N/A	N/A
Forestry, Fishing & Other	Resource Based	0.1	0.12	0.02	N/A	N/A
Mining	Resource Based	0.15	0.15	0	N/A	N/A
Utilities	Industrial	0.25	0.29	0.04	0.125	5
Construction	Industrial	6.61	8.46	1.85	0.125	231
Manufacturing	Industrial	7.72	9.43	1.71	0.125	214

TABLE 2: FUTURE EMPLOYMENT LAND ACREAGE REQUIREMENTS 2010 - 2030 continued
FORSYTH COUNTY

Employment Category	Land Use Type	2010 Total Employment*	2030 Total Employment*	Employment Change*	Acres/ Employee**	Acres Gained/ Lost
Manufacturing	Industrial	7.72	9.43	1.71	0.125	214
Wholesale Trade	Warehouse	6.62	10.14	3.52	0.125	440
Retail Trade	Retail	7.64	9	1.36	0.1	136
Transportation & Warehousing	Warehouse	1.05	1.21	0.16	0.04	6
Information	Office	0.76	0.99	0.23	0.04	9
Finance & Insurance	Office	1.96	3.85	1.89	0.04	76
Real Estate & Rental & Lease	Office	0.66	0.81	0.15	0.04	6
Professional & Tech Services	Industrial	4.77	9.35	4.58	0.125	573
Management & Enterprises	Office	0.38	0.49	0.11	0.04	4
Administrative & Waste Service	Industrial	4.99	11.06	6.07	0.125	759
Educational Serv.	Office	0.66	1.12	0.46	0.04	18
Health Care & Social Assist	Industrial	4.75	10.18	5.43	0.125	679
Arts, Entertaintment & Recreation	Industrial	0.45	0.64	0.19	0.125	24
Accommodation & Food Service	Industrial	4.26	7.94	3.68	0.125	460
Other Services	Industrial	2.82	3.7	0.88	0.125	110
Federal Civilian Govt.	Office	0.19	0.24	0.05	0.04	2
Federal Military Govt.	Industrial	0.42	0.43	0.01	0.125	1
State and Local Govt.	Office	6.67	8.19	1.52	0.04	61
Total		64.38	98.25	33.87	1.795	3,814
Vacancy Adjustment (+5%)						191
Total Additional Acres Required						4,004

*Projections in thousands
**Note: Based on density standards published in Urban Land Use Planning, 4th Edition by Edward J. Kaiser, David R. Godschalk, and F. Stuart Chaplin, Jr., University of Illinois Press, p.331.
Source: Woods & Pool Economics, Inc.

Little redevelopment is likely to take place within Forsyth County in the immediate future given the current availability of undeveloped land. As of 2010, 45.6% of Forsyth County land is zoned agricultural as shown in Table 15, 'Current Zoning Proportion by Acreage' within the Economic Development element. Although much of this land is currently occupied by low-density, detached dwelling units or utilized for agricultural commerce, this current land use designation represents the county's greatest source of future

development sites as traditional agricultural industries continue to decline in the metropolitan Atlanta area. Because rezoning agricultural land for the purpose of development often provides a fiscal advantage over real estate already designated for development, this has been the preferred approach of the development community. Approximately 70% of approved rezoning applications between January 2005 and January 2009 changed agriculturally zoned property to a non-agricultural zoning district. As Forsyth County becomes more urban over the next twenty years, the increasingly limited supply of available land will boost real estate values and likely lead to a gradual increase in redevelopment; the tipping point being where real estate prices for raw land supersedes that of existing development. Until the market for potential, redeveloped property reaches economic equilibrium with raw land, only redevelopment policies that provide financial incentives for redevelopment will likely increase the rate of existing development replacement.

J. Future Development

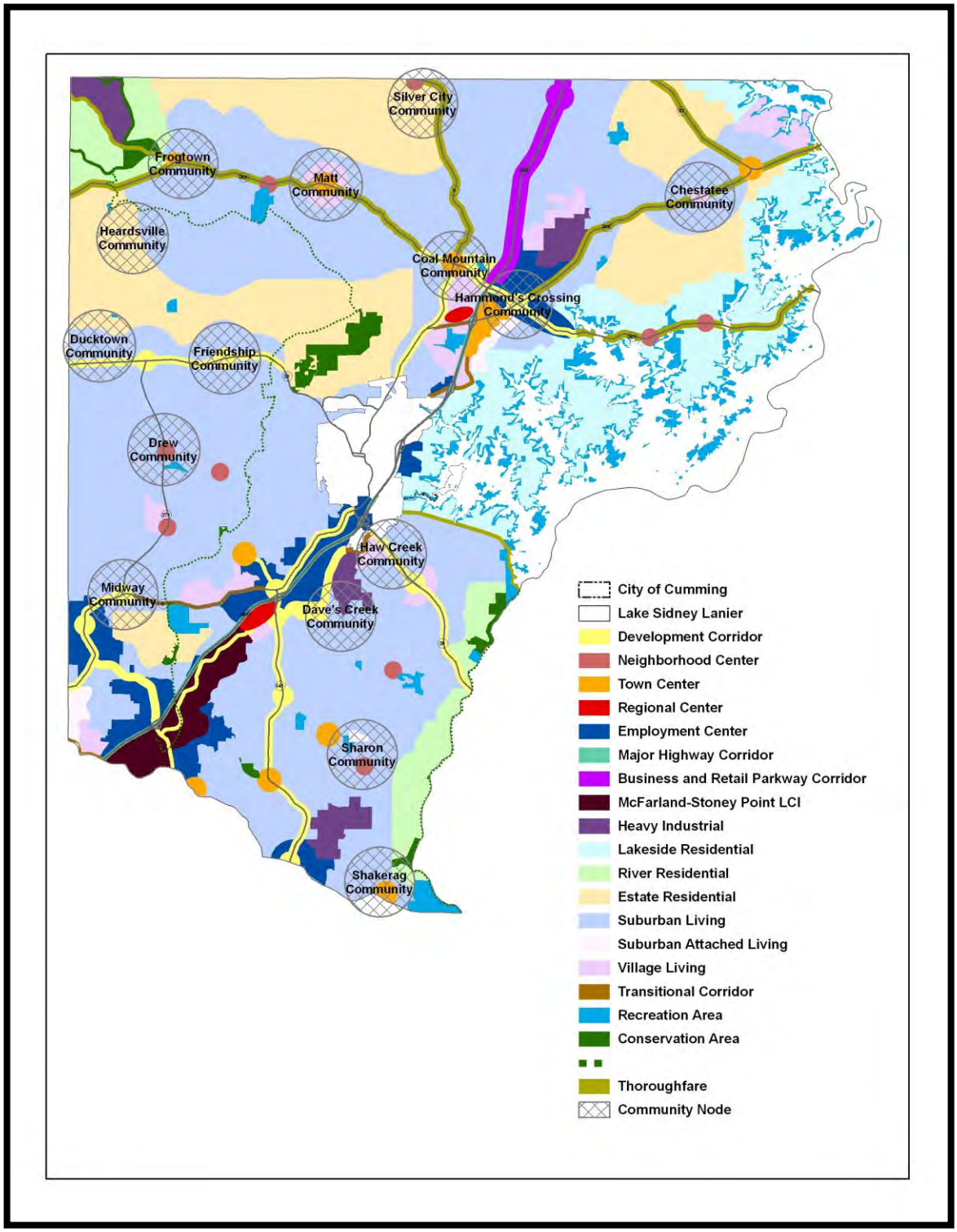
The future development map forms the core of the community vision and is intended to focus on the character, appearance and function of areas rather than simply separating land uses based on traditional zoning practice. This is accomplished through the delineation of character area boundaries on the future development map as defined in the succeeding narrative.

Character areas are geographic locales that are distinct based on their existing or planned form, pattern and intensity of land development. Character area designation is required by the Georgia Department of Community Affairs (DCA). These areas may contain special features to preserve or enhance; have the potential to develop into a distinctive district through planning and appropriate implementation measures; or require special consideration due to specific development concerns.

The future development map, along with the character area narrative, provides a description of development patterns that the community seeks to encourage in order to address the issues and opportunities as related to land use that are identified in the preceding section of the Community Agenda. The future development map is essential to the outline of preferred growth over the long-range planning period and is a result of a collaborative process between community stakeholders and appointed and elected officials.

The map on the following page indicates the location of each character area. For more information on definitions and descriptions of the character areas and a chart that correlates these areas with the Quality Community Objectives (QCO) established by the Georgia Department of Community Affairs (DCA), see the Forsyth County Comprehensive Plan.

Figure 2: Future Development Map (Draft)


Silver City Community
Frogtown Community
Matt Community
Chestatee Community
Heardsville Community
Coal Mountain Community
Hammond's Crossing Community
Ducktown Community
Friendship Community
Drew Community
Haw Creek Community
Midway Community
Dave's Creek Community
Sharon Community
Shakerag Community
City of Cumming
Lake Sidney Lanier
Development Corridor
Neighborhood Center
Town Center
Regional Center
Employment Center
Major Highway Corridor
Business and Retail Parkway Corridor
McFarland-Stoney Point LCI
Heavy Industrial
Lakeside Residential
River Residential
Estate Residential
Suburban Living
Suburban Attached Living
Village Living
Transitional Corridor
Recreation Area
Conservation Area
Thoroughfare
Community Node

Existing planning mechanisms	Method of use in Hazard Mitigation Plan
Comprehensive Plan (multi-jurisdictional)	Development trends
Local Emergency Operations Plan	Identifying hazards; Assessing vulnerabilities
Storm Water Management / Flood Damage Protection Ordinance	Mitigation strategies
Building and Zoning Codes and Ordinances	Development trends; Future growth
Mutual Aid Agreements	Assessing vulnerabilities
State Hazard Mitigation Plan	Risk assessment
Land Use Maps	Assessing vulnerabilities; Development trends; Future growth
Critical Facilities Maps	Locations
Community Wildfire Protection Plan	Mitigation strategies

Chapter 5
Natural Hazard Mitigation Goals, Objectives, & Actions

When Forsyth County and the City of Cumming begin any large-scale planning effort, it is imperative that the planning process is driven by a clear set of goals and objectives. Goals and objectives are the foundation of an effective Hazard Mitigation Plan. They address the key problems and opportunities to help establish a framework for identifying risks and developing strategies to mitigate those risks. Forsyth County's multi-jurisdictional Hazard Mitigation Planning Committee (HMPC) reviewed and re-evaluated the four major goals and numerous objectives for the purposes of this Plan and determined that they all remain valid and effective. No changes were recommended.

In order to fully understand the hazard mitigation goals, objectives, and actions, it is necessary to clearly define the terms **"goal"**, **"objective"**, and **"action"**:

A **goal** is a broad-based statement of intent that establishes the direction for the Forsyth County Hazard Mitigation Plan. Goals can essentially be thought of as the desired "outcomes" of successful implementation of the Plan.
An **objective** is the stated "means" of achieving each goal, or the tasks to be executed in the process of achieving goals.
An **action** is a project-specific strategy to mitigate a particular hazard event within the context of the overarching goals and objectives.

While specific mitigation actions are listed later in this chapter, it is important to note that the actions were selected and evaluated in relation to the overarching hazard mitigation goals and objectives of this plan, which are as follows:

Goal #1. Protect life and minimize loss of property damage.

Objective 1-1. Implement mitigation actions that will assist in protecting lives and property by making homes, businesses, public facilities, and infrastructure more resistant to vulnerable hazards.
Objective 1-2. Review existing ordinances, building codes, and safety inspection procedures to help ensure that they employ the most recent and generally acceptable standards for the protection of buildings.
Objective 1-3. Ensure that public and private facilities and infrastructure meet established building codes and enforce the codes to address any deficiencies.
Objective 1-4. Implement mitigation actions that encourage the protection of the environment.
Objective 1-5. Integrate the recommendations of this plan into existing land use plans and capital improvement programs.
Objective 1-6. Build upon past databases to ensure that vulnerable hazards' risks are accurate.

Goal #2. Increase Public Awareness.

Objective 2-1. Develop and implement additional education and outreach programs to increase public awareness of the risks associated with hazards and on specific preparedness activities available.
Objective 2-2. Encourage homeowners and businesses to take preventative actions and purchase hazard insurance.

Goal #3. Encourage Partnerships.

Objective 3-1. Strengthen inter-jurisdictional and inter-agency communication, coordination, and partnerships to foster hazard mitigation actions designed to benefit multiple jurisdictions.
Objective 3-2. Identify and implement ways to engage public agencies with individual citizens, nonprofit organizations, business, and industry to implement mitigation activities more effectively.

Goal #4. Provide for Emergency Services.

Objective 4-1. Where appropriate, coordinate and integrate hazard mitigation actions with existing emergency operations plans.
Objective 4-2. Identify the need for, and acquire, any special emergency services and equipment to enhance response capabilities for specific hazards.
Objective 4-3. Encourage the establishment of policies to help ensure the prioritization and implementation of mitigation actions designed to benefit critical facilities, critical services, and emergency traffic routes.

Format Utilized to Develop Mitigation Actions

The HMPC reviewed each jurisdiction's annual budget, multiyear work programs, and comprehensive plans to determine existing mitigation actions that met the goals and objectives of this Plan. The committee then developed a list of tentative mitigation actions based on committee members' personal knowledge, interviews with other officials of each jurisdiction, and knowledge of successful actions implemented in other communities.

The committee members developed a prioritized list utilizing the GEMA recommended STAPLEE prioritization methodology, with special emphasis on the following:

1. Cost effectiveness (and when potential federal projects are anticipated, cost-benefit reviews will be conducted prior to application);
2. Comprehensiveness, i.e. addresses a specific goal and objective;
3. Addresses reducing effects of hazards on new and existing buildings and infrastructure;
4. Addresses reducing effects of hazards on critical facilities where necessary; and,
5. Identification of future public buildings and infrastructure (Note: recognizing that the Plan may be modified and evaluated during the monitoring and evaluation period, and will definitely be completely updated within the federally mandated five year approval cycle, future development including future buildings will only include the five year period from Plan completion).

All rankings were composited to represent the consensus of the HMPC.

Members of the HMPC prioritized the potential mitigation measures identified in this Plan. A list of mitigation goals, objectives and related action items was compiled from the inputs of the HMPC, as well as from others within the community. The subcommittee prioritized the potential mitigation measures based on what they considered most beneficial to the community. Several criteria were established to assist HMPC members in the prioritization of these suggested mitigation actions. Criteria included perceived cost benefit or cost effectiveness, availability of potential funding sources, overall technical feasibility, measurable milestones, multiple objectives, determination of public and political support for the proposed actions, and the STAPLEE method described above. Through this prioritization process, several projects emerged as being a greater priority than others. Some of the projects involved expending considerable amounts of funds to initiate the required actions. Most projects allowed the community to pursue completion of the project using potential grant funding. Still others required no significant financial commitment by the community. All proposed mitigation actions were evaluated to determine the degree to which the County would benefit in relation to the project costs. After review by the HMPC, the prioritized list of mitigation measures, as presented within this Plan, was determined.

This same method of prioritization was utilized for the prior update to this Plan. Additionally, it was reviewed by the HMPC during the current plan update process and approved for continued use due to its effectiveness. No changes were recommended.

Mitigation Actions

Each mitigation action is presented by jurisdiction, or in the case of joint actions by multiple jurisdictions, or by independent public bodies (such as School System), or by private nonprofits (such as the Medical Center), in priority order (objective), by best estimate of cost, if applicable, by potential funding source if other than operating budgets, by department or agency that will administer the action, by secondary departments or agencies that will provide supporting rolls, and by timeframe.

Each mitigation action that follows may be supported by one or more jurisdictions below, as indicated by letters A) through B).

A) Forsyth County (unincorporated)
B) City of Cumming

The City of Cumming has a relatively small population. Due to limited financial and human resources, much support with regard to public safety is provided by Forsyth County. This includes assistance with emergency management, fire protection, and law enforcement. The City does have some capability, but it is augmented by the County. Therefore, many mitigation actions included on behalf of the County in the Plan are likely to have an indirect benefit for the City of Cumming.

Each mitigation action that follows is designed to mitigate one or more hazards discussed in this Plan. Those specific hazards are listed for each mitigation action at the end of each mitigation action description. The term "All" as used in the mitigation action section below refers to all hazards discussed in this Plan (severe thunderstorm, winter storm, flooding, tornado, wildfire, drought, earthquake, hazardous materials release, and dam failure).

Each mitigation action that follows mitigates the effects of hazards on existing structures/infrastructure, future structures/infrastructure, or both, as indicated.

In addition, the status of each mitigation action is indicated by one of the following three terms:

PRELIMINARY – unfunded projects or projects in planning stages.
IN PROGRESS – projects that have begun but aren't completed.
ONGOING – continuous projects that are never truly completed; may be funded or unfunded at any given time but are expected to continue unless removed from Plan.

**Note: fully completed or deleted projects are not found below, but in Appendix F.*

Priority	Mitigation Action	Hazard	Jurisdictions Involved	Status	Cost Estimate	Project Length
1	Watershed Improvement Project / Stream Bank Restoration	Flooding	F	In progress	$1 million	5 years
2	Updated Floodplain Mapping	Flooding	F, C	Completed	--	5 years
3	Debris Management Plan	All	F, C	Preliminary	$25K	1 year
4	Dam Inspections once every 5 years	Dam Failure, Flooding	F, C	Ongoing	Staff time	5 years
5	Raw Water Intake Backup Power	All	F, C	In Progress	$1.3 million	2 years
6	Potable Water Production Facility Backup Power	All	C	Preliminary	$2 million	2 years
7	Rerouting Vulnerable Water Lines from GA 400 Overpasses	All	C	Preliminary	$1.8 million	2 years
8	Advanced Water Reclamation Facility Security System	All	C	Preliminary	$15K	6 months
9	Potable Water Production Facility Security System	All	C	Preliminary	$15K	6 months
10	Water Distribution & Collection Division Shop Security System	All	C	Preliminary	$20K	1 year
11	Forsyth County Water Treatment Facility – Two GA Power Feeds w/auto switch gear	All	F	Complete	$500K	2 years
12	Forsyth County Water Treatment Facility – Backup Generator	All	F	Preliminary	$150,000	1 year
13	Forsyth County Water Maintenance Building – Backup Power	All	F	Preliminary	$150,000	1 year
14	Forsyth County Water Pump Stations – Backup Power	All	F	In progress	$150,000	1 year
15	Reverse Osmosis Water Purification Unit	All	F, C	Preliminary	$150K	1 year
16	Backup Generators for Critical Facilities and Infrastructure	All	F, C	Ongoing	Up to $100K each	5 years

Priority	Mitigation Action	Hazard	Jurisdictions Involved	Status	Cost Estimate	Project Length
17	Culvert / Pipe Upgrades	Flooding, Severe Tstorm	F, C	Ongoing	$200K per year	5 years
18	Outdoor Warning Sirens	Tornado	F, C	Ongoing	$25,000	5 years
19	Mass Evacuation Vehicles	All	F, C	Preliminary	$140K	5 years
20	GIS Aerial Imagery	All	F, C	Ongoing	$200K per update – every 2 years	2 years
21	Storm Shelter	Tornado, Severe Thunderstorm Winter Storm	F, C	Preliminary	$30,000	5 years
22	NOAA Weather Radios	All	F, C	Ongoing	$50K	5 years
23	Road Maintenance – sanding, salting, snow equipment	All	F, C	Ongoing	$100K per year	5 years
24	Public Awareness Campaigns including PSAs, forums, mailings, flyers, and electronic communications	All	F, C	Ongoing	$15K per year	5 years
25	Etowah River Flooding – Old Federal Rd / Nicholson Rd Engineering Study	Flooding	F, C	In Progress	$60K	5 years
26	Big Creek Flooding Engineering Study	Flooding	F	In Progress	$60K	5 years
27	Sawnee Creek Flooding	Flooding	C	Preliminary	Need from City	5 years
28	Mill Branch Flooding	Flooding	C	Preliminary	$50K	5 years
29	Community Rating System	Flooding	F, C	Ongoing	Staff time	5 years
30	Acquisition/Relocation Projects	Flooding	F, C	Preliminary	$500K per year	5 years
31	Fuel Reduction Plan	Wildfire	F, C	Preliminary	$100K per year	5 years
32	Community Wildfire Protection Plan	Wildfire	F, C	Ongoing	Staff time	5 years

Priority	Mitigation Action	Hazard	Jurisdictions Involved	Status	Cost Estimate	Project Length
33	Power Line Maintenance	All	F, C	Ongoing	Costs borne by private utilities	5 years
34	GEMA School Safety Plan	All	F, C	Ongoing	Staff time	1 year
35	Hazmat Vehicle	Hazmat Release	F, C	Preliminary	$250K	1 year
36	Response Training on Ammonia, Chlorine Gas, Natural Gas, Propane Releases & Petroleum Products	Hazmat Release	F, C	In Progress	$100K per year	5 years
37	Floating River Boom (PIGS)	Hazmat Release	F, C	Ongoing	$50K	5 years
38	Change Forsyth County specs to require foam delivery capability for every new pumper truck	Hazmat Release	F, C	Completed	Staff time	1 year
39	Sheriff's Office Equipment	All	F	Preliminary	$75K	5 years
40	Radiological Detection equipment	Hazmat Release	F, C	Ongoing	$40K	5 years
41	Additional Fire Stations and Engines	All	F	Ongoing	$34 million for total ISO compliance; $685K per pumper, $1.3 million per hook & ladder	
42	Increased Fire Dept Staffing – 375 additional firefighter	All	F	Ongoing	$46,000 per employee	5 years
43	Special Needs Shelters	All	F, C	Preliminary	$150K	5 years
44	Fire Boat	All	F, C	Preliminary	$2 million	2 years
45	Dive Boats	All	F, C	Preliminary	$75K each	1 year

Priority	Mitigation Action	Hazard	Jurisdictions Involved	Status	Cost Estimate	Project Length
46	Forsyth County Major Transportation Plan 2016 Update	All	F, C	In Progress	$250K	7 months
47	Bomb Team Coordination	Hazmat Release	F, C	In Progress	Staff time	5 years
48	Public Safety emergency shelter and supplies	All	F, C	Preliminary	$250K	2 years
49	Electronic Messaging Traffic Signs	All	F, C	Preliminary	$60K	4 months
50	Light and Air Apparatus	All	F, C	In Progress	$300K	6 months
51	Updated Communications Systems	All	F, C	Preliminary	$300K	3 months
52	Sheriff's Office Mobile Command Center Maintenance	All	F	Completed	--	--
53	IPAWS	All	F, C	Preliminary	$20K	1 year
54	EOC Redundant Communications for internet service	All	F, C	Preliminary	$40K	6 months

Chapter 6
Executing the Plan

6.1 – Action Plan Implementation

The hazard mitigation planning process was overseen by the Forsyth County Emergency Management Agency. Once GEMA completes its initial review of this Plan, it will be forwarded to FEMA for final approval. Once final approval is received from FEMA, the Plan will be presented to the Forsyth County Board of Commissioners and the City of Cumming Council for consideration. Once adopted, the Forsyth County EMA Director shall assume responsibility for the maintenance of the Plan. It shall be the responsibility of the EMA Director to ensure that this Plan is utilized as a guide for initiating the identified mitigation measures within the community. The EMA Director shall be authorized to convene a committee to review and update this Plan annually. The Plan will also have to be updated and resubmitted once every five years. Through this Plan updating process, the EMA Director shall identify projects that have been successfully undertaken in initiating mitigation measures within the community. These projects shall be noted within the planning document to indicate their completion. Additionally, the committee called together by the EMA Director shall help to identify any new mitigation projects that can be undertaken in the community.

6.2 – Evaluation

As previously stated, the Forsyth County EMA Director will be responsible for ensuring that this Plan is monitored and updated at least annually, after the occurrence of any major disaster, or more often if deemed necessary. The method of evaluation will consist of utilizing a simple checklist to determine what mitigation actions were undertaken, the completion date of these actions, the cost associated with each completed action , and the perceived level of success. A committee, perhaps with much of the same membership as the existing HMPC, will convene annually in order to accomplish the annual plan review and evaluation. These meetings will provide an opportunity to discuss the progress of the action items and maintain the partnerships that are essential for the sustainability of the HMP. The EMA Director should document the progress of all related meetings, and ensure the results are reported to the Forsyth County Board of Commissioners at least on an annual basis.

6.3 – Multi-Jurisdictional Strategy and Considerations

As set forth by Georgia House Bill 489, the Emergency Management Agency is the overall implementing agency for projects such as hazard mitigation. Forsyth County will work in the best interests of the County as well as the City of Cumming. At the start of this planning process, Forsyth County solicited the participation of the City of Cumming. The City of Cumming has provided a great deal of input for the purposes of this Plan. The City played an instrumental role in the planning process. As a result, a truly multi-jurisdictional plan was created for Forsyth County and the City of Cumming, with ideas and viewpoints of all participants included.

6.4 – Plan Update and Maintenance

According to the requirements set forth in the Disaster Mitigation Act of 2000, Forsyth County is required to update and revise the Hazard Mitigation Plan every five years. However, the Hazard Mitigation Planning Committee will meet on the plan approval anniversary date of every year, or within 30 days of said date as determined and scheduled by the EMA Director, to complete a review of the Hazard Mitigation Plan. At each such meeting, the HMPC will review the main facets of the HMP including the vulnerability assessment, critical facilities inventory, and mitigation goals, objectives, and actions.

It is during this review process that the mitigation strategies and other information contained within the Hazard Mitigation Plan are considered for incorporation into other planning mechanisms as appropriate. Opportunities to integrate the requirements of this HMP into other local planning mechanisms will continue to be identified through future meetings of the HMPC on an annual basis.

The HMPC recognizes the need to integrate other plans, codes, regulations, procedures and programs into future Hazard Mitigation Plan (HMP) updates. This plan is multi-

jurisdictional; therefore the mechanism for implementation of various mitigation plan items may vary by jurisdiction. This includes reviewing other local planning documents, processes or mechanisms for possible integration with the HMP.

To Be Reviewed in Future Update

Existing planning mechanisms	Method of use in Hazard Mitigation Plan
Comprehensive Plan (multi-jurisdictional)	Development trends
Local Emergency Operations Plan	Identifying hazards; Assessing vulnerabilities
Storm Water Management / Flood Damage Protection Ordinance	Mitigation strategies
Building and Zoning Codes and Ordinances	Development trends; Future growth
Mutual Aid Agreements	Assessing vulnerabilities
State Hazard Mitigation Plan	Risk assessment
Land Use Maps	Assessing vulnerabilities; Development trends; Future growth
Critical Facilities Maps	Locations
Community Wildfire Protection Plan	Mitigation strategies

It will be the responsibility of each participating jurisdiction to determine additional implementation procedures when appropriate.

During the planning process for new and updated local planning documents such as a comprehensive plan or Local Emergency Operations Plan, the EMA Director will provide a copy of the HMP to the appropriate parties. It will be recommended that all goals and strategies of new and updated local planning documents be consistent with, and support the goals of, the HMP and will not contribute to increased hazards in the affected jurisdiction(s).

Although it is recognized that there are many benefits to integrating components of this plan into other local planning mechanisms, and that components are actively integrated into other planning mechanisms when appropriate, the development and maintenance of this stand-alone HMP is deemed by the committee to be the most effective method to ensure implementation of local hazard mitigation actions at this time. Therefore, the review and incorporation efforts made in this update and the last, which consisted of a simple review of the documents listed in the chart above by various members of the HMPC, are considered successful by the HMPC and will likely be utilized in future updates.

The County's EMA is committed to incorporating hazard mitigation planning into its Local Emergency Operations Plan and other public emergency management activities. As the EMA Director becomes aware of updates to other County or City plans, codes, regulations,

procedures and programs, the Director will continue to look for opportunities to include hazard mitigation into these mechanisms.

The Forsyth County HMPC will reconvene not later than the fourth anniversary of the plan approval anniversary date, as determined and scheduled by the EMA Director, to begin planning for the formal Hazard Mitigation Plan revision process. The revision process will include a clear schedule and timeline, and identify any agencies or organizations participating in the plan revision. The committee will review the mitigation goals, objectives and actions to determine their relevance to changing situations within the different jurisdictions, as well as changes in State or Federal policy, and to ensure current and expected conditions are being addressed. The HMPC will also review the prior vulnerability assessments to determine if this information should be updated or modified, given any new available data.

Forsyth County is dedicated to involving the public directly in reviews and updates of the HMP. During the plan revision process, the committee will conduct, at a minimum, two public hearings during the revision process. These public hearings will provide the public a forum for which they can express their concerns, opinions, or ideas about the Plan. Additionally, if persons from the community express interest in participation in the planning process, they will be provided the opportunity, via meetings, the County website, social media, and/or public forums, to suggest possible mitigation measures for the community. Documentation will be maintained to indicate all efforts at continued public involvement. All relevant information will be forwarded to GEMA and FEMA as a product of the proposed plan revision.

The EMA Director will ensure the revised plan is presented to the governing body of each jurisdiction for formal adoption. In addition, all holders of the HMP will be notified of affected changes. The EMA Director shall submit a revised Hazard Mitigation Plan not later than the five-year anniversary of the most recently updated HMP to the Georgia Emergency Management Agency for review and subsequent submittal to the Federal Emergency Management Agency for ultimate approval.

Once approved by FEMA, copies of the Forsyth County Hazard Mitigation Plan will be provided by the EMA Director to the appropriate governmental jurisdictions, agencies, and/or departments for review and possible inclusion into plans and programs. The HMP will be distributed by the EMA Director to the appropriate officials to allow them to review the Plan and determine to what extent the Plan should be integrated into, or referenced by, other plans and programs. Limitations may be placed on certain sensitive information by the EMA Director.

Chapter 7

Conclusion

7.1 – Summary

Forsyth County has gained a great deal of knowledge relating to the County's disaster history and future potential for disaster as a result of the hazard mitigation planning process. This includes an extensive hazard history of recorded hazard events from the past fifty years, a vulnerability assessment, a detailed critical facilities database with valuable information on some of most critical County and City structures, and some valuable ideas from the community abroad concerning measures that should be considered for future hazard mitigation. Community involvement has been at the heart of this effort. Not only did the planning process include the creation of a Hazard Mitigation Planning Committee with representatives from all walks of life, but multiple public hearings were conducted to provide all Forsyth County citizens with the opportunity to comment on, and offer suggestions concerning potential hazard mitigation measures within the community. Forsyth County and the City of Cumming each contributed to ensure a broad range of citizens were represented. These efforts have all had the effect of better protecting our Community from the threats of nature and technology. While it would be naïve to believe this Plan provides complete protection to Forsyth County and its residents, it is the hope of all parties involved in this planning process that the recommended mitigation measures contained within the Plan will provide some level of increased preparedness as well as spur further discussion and planning related to the important subject of Hazard Mitigation for years to come.

7.2 – References

Publications/Documents:
The Disaster Mitigation Act of 2000
Robert T. Stafford Disaster Relief and Emergency Assistance Act
FEMA Pre-Disaster Mitigation *How-to Guides #1, 2, 3, 7*
GEMA Supplements to FEMA Pre-Disaster Mitigation How-to Guides
Georgia Tornado Database 1808 – 2002 (Westbrook)
Forsyth County Local Emergency Operation Plan
Forsyth County Comprehensive Plan

Web Site Sources:
www.fema.gov (FEMA)
www.usfa.fema.gov (USFA)
www.fs.fed.us (USFS Fire Danger Class)
www.cpc.ncep-noaa.gov (Drought Severity Index)
www.ncdc.noaa.gov (National Climatic Data Center)
http://eqint.cr.usgs.gov (USGS Earthquake Probability Maps)
http://roadsidegeorgia.com/nrhp/Forsyth (National Register of Historic Places)
www.tornadoproject.com (Tornado Project Online)
www.disastercenter.com (The Disaster Center)
www.gema.state.ga.us (GEMA)
www.gfc.state.ga.us (GFC)
www.georgiadrought.org (Drought in Georgia)
www.ForsythCo.com (Forsyth County)
www.CityofCumming.net (City of Cumming)
www.georgiaencyclopedia.org (Georgia Encyclopedia)
www.LOC.gov (Library of Congress)

Other Sources:
American Red Cross
American Society of Civil Engineers
Forsyth County, Georgia
Forsyth County Chamber of Commerce
City of Cumming, Georgia
City of New Madrid, Missouri
Federal Emergency Management Agency
Georgia Department of Natural Resources
Georgia Environmental Protection Division
Georgia Emergency Management Agency
Georgia Forestry Commission
Georgia Safe Dams Program
Library of Congress
National Climatic Data Center
National Oceanic & Atmospheric Administration
National Weather Service

U.S. Army Corps of Engineers
U.S. Fire Administration
U.S. Forest Service
U.S. Geological Survey